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ELECTRICAL REVIEW.

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THE WAGE PROBLEM.

THE House of Commons recently discussed one of the many measures which, in the opinion of the present Government, are necessary if the nation is to be prepared for the post-war period of dislocation. There will be no possibility of dodging or evading the difficulties of that period, but we may be able to avert some of its dangers by taking action in advance. However hopefully we may regard the signs from the standpoint of a particular industry, there will inevitably pass before us a continuous succession of conditions and circumstances, demands and problems, which will call for some very careful thinking. Some of them will crowd upon us simultaneously, others will follow later. Hearts warm and sympathetic, of course, we must have; but where will they lead us if the clear head be wanting or if the controlling hand upon the rein be weak and uncertain? That hand must be strengthened now. Before the war we were familiar with the "Right to Work" procession; during the war we have discussed the right to "slack." After the war, according to the prophets, we may be faced with both agitations again. In considering the interests of national efficiency we are less afraid of the former than we are of the latter, though the former may be serious enough. The Unions may be able to exercise a healthy influence upon their members if they teach that national prosperity can be brought about by individual efficiency. But what of the cry that will be heard for work and wages for all—in other words, the demand for the right and the wherewithal to live? It seems as though we can hear the distant rumblings of those agitations as we read the House of Commons discussion on the second reading of the Trade Boards Bill. The industrial conditions directly the war ends will be vitally changed. Already strong pressure has been brought to bear upon the Government to induce it to fix, by Parliamentary statute, a national minimum wage. Everybody may have the sympathetic heart that would favour such a course; but Mr. G. H. Roberts, as Minister of Labour—generally, as we think, courageous in his vision of the future, yet practical in his conceptions—sees the impossibility of Parliament agreeing upon any one figure which might be adaptable to all industries. He holds that every worker is entitled to a reasonable minimum wage, but from what we have heard of his previous utterances we believe he would fully agree with us that emphasis should be placed upon the word *worker*. It is the *labourer* who is worthy of his hire. Not the slacker, the shirker, the malingerer! But Parliament cannot say what the right minimum wage for every section of industry should be. Even its labour advisers do not know, when they consider merely one particular industry, whether a *reasonable* minimum wage for a childless man is equally reasonable for a man with a family, and when there is no general agreement among those who are directly concerned, how can Parliament be expected to sanction any one special estimate or

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view? The policy of the Government, then, as enunciated by Mr. Roberts, is to aim at a gradual improvement of the conditions obtaining in industry. Gradual it *must* be—there is no scope for the skill of the social prestidigitator here. Therefore, in the light of our present knowledge, the nearest point at which we can arrive is that where we bring employers and workmen together, so that they can sit down unitedly to the task of improving their own conditions. The place of the State is to facilitate such co-operative negotiations. The fixing of wages will be left to Trade Boards of the various industries. Mr. Whitley stated in the course of the discussion that the purpose of the Trade Board must be to form a stepping-stone to a system of self-government in an industry. Only by pursuing such an aim can we reduce Government interference to a minimum. Of this we have been assured again and again.

We notice that there was some opposition to the Trade Boards measure. Certain members of the House wanted it rejected because it was not a measure intended to meet present-day requirements. Suppose we were to judge all legislation by that low standard! Is it not just the sort of attitude that left us unprepared for war, and would disastrously leave us unprepared for peace? Major Astor followed approving of the Bill, because it would tend to better organisation in industries that were previously unorganised, or badly organised; also because it would tend to improve the general standard of living to sections of the community that most required it, but the inevitable Sir F. Banbury did not help to improve the industrial atmosphere in such times as these by saying that the more wages men got the less work they did. "In many industries, if men could get just enough to be going on with, they would not try to earn more." Now, in how many industries is it likely that the present rate of wages can continue after the war? It seems to us that the rates that the Boards fix must be high enough to be reasonable, and low enough to be economically sound, and, after the high-wages habit of the last few years, and with the prospect that the cost of living cannot fall greatly all at once, there will be the incentive, if we give payment by results, which most reformers argue for now, to increase production.

Perhaps the most serious aspect of the whole question, and a genuine reason for proceeding with the Bill, was that referred to by Mr. Bridgeman in reply to the discussion. It is sometimes stated that women having found their way into the engineering trades, and having proved their aptitude for such service under appropriate conditions, are likely to remain there for a long time to come, if not permanently. It may be so, though, in our belief, the desire of many women for filling their natural sphere will be strong, and it will prevail unless conditions make it necessary for them to supplement the family earnings or the wounded soldier's pension. But, apart from the engineering industry, in which there will be abundance of work for years to come, there will be other branches of industry from which large numbers of women and juveniles will be dismissed directly the war ends. Then there will be the danger that in seeking other classes of work they will increase the tendency to low wages and sweating, which it is so necessary to avoid, if possible. It is impossible to foretell what the future has in store for the masses, but it is our duty to prepare against feared evil possibilities, and if by setting up the proposed Trade Boards we can do something practical to that end, then let us support the Government measure. Labour is demanding a larger share of control in industry, and this is one way in which that can be granted. If it carry with it an understanding of the immediate commercial problems of industry, the effect of competition, internal and international, upon selling prices, the importance of keeping down working costs, and of increasing production, it will go far towards establishing on a rational basis relations between employer and employed.

Fuel Economy and Cheap Power.

In the course of the discussion on electric power supply at the recent meeting of the I.M.E.A., many very interesting points were raised, some of which in themselves would provide material for prolonged debate. Amongst these was the question whether, of the two main objects in view, the saving of fuel or the provision of cheap electric power was the more pressing need. To a considerable extent the two are correlated; we cannot supply electrical energy cheaply without economising fuel: and if we save coal we shall be in a better position to provide a cheap supply of electricity. But the advantage thus gained in the latter case may be wholly neutralised by increased outlay in other directions, particularly by standing charges due to capital expended on extra plant, long transmission lines, &c., and running charges on account of loss in transmission. Hence it would appear that the national interests will be most surely served if our attention is directed primarily to the problem of cheapness of supply, to which economy of fuel is a necessary corollary.

Now, several speakers, including some who champion the cause of the smaller undertakings, advanced the view that mere cheapness of supply was somewhat of a fetish; that the national industries—with admitted exceptions, such as electrochemical and similar processes in which the cost of energy was the controlling factor—were satisfied with the prevailing conditions, and would derive but trifling advantage from a reduction even of the order of 50 per cent. While this is perfectly true in many cases, and *under pre-war conditions*, we cannot agree that their contention holds good when we consider, as we must, the necessities of the future. It is agreed that the cost of labour will never return to the low standards which prevailed before the war; consequently, it is imperatively necessary to reduce to the minimum the proportion of hand labour to the total cost of the finished product by immensely developing the use of labour-saving machinery and processes, while at the same time greatly increasing the output of our factories. Obviously, therefore, the proportion of cost assigned to motive power will be greatly increased, and the cheapening of electricity supply in future will be a matter of the first importance to existing industries.

Moreover, it should be borne in mind that we must provide a supply of energy at the lowest possible rates for various new applications of electricity, prominent amongst which are main-line railway traction, agricultural work, domestic heating and cooking, and industrial heating. Whilst some of these items may appear lacking in novelty, it must be admitted that not one of them has been developed beyond the most elementary stages, and that the demand which they will provide will vastly exceed anything that we have yet experienced. In addition, steps should be taken to develop industries, such as agriculture, ice-making, &c., which will help to fill up the summer valley in the annual load curve: and it was suggested by one speaker that electrochemical processes which could be carried on at night should be encouraged, in order to keep the costly generating plant employed. All these factors, of which some demand and others promote cheapness of supply, should be taken into consideration when the question is under discussion.

Perhaps the most obvious defect in our existing system of generation, and one which cries shame upon us as economy engineers, is the frightful waste of heat in the condensing water. More than one speaker drew attention to this deplorable squandering of our precious heritage, in pursuit of which we are actually studying the map to find out where we can most effectively throw heat away!—while, on the other hand, we are earnestly seeking means to economise coal, a situation which would be ridiculous if it were not tragical.

Mr. George Wilkinson advocated the sale of heat, Mr. Turnbull its use for intensive agriculture, and both are promising and practicable suggestions. Mr. W. M. Selvey recently devised a scheme, of which we give some particulars elsewhere in this issue, for combining electric power supply with commercial heating, and we think that the subject is one which urgently calls for the most earnest attention of station engineers and managers.

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TELEPHONY IN THE FRENCH ARMY.

Without an efficient telephone service an army under modern conditions is semi-paralysed; rapidity of communication is essential, and there is no means to be compared with the telephone in this respect. Unfortunately, the telephone system, involving the use of a network of small wires with endless ramifications, is exceedingly vulnerable, and is constantly liable to interruption by enemy shell fire, or even by accidental action on the part of its friends. Hence the rapid installation of a complete telephone system

French Official.

Fig. 1.—French Soldiers Erecting Telegraph Lines.

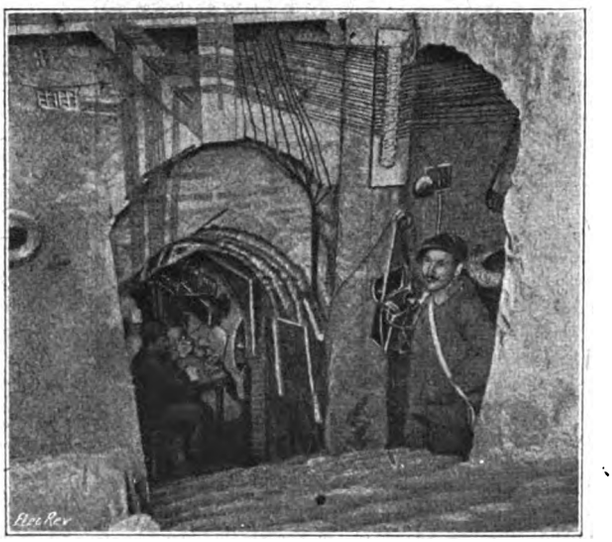
in the first instance and its continual maintenance in working order are included amongst the most important functions of the military engineers.

The accompanying illustrations, from French official sources, will give some idea of the methods adopted by our Allies for these purposes.

Fig. 1 shows a party of soldiers laying telephone wires in the Somme district; the wires coming from the right are strained with blocks and tackle, and are about to be fixed on a pole, making a right-angle change of direction towards the foreground at this point.

Fig. 2 is a view of a shell-proof underground central telephone station in the trenches in the district of the Oise.

Fig. 3 shows a party of soldiers laying a made-up cable in a deep trench, with a view to its protection from shell fire and bombs, and fig. 4 shows wooden frames containing drums from which the individual wires composing the cable are simultaneously run off.



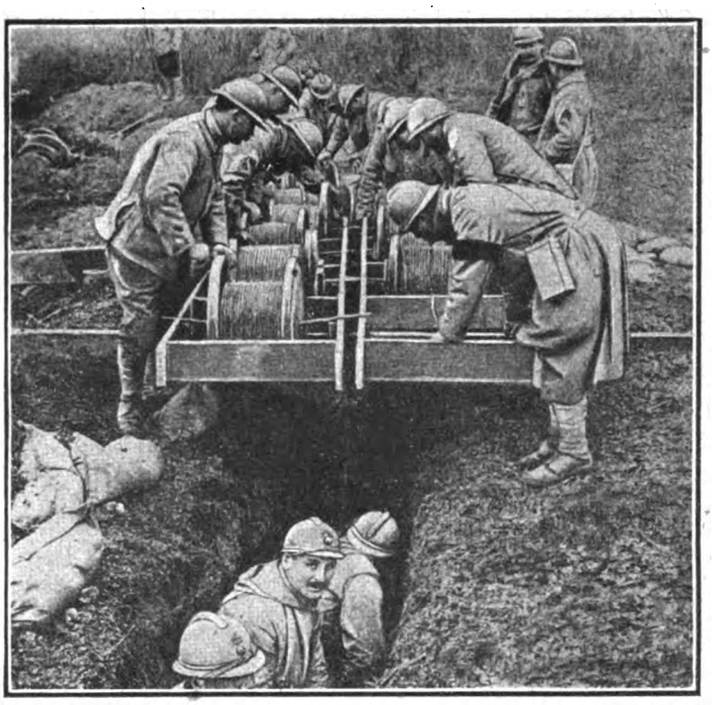
French Official.

Fig. 2.—An Underground Central Telephone Station.

Fig. 5 is a view of an angle pole on which telephone wires are being fixed; naturally, the appearance of the poles is not an important consideration in this connection, and it will be seen that the insulators used are of a small bobbin type, while the cross-arms are attached to the poles by simple clamps.

French Official.

Fig. 3.—Laying Cable in Deep Trench.



French Official.

Fig. 4.—Drums of Wire Mounted in Frames.

Fig. 6, on the other hand, is a view of a wireless antenna mounted on the top of a railway vehicle, so arranged, of course, that it can be readily unrigged when a move is in prospect. Thanks to its immunity from interruption, except by direct action on the stations themselves, the wireless system has been of great service in this war; but it suffers from the serious disadvantage that it lacks secrecy.

According to the *Scientific American*, even burying the

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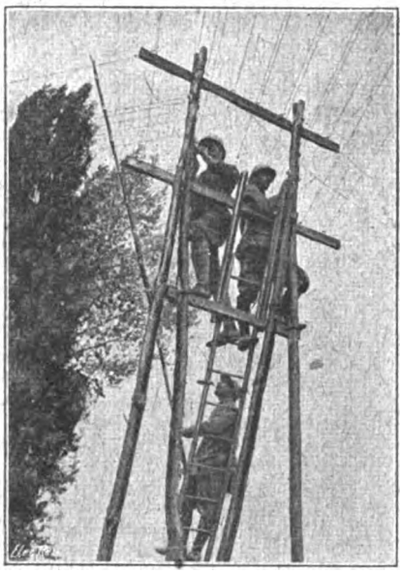
telephone wires deeply has failed to protect them from injury by high-explosive shells and bombs, and consequently short poles have been adopted, supporting the wires a few feet above the ground, so that broken wires can readily be

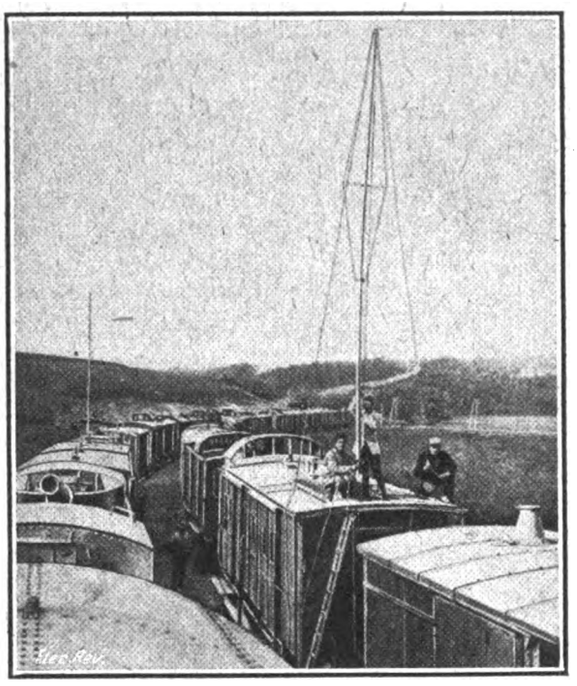


French Official.

FIG. 5.—ERECTING TELEPHONE WIRES.

repaired by the telephone patrols, while the poles are inconspicuous.

Even telephone circuits are not immune from tapping, either by induction or conduction, according to the system employed; consequently, in all important communications by telephone in the advanced sections of the system letters



French Official.

FIG. 6.—A TRAVELLING WIRELESS STATION.

or numbers are used to represent the names of places, regiments, and batteries, in accordance with secret codes.

It is on record that in the early days of the war the British telephone system was so efficient that it enabled Sir John French to direct the operations of the Army in Flanders by telephone for three days from his house in London. The French system was no less effective, and was used by General Joffre to regulate all troop movements over 200-mile front.

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

ANNUAL CONVENTION.

(*Continued from page* 623.)

Presidential Address.

BY S. J. WATSON.

(*Abstract.*)

(*Concluded from page* 622.)

As the question of "bulk supply" is likely to come more to the front in the near future, it will be of interest to consider what cost is likely to be incurred in generating such supplies at a large modern power station, and to what extent the cost is affected by the conditions which obtain after the supply is delivered by the main generators to the station bus-bars. All the figures used as estimates are based on pre-war prices.

Assuming that a convenient site is available possessing ample natural water and good facilities for obtaining deliveries of fuel, the capital expenditure in providing an installed capacity of 100,000 KW. should not exceed £900,000, made up as follows:—

TABLE I.

		Cost per KW.
Land and clearing	£25,000	£·25
Sidings or wharves	40,000	·40
Buildings, foundations, coal storage, and handling	275,000	2·75
Engine-room equipment	310,000	3·10
Boiler-house equipment	210,000	2·10
Water-pipes, conduits, &c.	40,000	·40
Total	£900,000	£9·00

The cost per E.H.T. unit delivered to the bus-bars under the load factor conditions specified would be as follows:—

TABLE II.—PLANT INSTALLED, 100,000 KW.; MAXIMUM LOAD, 75,000 KW.

Units to bus-bars	220,000,000		300,000,000	
Load factor	33·5 per cent.		45·7 per cent.	
Coal (at 12s.)	2 lb. per unit.		1·8 lb. per unit.	
	Annual cost.	Per unit.	Annual cost.	Per unit.
Fuel	£117,857	·128d.	£144,643	·115d.
Oil, &c.	1,000	·002d.	1,250	·002d.
Salaries and wages	16,500	·018d.	18,500	·014d.
Repairs...	11,500	·012d.	12,500	·010d.
	£146,857	·160d.	£176,893	·141d.
Rates, taxes, and management	17,000	·019d.	18,500	·015d.
Cap. dep. obsce. at 10 per cent.	90,000	·098d.	90,000	·072d.
Total cost	£253,857	·277d.	£285,393	·228d.

In the coal figures I have taken an average calorific value of 12,500 B.TH.U. per lb., which works out at an overall thermal efficiency of 13.8 per cent. and 15.3 per cent. under the two sets of conditions.

The method of dividing up the costs adopted by the I.M.E.A. and I.M.T.A. in 1912 for the purpose of ascertaining the cost at the power station of a supply for tramways was as follows:—Fuel, 25 per cent. standing, 75 per cent. running; oil, &c., 25 and 75 per cent.; wages, 50 and 50 per cent.; repairs, 75 and 25 per cent.; rates, management, and capital, 100 per cent. standing.

Applying this principle to the cost sheet given above, the following results are obtained:—Load factor, 33.5 per cent., £2 0s. 11d. per KW. maximum load + 0.10d. per unit; load factor, 45.7 per cent., £2 3s. 8d. per KW. + 0.098d. per unit.

If the output is reduced, resulting in a lower load factor, the standing cost per KW. demanded will be lower and the running cost higher, and *vice versa*.

For the purpose of further illustration, assume that a charge of £2 2s. 6d. per annum per KW. of maximum demand at the bus-bars plus a charge of 0.102d. per unit supplied would provide sufficient income to cover all the costs incurred. It is at this point that the "diversity factor" begins to affect the charges for the supply.

As the number of processes and purposes for which the supply can be used is increased we may anticipate an appreciable improvement in the diversity factor, and it seems probable that this improvement will exercise a great influence on future selling prices. So far as the charges are influenced by the initial cost of plant, and present methods of generation, it does not seem possible to effect any very marked improvement in the immediate future.

Assuming the ratio between the maximum load on plant and the sum of the feeders' maximum demands to be 75,000 KW. to 86,250 KW., or 1 to 1.15, the cost of £2 2s. 6d. per KW. per annum at the bus-bars becomes £1 17s. per KW. demanded on the feeders.

A further item affecting the charges is the diversity factor of each feeder. Taking a ratio of 1 to 1.1 the cost of £1 17s.

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per KW. demanded at the point of origin of the feeder becomes £1 13s. 7d. per KW. demanded at the point of usage, subject to the additional costs incurred in transmission.

I roughly estimate that the sum of £660,000 would enable a maximum load of 75,000 KW. to be supplied over an area of 400 square miles by means of underground cables. Allowing 10 per cent. per annum for capital, depreciation, and maintenance, the annual cost for these items will be £66,000. This amount divided by the total demands at the point of usage gives an average cost of about 12s. 6d. per KW. per annum.

By reason of the cost of transmission systems the annual cost may vary, say, between 2s. 6d. and 22s. 6d. per KW. demanded per annum. It appears inevitable that this difference in cost must be taken into consideration in some instances.

The losses in transmission will usually vary between the limits of 5 per cent. and 15 per cent., depending on the distance and the load factor of the supply. The cost of £1 13s. 7d. per annum per KW. demanded at the users' premises and the cost of .102d. per unit supplied will require adjusting to include these allowances.

The total cost at the point of usage of the E.H.T. supply will be as follows:—

TABLE III.

	Cost minimum.	Cost average.	Cost maximum.
KW. charge ...	£1 13 7	£1 13 7	£1 13 7
Loss	1 10 (5 %)	3 8 (10 %)	5 6 (15 %)
Transmission...	2 6	12 6	1 2 6
Cost per KW.	£1 17 11	£2 9 9	£3 1 7
plus			
Charge per unit	·107d. (5 %)	·112d. (10 %)	·117d. (15 %)

Three-phase alternating current is undoubtedly going to be the standard for this country. Where extensive direct-current networks exist the cost of changing the system and the apparatus on consumers' premises will be prohibitive, but extensions of direct-current networks should be avoided. The continued use of a direct-current system in conjunction with three-phase generation must for all time necessitate a considerable additional expenditure on sub-station equipment, with serious annual costs and losses in conversion. To enable the supply to be given at the lowest price, extended use will be made of three-phase four-wire alternating current distribution from transformer sub-stations.

The capital charges and working expenses of static transformer sub-stations will vary from 5s. to 10s. per annum per KW. supplied. The KW. demanded on the E.H.T. side will be from 2 per cent. to 4 per cent. higher than the KW. demanded on the L.T. side, and the units delivered to the E.H.T. switchboard will be from 3 per cent. to 9 per cent. more than the units delivered to the L.T. switchboard. Hence the cost of the E.H.T. supply when transformed to low-pressure alternating current will be as follows:—Minimum, £2 3s. 8d. and 0.110d.; average £2 18s. 9d. and 0.118d.; maximum, £3 14s. 1d. and 0.126d.

The capital charges and working expenses of a sub-station containing rotating plant for converting E.H.T. alternating current to direct current will vary between 15s. and 30s. per annum per KW. supplied. The KW. demanded on the E.H.T side will be from 6 per cent. to 10 per cent. higher than the KW. demanded on the L.T. direct-current side, and the low-pressure units delivered to the switchboard will be from 10 per cent. to 20 per cent. lower than the units delivered to the E.H.T. switchboard. Hence the cost of the E.H.T. supply when converted to low-pressure direct current will be as follows:—Minimum, £2 15s. 2d. and 0.118d.; average, £3 16s. 3d. and 0.129d.; maximum, £4 17s. 9d. and 0.140d.

There are a number of undertakings in operation having outputs approximating to 4,000,000, 10,000,000, and 17,000,000 units per annum. The following costs may be considered well within the range of attainment.

TABLE IV.

	(a)		(b)		(c)	
Units supplied ...	4,000,000		10,000,000		17,000,000	
Maximum load ...	2,000 KW.		4,000 KW.		6,000 KW.	
Load factor ...	22·5 per cent.		28·5 per cent.		32·4 per cent.	
Capital outlay ...	£60,000		£100,000		£130,000	
	Annual costs.	Per unit.	Annual costs.	Per unit.	Annual costs.	Per unit.
	£	d.	£	d.	£	d.
Fuel at 12s. ...	4,800	·29	8,100	·19	11,400	·16
Other expenses ...	5,600	·34	7,475	·18	9,225	·13
Capital charges ...	6,000	·36	10,000	·24	13,000	·18
	16,400	·99	25,573	·61	33,625	·47
Cost per KW. ...	£5 12s. 3d.		£4 6s. 9d.		£3 14s. 6d.	
Plus per unit ...	·310d.		·198d.		·160d.	

In these figures I assume that the output under (c) is generated by reciprocating plant in the form of low-pressure direct current, and that the additional output under (b) and (c) together with a portion of the original output is generated by turbine plant in the form of three-phase, E.H.T. alternating current, and subsequently transformed or converted. I have not considered the case of the establishment of a new undertaking, or of those already existing with an output less than 4,000,000 units per annum, because the purchase of a bulk supply on reasonable terms would be overwhelmingly advantageous, and the present tendency is undoubtedly to develop on such lines.

TABLE V.

	Units.	Maximum load. KW.	Load factor. Per cent.
(a) Generated locally ...	1,500,000	1,500	11·4
Purchased	2,500,000	500	57·0
Total	4,000,000	2,000	22·5
(b) Generated locally ...	3,750,000	2,750	15·7
Purchased	6,250,000	1,250	57·0
Total	10,000,000	4,000	28·5
(c) Generated locally ...	7,000,000	4,000	20·0
Purchased	10,000,000	2,000	57·0
Total	17,000,000	6,000	32·4

Many cases have already arisen, and more will occur in future when those responsible for the administration of an undertaking have to consider two alternatives: (1) whether to extend an existing plant, or, possibly, contruct a new power station, and (2) to purchase a bulk supply from a neighbouring authority.

Should it be decided to purchase a bulk supply, instead of extending the local plant when the position indicated at (a) is reached, it will be an advantage to convert a portion of such supply to direct current, so as to enable the local plant to be entirely shut down during periods of light loads.

The local power station will at times be run as a combined power station and sub-station, and at other times as a sub-station only. The position will then be as follows:—

Allowing for the cost incurred at the local power station in connection with the reduced output, the cost of supplying the units given in Table IV by using the local plant to the extent indicated in Table V in conjunction with a bulk supply at prices given above will be as follows:—

Bulk supply at minimum costs: (a) £13,166; (b) £22,504; (c) £31,530.

Bulk supply at average costs: (a) £13,809; (b) £23,654; (c) £33,372.

Bulk supply at maximum costs: (a) £14,460; (b) £24,821; (c) £35,238.

The above figures can now be compared with the cost of a bulk supply, assuming the local power station to be non-existent, the low-pressure supply being used in the form of (1) three-phase alternating current only; (2) direct-current and three-phase alternating current; and (3) direct current only; and by summarising the data a comparison can be made between the cost of affording a supply in different forms to a local area where the consumption is 4,000,000, 10,000,000, and 17,000,000 units per annum respectively, and the supply is generated: (1) wholly in the area, (2) partly in and partly outside the area, and (3) wholly outside the area.

TABLE VI.—UNITS SUPPLIED PER ANNUM, 4,000,000. MAXIMUM DEMAND, 2,000 KW.

Source of supply.	Form.	Distance and losses.	Annual cost.	Price per unit.
Bulk ...	A.C.	Minimum	£6,200	·372d.
,, ...	D.C.	,,	7,483	·449d.
,, ...	A.C.	Average	7,842	·470d.
,, ...	A.C.	Maximum	9,519	·571d.
,, ...	D.C.	Average	9,775	·586d.
,, ...	D.C.	Maximum	12,108	·726d.
Local & bulk	D.C.	Minimum	13,166	·790d.
,, ,, ,,	D.C.	Average	13,809	·828d.
,, ,, ,,	D.C.	Maximum	14,460	·867d.
Local ...	D.C.	Actual	16,400	·984d.

TABLE VII.—UNITS SUPPLIED PER ANNUM, 10,000,000. MAXIMUM DEMAND, 4,000 KW.

Source of supply.	Form.	Distance and losses.	Annual cost.	Price per unit.
Bulk ...	A.C.	Minimum	£13,317	·320d.
,, ...	A. & D.C.	,,	14,600	·350d.
,, ...	D.C.	,,	15,949	·383d.
,, ...	A.C.	Average	16,667	·400d.
,, ...	A. & D.C.	,,	18,600	·446d.
,, ...	A.C.	Maximum	20,088	·482d.
,, ...	D.C.	Average	20,625	·495d.
Local & bulk	A. & D.C.	Minimum	22,504	·541d.
Bulk ...	A. & D.C.	Maximum	22,657	·544d.
Local & bulk	A. & D.C.	Average	23,654	·567d.
,, ,, ,,	A. & D.C.	Maximum	24,821	·595d.
Bulk ...	D.C.	,,	25,383	·609d.
Local ...	A. & D.C.	Actual	25,575	·614d.

The three preceding tables emphasise the advantage of a low-pressure three-phase alternating current supply in preference to low-pressure direct-current when energy is purchased in bulk. The cost of direct current compared with alternating current is higher by 20.7 per cent. in Table VI, 19.7 per cent. in Table VII, and 19.2 per cent. in Table VIII at minimum

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rates, and 27.2 per cent., 26.4 per cent., and 25.9 per cent. respectively at maximum rates.

The cost of supplying from a local power station compared with an alternating-current bulk supply is higher by 165 per cent. in Table VI, 92 per cent. in Table VII, and 61 per cent. in Table VIII at minimum rates, and 81 per cent., 27.3 per cent., and 7.7 per cent. respectively at maximum rates.

TABLE VIII.—Units Supplied per Annum, 17,000,000. Maximum Demand, 6,000 kw.

Source of supply.	Form.	Distance and losses.	Annual cost.	Price per unit.
Bulk ...	A.C.	Minimum	£20,893	·295d.
,, ...	A. & D.C.	,,	22,175	·312d.
,, ...	D.C.	,,	24,906	·351d.
,, ...	A.C.	Average	25,983	·366d.
,, ...	A. & D.C.	,,	27,917	·394d.
,, ...	A.C.	Maximum	31,182	·440d.
Local & bulk	A. & D.C.	Minimum	31,530	·445d.
Bulk ...	D.C.	Average	32,013	·452d.
Local & bulk	A. & D.C.	,,	33,372	·470d.
Local ...	A. & D.C.	Actual	33,625	·475d.
Bulk ...	A. & D.C.	Maximum	33,751	·476d.
Local & bulk	A. & D.C.	,,	35,238	·498d.
Bulk ...	D.C.	,,	39,242	·554d.

The difference in cost, amounting to over £2 per kw. demanded, shown in Table VI between low-pressure direct current obtained from a bulk supply at maximum rates and the local power station, indicates conclusively that for an output of this size it is not economical to establish a local power station if a bulk supply is obtainable on reasonable terms.

Regarding Table VIII, it is extremely unlikely that so large a supply as 17,000,000 units per annum would be purchased in bulk in the form of E.H.T. alternating current and entirely converted to direct current for general distribution purposes. With this exception the cost of the bulk supply in the form of direct and alternating current at maximum rates is substantially the same as the local power station, and the supply partly in bulk at maximum rates and partly from the local power station is only 4.8 per cent. higher than when the whole supply is given from the local power station.

The Electric Vehicle Committee of Great Britain.*

(*Formed under the auspices of the I.M.E.A.*)

Annual Report—*Abstract.*

Constitution of the Committee.—During the period reviewed in this report, additional members have been added to the Committee representing the following:—The Association of British Motor and Allied Manufacturers, Ltd.; the Motor Trade Association; Agents for Electric Vehicles; and the London Electric Supply Companies.

Journal.—The Committee's journal, *The Electric Vehicle*, continues to gain in popularity, as evinced by increased sales. Owing to increased cost it has been found necessary to restrict the issue of free copies.

Co-operation of Motor Traders.—At the suggestion of Mr. A. Goodwin, representative of the Motor Trade Association, a joint meeting was arranged between the Committee, the Council of the M.T.A., and the Executive of the Agents' Section of the M.T.A. The meeting served a most useful purpose in effecting an exchange of views upon various matters, but mainly in connection with Clause 23 in the draft I.M.E.A. Supply of Electricity Bill. As a result of this meeting, two special joint committees were formed, comprising members of the Committee and of the Executive of the Agents' Section, Ltd. One Committee was to consider and recommend to the I.M.E.A., through the E.V.C., such alteration or modification in Clause 23 of the Bill as might seem desirable in order to afford adequate and reasonable protection to the existing motor traders. The other was to consider terms and conditions of sale of electric vehicles.

Progress in the Adoption of Electric Vehicles.—The adoption of electric commercial vehicles for short-distance haulage continues to make satisfactory progress, when it is remembered that under present conditions these machines can only be obtained for use for war work or work of supreme national importance. The knowledge that in actual commercial service the electric vehicle provides the cheapest means of transporting a given weight of goods a given distance in urban transport and delivery duty, is diffusing far and wide in commercial circles, and there are clear indications that so soon as normal conditions return, a great demand for electric vehicles will be manifest. The Committee has suggested to British automobile manufacturers that they should develop, after the war, an electrical vehicle line as a branch of the petrol motor business. It is satisfactory to be able to record that commercial electric vehicles are being produced in England to-day which in design, workmanship, and performance compare most favourably with, and are in no way inferior to, the best of the imported vehicles.

Electric as Competitor of Petrol Vehicle.—It has been thought that the electric vehicle is being put forward as a direct competitor of the petrol vehicle. Such is not the case so far as the Committee is concerned. The electric is essentially a moderate-speed machine with a definite limit to its radius of action, and its sphere is that of use in urban and suburban areas for what is generally termed "short-distance frequent stop" delivery and transport duty. It only enters into competition with the petrol vehicle when the latter is employed in that sphere.

The future will show that for each class of power-propelled vehicle, including steam, there is an extensive and definite field of application open, where its peculiar and inherent advantages will enable it to hold its own, and will mark it as the most economical type to employ. The Committee has not hesitated to condemn the statements that have been made that the electric is destined, in the near future, to entirely supplant the petrol and steam types for all classes of work.

Financial Position and Propaganda.—The financial position of the Committee is satisfactory, although it still appeals for donations. The Committee aims at adopting a propaganda and publicity effort of the most intensive form possible after the war, and such publicity work can only be inaugurated if sufficient funds are in hand for the purpose. These funds the Committee is endeavouring to accumulate.

The Committee wishes again to place on record its high appreciation of the voluntary services of Mr. F. Ayton, its hon. secretary.

* See Elec. Rev., March 22nd, 1918.

Electric Power Supply.

(*Continued from p.* 623.)

Coun. Dymond (Hereford) criticised the report on the score of its omissions. Not a word was said as to the cost of fuel. The impression would be given that the electricity supply industry had been wasteful in the past. No matter how big the generating station, unless the price of coal was controlled there was no prospect of cheap power. Unless the trade unions could be made to see that the national interests and their own did not lie in the direction of high prices for coal, no progress could be made. Let the I.M.E.A. Council prepare a report on the Board of Trade Report, and induce their committees to adopt a co-operative policy, which could be carried in Parliament by their representatives. He was convinced that many of the large undertakings were not more economical than the small ones. At Hereford the costs were below those of Manchester, Glasgow and Birmingham.

Mr. C. H. Wordingham was deeply indebted to Mr. Pearce for his excellent review of the report, which was epoch-making; on the attitude of the meeting towards the report depended the future of the industry. A committee representative of all branches of the industry should be set up to consider the report in all its aspects, with sub-committees to deal with special features. Thus they could form a consensus of opinion for the industry as a whole; detailed criticism with the full support of the industry would carry weight with the authorities. The broad principles were those enunciated by Dr. Ferranti 25 years ago, and applied by Manchester 20 years ago, when the city of 8 square miles set out to supply an area of 140 square miles—for electricity supply must *not* follow municipal boundaries. The final proposals must be carefully examined. The main considerations were: (1) Which was the most important—to save coal, or to supply electricity at the lowest possible cost? (2) Not the cost of generation, but the cost to the consumer was the main question. (3) A general supply over the whole country was aimed at. Such a supply in certain areas would never pay; ought those areas to share in it? (4) It was of paramount importance that the scheme should provide material inducements to the exercise of the utmost economy. (5) The matter was most urgent; they must not delay it, waiting for ideal conditions, but must be ready in time for the return of peace. (6) When the scheme was carried out, let it be wholly British—designed, built and carried out by British engineers.

Mr. G. Wilkinson (Harrogate) said it remained to be proved that any public supply could attract manufacturers having a load of 1,000 kw. and a good load factor—certainly not if the works were far from the E.H.P. lines; this cut out a large number of potential consumers. There were large tracts of country where the density of demand was low, and a national supply would not pay; many residential towns both on the coast and inland similarly lay outside the scheme, as they could not be reached with E.H.P. mains on economical lines. Local stations combining heating by exhaust steam with their electricity supply afforded the most economical solution of the problem. In Harrogate the domestic consumption of coal was 12½ times that of the power station; a central heating supply would save a large proportion of the house coal, and provide a more economical electric power supply. American practice was good, but we could obtain better results now that simple and accurate heat meters and effective temperature control devices were available. This again cut out a large area of operations. The national electricity supply was not an economical proposition for chemical, dyeing, woollen, cotton, and like industries, which must have large supplies of low-pressure steam, and could usefully employ the heat in the condensing water at low temperatures. There was a fearful waste in the cooling water, and all textile mills used low-grade heat. One pound of steam at 20 lb. gauge-pressure contained 1,160 B.TH.U. (low grade); 1 lb. at 280 lb. pressure, and 660 deg. superheat (high-grade) contained 1,343 B.TH.U., or 183 more = 16 per cent. A modern 3,000-kw. set working at 280 lb., 660 deg. superheat and 28 in. vacuum used 12.75 lb. steam per kw.-hour, while a similar set with 20 lb. back

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pressure used 25 lb.; the former used 1,343 B.TH.U., and the latter 183 × 2 = 366, or less than 25 per cent. of the heat expended by the supply company. He hoped the authorities responsible for the national scheme would give due regard to these important points, and avoid heavy loss and disappointment.

Mr. R. A. CHATTOCK (Birmingham) said that the essence of the report was nationalisation, and recalled his presidential address of 1914, in which he indicated the necessity of cheap supply, the conditions governing it, the retention of existing distribution systems, and the need of wayleaves, &c. He then urged that the large municipalities should meet and organise a scheme; if that had been done they would have anticipated the report, and would, perhaps, have got something done. The new scheme was a compromise between Government, municipal and company control, and all were pretty well satisfied with the proposals. The appointment of Commissioners was admirable, and the constitution of the district boards was satisfactory, but not so the delegation of powers to other bodies; a company *must* make a profit, and that was not in the national interests as regarded the provision of the cheapest possible supply. The district boards should control the generation and distribution and divide no profits. Some incentive should be given to authorities to work economically. The proposed conditions of purchase were inequitable; those undertakings which had been thrifty would come off worse than others. A valuation board should be set up by the Commissioners to value undertakings on a consistent basis. Large consumers supplied direct from the feeders must be charged the same price as others, lest they should derive an unfair advantage. Who should have the resulting profit? He suggested that the distributors should not be allowed to make any profits, but should receive 2½ per cent. on their turn-over to provide funds to carry on their work. The sweeping recommendations of the Coal Conservation report were to be strongly deprecated. Many districts had no suitable sites for big stations, and long transmission lines were not economical. With regard to cooling towers versus river water, 20 miles was about the limit of economical transmission. In his own district, comparing 20 miles with 2 miles, the saving in favour of the latter was 5 per cent. An additional advantage of being close to the demand was the greater earning power of the station; transmitting 150 million units per annum 20 miles there was 10 million units less to sell owing to the loss in transmission. State assistance should be given to undertakings developed while prices were high; the Government should be asked to refund the difference between present prices and the prices a few years after the return of peace. Fuel was very costly, owing to the conditions of labour; but privately generated power was also subject to the high price of fuel.

Mr. F. W. PURSE (Carlisle) said that the two reports were based on assumptions, and it was disappointing that, except for Mr. Pearce's very effective exposure of the fallacies of the Coal Conservation report, they had not been seriously challenged by the municipal engineers. Whilst accepting the general principles, they should be careful not to be deceived as to their application to existing conditions. Many of them could make very substantial reductions in their charges if they possessed the privileges foreshadowed in the Board of Trade report. No figures were given as to the cost of setting up the new schemes, or the cost of production; this was a very serious defect. Taking the case of the Lancashire group of stations, but excluding Manchester and Salford, he found that with a maximum demand of 73,000 KW. they generated 180 million units, and had annual capital charges of about £230,000. A superstation of 100,000 KW. to supply this group would cost not less than £1,500,000, with annual charges of £150,000, making 0.2d. per unit. The cost of coal at 15s. a ton, with oil, wages, maintenance, &c., would be not less than 0.18d. per unit, making a total of 0.38d. The average consumption of coal for these stations was 3.5 lb. per unit, costing 0.28d. per unit. There was thus a big margin between the two costs under present conditions, which would increase as the stations installed more efficient plant, so that the superstation could not compete as a whole with existing conditions without State assistance, and the other privileges above referred to. Committee representatives must consider what was going to happen to their gas undertakings if by reason of State assistance the electricity supply was enabled to undercut the gas supply; the gas consumers would change over to electricity, and there would be a loss on the gas supply to be made good. Great emphasis had been laid upon the necessity of a cheap supply of electricity for industrial purposes, but in how many cases was the cost of electricity a relatively big item in the process of manufacture? In a case in point it was only 2 per cent. of the cost of the finished article. There were many other factors apart altogether from the present cost of the supply which had operated against the superincrease in the consumption of electricity. If, however, Parliament could be induced to proceed with a scheme, it was imperative that the Association should see that the officials of municipalities were not sacrificed on the altar of alleged future national advantage. No displacement of officials should take place. The proposals resembled those of Kaiserism; unless stringent safeguards were provided, despotic control would ensue, and the future conditions would be infinitely worse than the present.

The discussion was then adjourned to the following day. After an appeal by the President, on behalf of the Council, for constructive rather than destructive criticism, Coun. BARGE (West Ham) remarked that the meeting had criticised the Bill (*sic*) in detail, but approved it on the whole. The Bill had got to come; no petty or parochial feelings of jealousy must interfere with the progress of the whole country. They were prepared to support it as a reasonable and rational measure. Clause 70 said that the boards "may provide compensation for displaced engineers," but this provision should be compulsory.

Mr. H. S. ELLIS (South Shields) said that no engineer on the North-East Coast wished to destroy the proposals of the report, but they must look after their own interests. The I.M.E.A. statement excluded the North-East Coast; would the Association protect their interests? The price charged on the N.E. Coast (½d. per unit) was taken as that likely to prevail in the future, but this was a fallacy; in Newcastle the charges for lighting and heating were higher than in South Shields and other towns. The saving of coal alleged by the Coal Conservation Committee to be possible—50 million tons—was absurd; to reduce the assumed consumption of 5 lb. per H.P.-hour to 1½ lb. was absolutely impossible. The Board of Trade report was much better; it did not attack municipal trading at all. That Association, whose interests predominated, should have had a policy of its own. He agreed that the electricity supply of the country should be thoroughly overhauled; but what had been done on the North-East Coast could not be done elsewhere. He had not had a complaint of high prices in six years at South Shields, where power was .99d. per unit. He was pleased with Mr. Purse's remarks; cheapness of supply was not so important as was supposed. Better use should be made of the big plants that stood idle all night, when they might be supplying industries at very low rates. When the Bill was drafted, the I.M.E.A. ought to have an opportunity of discussing it.

Mr. J. W. BEAUCHAMP (West Ham) said that the Government must not overlook the fact that it was almost entirely due to the municipalities that electricity supply had attained to so great a development. There were two leading ideas in the minds of the promoters of the movement—saving coal, and reducing cost; the Government had emphasised the latter, but cheap electricity was not nearly so essential to industries in general as was imagined. The big towns were already giving low prices; the main object should be to lower high prices, where they existed, and to distribute industries about the country instead of bunching them as at present. Industrial unrest was largely due to uncomfortable conditions of living; it could be cured not by high wages, but by reducing overcrowding. Conservation of coal should be emphasised by Government rather than cheapness; a centralised authority could purchase coal in bulk and effect great savings in various ways.

Ald. HIGHAM (Accrington), as a large user of power for cotton spinning and chairman of the Accrington undertaking, discouraged optimistic statements as to textile mills coming over to electricity supply. In Lancashire they *must* have cheap power. In a new mill public supply could not compete with steam power; the expert steam engineer offered to give power at such a price that they could not afford to pay 0.4d. per unit for weaving or spinning (before the war). But a great increase of other kinds of load could be effected on the lines of the report. Directly peace returned there would be an immediate demand for increased supply, and the existing stations *must* be extended to meet the pressing needs. The powers outlined in the report were far too wide and drastic to be entrusted to three Commissioners; their number must be increased, and they must be responsible to a higher authority. The district boards should be established and set to work to test their ability before endowing them with full powers. The financial proposals were the weakest feature of the scheme. Accrington had four 1,000-H.P. gas engines, which were "running at this moment, for all I know," with gas producers and by-product recovery apparatus, admirably suited for experimental work on the carbonisation of coal.

Mr. H. FARADAY PROCTOR (Bristol) pointed out that only three of the Commissioners were whole-time men, what about the others? It was imperatively necessary, and the I.M.E.A. evidence had emphasised the fact, that *all* the Commissioners in such important positions should devote their whole time to the work, and have no financial interests in any other undertaking.

Ald. SMITH (Liverpool) supported Mr. Wordingham's suggestion that a committee and sub-committees should be appointed to consider the report and prepare a scheme that they could support in the form of a Bill. If they did not combine their forces on one scheme, they would be killed off in detail. The scheme in some form was bound to come.

Mr. R. LOMAX (Stockport) said that the committees which drew up the reports knew very little about power supply; neither report was supported by adequate evidence, and the comparisons that were made were unfair.

Bailie WILLOCK (Glasgow) commented on the terms of purchase with reference to the subject of rate-aid, and emphasised the importance of the recovery of by-products; in Glasgow much had been done in this direction.

Mr. C. TURNBULL (Tynemouth) laid stress on the enormous waste of heat in condensers—they were actually hunting for water to carry off this heat, which should be utilised. If it were used for warming large areas of land, and the sewage were also used as a fertiliser, an enormous amount of food could be raised.

Mr. F. W. PURSE pointed out that the report of the com-

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mittee on the electrical trades stated that by-product recovery had not proved economical except on a very large scale.

Mr. T. D. CLOTHIER (Bootle) agreed that changes had to be made in the system of control of the electrical industry. That cheap electricity would be obtained was questionable, owing to the cost of transmission; an abundant supply was more important than cheapness.

Replying to the discussion, Mr. S. L. PEARCE said it would be most unfortunate if any suggestion went forth to the effect that our supplies of electricity all over the country were cheap enough; they should be both cheap and abundant. Railways and electro-chemical works were coming on, and cheapness was essential. He admitted the difficulty in competing with steam in new mills, but said that old ones were readily converted to electric driving. Centralised control was most important; the delimitation of areas would be a great step towards future reconstruction. Certain extensions would undoubtedly have to take place. The Commissioners might well be appointed to deal with the interim stage, and might take over the powers of the Ministry of Munitions. Their aim should be to reproduce over the whole country the low costs now obtained in favoured localities; that was a cardinal point of the proposals. There was general agreement regarding the inequitable conditions of purchase. If the Government provided the funds, rate aid would be abolished at one stroke, as the ratepayers would have no claim. The district boards were not to make any divisible profits, but to retail at cost price. Obviously the cost of supply must vary from place to place. He objected to the suspension of the sinking fund and payment of interest out of capital; the gas interests were already declaiming against the preferential treatment of electricity supply.

NOTES FROM CANADA.

[From our Special Canadian Correspondent.]

THIS country is steadily feeling the effects of the war more and more, and one noticeable feature is the restrictions placed on the use of electric power by the Power Controller. Sign lighting is prohibited altogether, and the lighting of shop windows is only allowed on Saturday evenings; the lighting inside the shops is restricted to a maximum of 1 watt per sq. ft. of floor area; in most streets, except where the tramcars run, the lighting is reduced by approximately one half.

In Ontario, owing to the extraordinary demand made for electric power for industries, particularly for munitions, the Power Controller has ordered many steam plants, which owing to the use of electric power had been shut down for years, to be started up again in order to set free hydro-electric power for other places where steam power is not available.

This gives rise to rather a curious condition, because such an order is really in direct opposition to the objects for which the fuel controller was appointed, viz.: to conserve coal. One wonders if one day some luckless engineer will receive an order from the Power Controller to start up his steam plant, and the next day one from the Fuel Controller to shut it down.

A member of the staff of the Shawinigan Water & Power Co. recently gave out some details of the activities of the company. Its power houses have an installed capacity of almost 200,000 H.P., and very large industries are in operation to-day as a direct result of the facilities for obtaining large quantities of power which have been provided.

Almost the entire world's supply of asbestos is mined in Quebec with Shawinigan power.

Some very instructive figures were given relating to electric heating of houses, a matter which has received a fair amount of attention since war broke out owing to the shortage of coal and its high cost. Many of the general public are expecting the use of electricity to become almost general here for heating.

The Shawinigan Co.'s experience shows that it takes about 20 KW. of maximum demand to heat an average house, presumably in Montreal, and 40,000 KW.-hours per year. Assuming only 20 H.P., instead of KW., it would require over 2,000,000 H.P. to heat the houses of the city of Montreal alone, and on this basis there is not enough hydro-electric power developed in all the North American continent to heat the houses of Quebec Province.

An interesting circular (No. 6) has just been published by the engineering experimental station of the University of Illinois, U.S.A., on the storage of bituminous coal, the price being 50 cents.

A series of questions regarding this subject was sent out to a large number of firms, and a summary of conclusions and suggestions culled from the replies was drawn up. Apart from this, however, a summary of conclusions is given which is based on the particulars set forth in the circular itself; this latter points out the reasons for storing coal, the kinds and sizes of coal which may be safely stored, methods of piling coal, &c. Numerous illustrations of methods of storing coal and the equipment employed are given. The reason advanced for going into this subject is the coal shortage during the winter of 1917 and 1918, and the circular is really an investigation of the problem of safely storing large quantities of coal at or near the point of use, so that it may be obtained during seasons when consumption is lightest and when the railways are best able to handle the traffic. This circular measures 9 in. by 6 in., and contains 192 pages of extremely useful information regarding coal storage, most of it being based on actual experiences of firms handling large quantities of coal.

It was recently announced that women conductors were to be employed on the Toronto Street Railway (otherwise tramway), but the men employés objected very strongly, and so far at any rate no women have appeared—whether they ever will do so remains to be seen. Comparatively few women in Canada have so far been employed on unusual (wartime) work of any kind. Munition works employ a good many, and there are some running motor cars for the Red Cross, &c., but that seems to be about all.

LEGAL.

A.E.G. ELECTRIC CO., LTD.

IN the Chancery Division on Tuesday, Mr. Justice Younger had before him a petition by the Board of Trade to wind up this company under the Trading with the Enemy (Amendment) Act, 1916.

Mr. AUSTEN-CARTMELL said this was the last of the three companies formed by the large parent company in Berlin, the other two having been wound up by the Court on May 28th. The business of this company had been wound up by order of the Board of Trade, and there was no defence now to the winding up of the company itself. But there had been reference to an arbitrator respecting a large claim and counter-claim between this company and the Rio Tinto Co., Ltd. In that arbitration, the arbitrator appointed, Capt. Riall-Sankey, had found some difficult questions of law, which were now before Mr. Muir Mackenzie, the Official Referee. It was thought that his decision would not be available until after the Long Vacation. The Board of Trade would like the matter settled before the Long Vacation, and he suggested that the petition should stand over to July 23rd.

Mr. CONWAY, for the company, took the view that if there was a winding up of the company it might have the effect of prejudicing the arbitration.

His LORDSHIP said he would have the petition put in the list for July 23rd.

RIO TINTO CO., LTD. *v.* A. E. G. ELECTRIC CO., LTD., AND A. E. G. ELECTRIC CO., LTD. *v.* RIO TINTO CO., LTD.

(Consolidated).

Mr. MUIR MACKENZIE, one of the High Court Official Referees, on Monday, July 1st, commenced the hearing of these consolidated actions, which related to the supply of machinery for extracting copper from ore from the mines of the Rio Tinto Co. The A. E. G. Electric Co. claimed for the supply of a turbo blower, and the Rio Tinto Co. claimed damages for the failure of the machine to do the work required of it.

Mr. Grant, K.C., was for the Rio Tinto Co., and Mr. Colefax K.C., with Mr. Conway, was for the A. E. G. Co.

Mr. GRANT, in the course of a lengthy opening of the Rio Tinto Co.'s case, said that the action was one claiming damages for the failure by the A. E. G. Co. to supply a machine which would do the work it was intended to do when it was ordered. The machine in question was called a turbo-blower, which was used in connection with blast furnaces. The plaintiffs owned large copper mines at Rio Tinto. The ore, of which there was practically an unlimited supply, was ore which contained valuable constituents, the chief of which were copper and iron. The most valuable was the copper, but the percentage was not great. In some of the ore there was very little, and in some it ran up to 4 or 5 per cent. Normally it was about 3 per cent. It was, of course, never found pure, and therefore it was necessary, in order that it might be made into a commercial article, to extract it, with the other constituents from the ore. That was done by two processes, but with only one of those was the court concerned. The process began in the blast furnaces, and, after passing through them, the material went on to the Bessemer process. In the blast furnaces where they began they put the copper ore together with coke and another material, such as lime, in order to produce a flux. Then they had to create intense heat, the result of which was that the mixed mass in the furnace became fluid, and owing to the difference in specific gravity, the copper sank to the bottom and thereby was produced copper of greater or less purity, and the greater or less purity depended upon the intensity of the heat, and the intensity of the heat depended, to a large extent, upon the volume of air which could be blown into the furnaces. The greater the volume of air the greater the process of oxidation and the greater the purity of the copper matte which was produced. The copper matte so fused was taken in its liquid form to the Bessemer process —into the converters. This was all done by a forced draught

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and by that means was produced the commercial copper. The copper matte which was taken into the Bessemer converters was generally of about 40 per cent. of copper and the Bessemer process did the rest. Everything depended upon the draught of air, a point which was material in the case because the machine ordered was for that process. The Rio Tinto Co. were great producers of copper, and had been so for many years, and the method they employed was that which he had described. They had at their works at Rio Tinto a range of six blast furnaces air-operated by turbo-blowers. There were four of these blowers, one of which was a modern one—a Parsons turbine—which was capable of blowing one furnace and a little more. The other three blowers were old and not so powerful as the Parsons, and they were able to operate only three furnaces. The result was that they were only able to operate four furnaces although six existed, and those furnaces were used at the works as they had existed before the change was made, producing a copper matte of about 20 degrees only. The Rio Tinto Co. were minded in 1911 to improve their works, and the first step was to build new converters, and it was decided to put them alongside the six furnaces and so increase their utility by doing the whole of the preliminary blast furnace operation there, and to carry the matte into the Bessemer converters to be there erected and so finish the process. What the Rio Tinto Co. was claiming damages for was the failure of the turbo-blower to do the work for which it was supplied. One of the heads of the damages claimed related to the failure and the fall in the output of the plaintiff's works in consequence. Owing to the failure of the machine the output of copper fell off considerably, and the great question to be decided was whether such falling off was recoverable by way of damages. It was possible to found the case on the general ground that the defendants, through their agents, must have known the purpose for which the blower was to be employed, and must have contemplated the possibilities, if when supplied, the machine did not do its work, of the result to plaintiff's business. The case became much stronger if he proved, as he hoped to be able to do, that the defendants were aware of the exact situation of matters at the plaintiff's works, and of the particular use to which it was intended to put the machine, and if they knew that the failure of the machine to work must necessarily involve great loss to the plaintiffs. It was with a view to establishing that case that he proposed to deal in detail with the changes that had been made and how they came to the defendants' knowledge.

In this regard counsel read volumes of letters which had passed between the parties, and continuing, said that for the purposes of the Bessemer converters a blowing machine was required, and in the year 1912 the question of the supply was on the tapis. The defendants, amongst others, were asked to tender for the blowers, and the machinery was described to them in the specifications. The application led to an interview between Mr. Adler and Mr. Clift—Mr. Adler being the representative of the A. E. G. Co. The A. E. G. Co. was a Berlin Co., which had founded in various parts of the world subsidiary companies; one of these subsidiary companies was founded in London, and they were the defendants in this suit. There was another branch company in Spain. The A. E. G., although a branch of the Berlin company, was a limited company in England, and Mr. Adler had all the dealings as to the blower for the blast furnaces. The interviews would be testified to by Mr. Clift, who was the commercial manager of the Rio Tinto Co. in London. He explained to Mr. Adler what was going to be done—how the Rio Tinto Co. was proposing to erect new converters side by side with the six furnaces. The question was discussed at great length of the supply of air—whether it should be supplied by steam power or by electricity. The matter was re-opened in June, went on until August, when the defendants sent in a tender. Mr. Adler thoroughly understood what was being done at plaintiffs' works. After further consideration, in the light of information supplied by Mr. Adler, the plaintiffs decided that they would not have turbo-blowers but would induce the air by reciprocating engines, and accordingly those engines were ordered from the firm of Messrs. Fullerton, and they were installed. When the turbo blower was ordered, Mr. Adler was plainly told what was being done, and was asked to tender for the blower engines, and he was told exactly what the position was as to the new converters and the steam power. The next step was to get the new furnaces into active operation, and in the year 1913 the plaintiffs took up the question of the new blower necessary in order to create a better draught of air. The Parsons turbine was to operate the one furnace, and the defendants were to supply a new turbo-blower to operate the other furnace. At this stage Berlin asked London for details of the order. It was explained to Mr. Adler that the machine would have to work the five furnaces night and day, and that there was no other machine to do the work. They knew it was intended to dismantle the three old blowers and to retain the Parsons turbine, and that the new blower would have to create the draught for the five furnaces. The A.E.G. had never made a blower for so big a draught before. They wanted plaintiffs to pay the second instalment as a condition precedent to anything, but plaintiffs refused until proper tests had been made, which defendants declined to make. At the first trial the machine broke down, the shaft bent, and it would not work. After the breakdown the plaintiffs became more suspicious than before. They were dealing with a German firm, and the firm in England, under a supervisor, was unable to do anything, while the Spanish firm refused to do anything. The A.E.G., owing to their German connection, could get no one to work for them. No British firm would have anything to do with the defendants, and plaintiffs took up the provision of a new shaft to replace the defective one. There was a third trial, when the machine again broke down, but in the end an entirely new shaft was made and sent out by plaintiffs, and since then the machine had done its work. That being so, they made their claim on April 20th, 1916. The arbitrator had found that a serious error existed in the original plans, and that there was a defect in the design. The arbitrator, he contended, had taken too narrow a view of his powers, otherwise he would have found that the breakdown was due to the bad design, which caused the machine to fail at the critical speed.

In the course of his speech, Mr. GRANT repeatedly referred to Mr. Colefax as "the English gentleman representing the German company," an observation which ultimately drew from Mr. Colefax a strong protest, not with regard to his being an English gentleman, but against the statement that he represented the German company, as he was, in fact, representing the Board of Trade in the litigation.

The hearing was adjourned.

WAR ITEMS.

Exports to China.—In the "London Gazette" for June 28th there appears a list of further firms, &c., in China to whom exports may be consigned.

Trading with the Enemy.—The "London Gazette" for June 28th contains a further list of persons and bodies in the following countries with whom trading is prohibited:—Argentina, Paraguay and Uruguay, Bolivia, Brazil, Costa Rica, Cuba, Mexico, Netherlands, Netherlands East Indies, Norway, Peru, Salvador, Spain, Sweden.

Labour Ministers and German Trade Methods.—Speaking at Preston last week, Mr. G. J. Wardle, M.P., Parliamentary Secretary of the Board of Trade, said Labour Ministers could, he thought, determine their own policy. They had seen what German trade meant before the war, and were resolved that in the future trade must be considered, not from the individual standpoint, but from the view of the defence of the country.

The Official Price of Lead.—The Ministry of Munitions has modified the maximum prices of lead as fixed by the Lead Order of 1917. As from June 28th that Order will be subjected to the alterations indicated in the following table:—

Class of Lead.	New Figures.	Original Figures.
Sheet Lead	£41 0 0	£39 10 0
Lead Pipe	41 10 0	40 0 0
Dry White Lead	51 0 0	46 0 0
White Lead in Oil	58 0 0	53 0 0
White Lead in Oil	60 0 0	55 0 0
Red Lead and Litharge	45 0 0	42 0 0

Demobilised Electrical Apprentices.—According to the *Manchester Daily Despatch*, the problem of returning apprentices is already engaging the attention of Trade Unions. At a delegate meeting of the Electrical Trades Union, in Manchester, it was reported that there seemed to be no considered policy with regard to the treatment of apprentices on their return from the Army. Some employers are agreeing to count time spent with the Forces as part of the period of apprenticeship, while in other cases that time is not counted. The delegates held that if time spent with the forces is counted the standard of craftsmanship may suffer, except in cases where apprentices have been serving in a technical capacity in the Army. If, on the other hand, the period of service with the Colours is not counted and the apprenticeship has to be completed, that will mean that adult men will have to work as apprentices, and presumably at apprentices' rates of wages. The Electrical Trades Union decided to call upon Trades and Labour Councils nationally to urge upon the Government the payment of full district rates of wages to these men while they are completing their apprenticeships on their return to civil life.

Industrial Problems in Peace Time.—Mr. A. Henderson, in a recent speech at Brighton, said that on the conclusion of peace a host of problems would confront those concerned with industry, which could not be satisfactorily settled save by consultation and agreement. The war over and over again had demonstrated the need of some machinery, practically in every industry, for consultation and discussion between employers and workers. Where no machinery existed it had to be improvised during the war. Even in well-organised trades, in consequence of the suspicion of each other's motives, the conduct of negotiations proved extremely difficult, and they were often protracted. Elaborate precautions had to be taken to convince both sides that no trap was being set for them. After the war it would be more than ever essential that we should have in the well-organised trades some comprehensive machinery for consultation, and a better ordered system of representation and control. In the years ahead, when we were rebuilding society, a prolonged stoppage of work, for whatever cause, might be a national disaster. Co-operation

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was the keyword of the Whitley Report, and it ought to be the watchword of the future in national and international affairs. Co-operation or disastrous strife, reconstruction or revolution, reason or madness, it was no exaggeration to say were the alternatives. For intelligent people there could be no question of choice. The idea that the relationships between Capital and Labour must necessarily be antagonistic must be abandoned on both sides. If they continued to be opposing forces, mistrusting each other, the one paying as little as possible, the other indifferent as to his contribution to the sum total of production, they both inflicted injury on the community. What was required was a clearer recognition of each other's difficulties, and a determination to approach them in a spirit of toleration, mutual confidence, and goodwill.—*Birmingham Daily Post.*

Prohibited Exports.—The "London Gazette" for July 2nd contains particulars of further changes made in the lists of prohibited exports.

One-Man Businesses.—An association has been formed of those who come under this heading, its objects being to look after the interests of its members both during and after the war. The Association has received the official recognition of the Ministry of National Service. Practically every trade and profession is represented amongst its members. Those interested should apply to the Hon. Secretary, One-Man Business Association, c/o Anderton's Hotel, Fleet Street, London, E.C. 4, who will be pleased to forward all particulars regarding the Association.

German-Controlled Businesses.—At the outbreak of war certain businesses here were carried on by naturalised Germans in close association with German subjects or German companies, and they were wholly or mainly under the control of German subjects. Sir Albert Stanley has recently been asked in Parliament whether he would introduce legislation for winding up such businesses. In reply, Sir Albert (*Times* report) said he presumed that the cases referred to by his questioner (Sir J. Butcher) were those where the outbreak of war had the effect of dissolving a partnership existing between partners in this country who are naturalised British subjects and partners in Germany. These cases have generally been dealt with by vesting the enemy interest in the custodian in order that it may be realised by him. Sir Albert is looking into the matter, with a view of deciding whether it is necessary to take further powers in such cases. In reply to Sir E. Carson, Sir Albert said he would also look into the cases where the only remaining partner is a naturalised German, who seems to carry on the business as if it were an English concern.

Parliamentary References to Siemens Bros. & Co., Ltd.—The new arrangements in regard to Messrs. Siemens Bros. and Co., Ltd., have been fully reported in the Electrical Review, and the position is, we believe, well understood by our readers, but as the matter continues to occupy attention in Parliament, we reproduce from the *Times* the following discussion which took place in the Commons on Monday last respecting the managing director:—

Sir H. Dalziel asked whether Mr. Chauvin, managing director of Siemens, who were Government contractors, was a German naturalised since the outbreak of the war; whether his name was previously von Chauvin; whether, on the winding up of the business as an enemy concern, it was a condition of purchase that Mr. Chauvin's services should be retained; whether, in view of the close relations of the firm to the Government in the production of war material, he would consider the possibility of employing a manager who was British-born; and whether Mr. Chauvin was also a director of the Deutsche Bank.

Sir Albert Stanley replied:—Mr. Chauvin, whose name was previously von Chauvin, is of German birth, and has been naturalised since the outbreak of war. So far as I am aware he has never been a director of the Deutsche Bank. On the sale of the shares of Siemens Bros. & Co., Ltd., there was no condition with regard to the retention of Mr. Chauvin's services, and the agreement under which he now acts as managing director of the company was, I understand, entered into by the new directors appointed by the purchasers of the shares.

Sir H. Dalziel pressed for an answer to the inquiry whether a person of British birth could not be found to undertake the delicate and important work of the manager. Sir A. Stanley: I think that is a matter which rests with the shareholders of the company. I have no control of it. Sir E. Carson: Is my right hon. friend satisfied that the purchase was a real purchase, and not a sham one in order to keep on this same manager? Sir A. Stanley: I am perfectly clear on that point. The sale of the shares was a *bona-fide* transfer. The company is thoroughly British, and is bound by the model clause, which ensures that it will remain British. Sir H. Dalziel: Has the right hon. gentleman the authority of the Public Trustee for stating that it was not a condition that the same manager was to be retained? Sir A. Stanley: Yes.

Exemption Applications.—At Southwark, the Tribunal entered a vigorous protest against the statement of Sir Auckland Geddes, of the Ministry of National Service, in the House of Commons that there were many men protected by tribunals because their fathers were friends of members of the tribunals. The National Service Representative, whilst maintaining that this charge did not apply to London, but to provincial tribunals, more especially those in agricultural districts in the West of England and Wales, said much more serious complaints could be made about the issuing of protection cards by the Munitions Area Recruiting Officers. A lot of firms had worked themselves into the protection scheme who were not engaged on any kind of war work, and whose claims for protection cards were not properly investigated by the officers before they issued the cards. This was open to greater criticism than the work of the tribunals.

At Southwark, G. A. Knapton, director and secretary of the New Union Electric Co., Ltd., of 57, Park Street, 43, in Grade 2, applied for exemption for the first time under the new Military Service Act. It was stated that the firm had supplanted a German trading company. He was granted conditional exemption as being in a certified occupation.

At the Sheffield Tribunal, last week, there were under consideration the cases of 597 employés from the various departments of the Corporation tramways. Mr. Fearnley, general manager of the tramways, said 564 men had joined the Forces up to the present, and an equal number had left to go into the munition works. Ald. Fenton said that now they had nearly as many women as men in the service. The difficulty in regard to drivers was that they required men of good medical qualifications. The National Service Representative said he had received no instructions of any kind in the matter. If the Sheffield tramways carried eight-ninths of the population every day it showed there was plenty of room for curtailment, and how could it affect munition workers if there should be any curtailment? Mr. Fearnley said they could not cut down the running of cars between five and seven o'clock when the munition workers were returning from work. Mr. Fearnley said more women were employed on the Sheffield tramways than on any other tramways in this country. There was no prejudice against women as drivers; they would be glad to employ them if they could safely do so. They had made a "clean cut" of every man up to 28 years without any pressure from the National Service authorities. The Tribunal decided that they had no jurisdiction to deal with the cases of decertified men, but suggested that the Tramway Committee should approach the National Service authorities with a view to having the men called up in batches at periods to meet the convenience of the Tramways Committee. In all the other cases general exemption was given until November 30th, the men to be excused from drilling with the Volunteers.

At Newmarket, a firm of electrical engineers applied for conditional exemption for a Grade 2 man, aged 43 (married, three children), employed as electrical engineer on a large estate where there is extensive pumping and power plant. Appeal refused. Ordered to join up July 21st.

At Southport there was a review of the case of a fitter (37, Grade 2), engaged in the Corporation tramways department. The general secretary of the Amalgamated Union of Tramway and Vehicle Workers stated that as a result of negotiations between the Ministry of National Service and the Union certain tramway workers were to be exempted, and he held that the man in question was included. Ald. J. E. Willett, National Service Representative, said that the man was registered as a motorman, and Mr. Kendrew (manager) said that was so, but he was now engaged as a fitter, and was doing nothing else. The case was put back for a month for the Tramways Committee to come to an arrangement with the National Service Representative as to what men can be released.

Before the Stratford-on-Avon Rural Tribunal, exemption was claimed for J. S. Allsopp (Grade 2), electrician with Mrs. Gaskell, of Kineton. The National Service Representative opposed the appeal on the ground that the electric light was not of national importance; they could always come down to candles. Final exemption until July 22nd was granted.

The National Service Representative appealed to the Herts. Appeal Court against exemption held by W. S. Rowbory (Grade 1), electrician with Mr. Minet, of Little Hadham. He was given until the end of July, with a medical re-examination.

Hertford Rural Tribunal has given exemption until July 31st to W. H. Dubbins, electrician to Lord Desborough, at Panshanger.

At Aylesbury, on June 24th, Messrs. E. T. Mackrill & Sons, of Kingsbury, appealed for J. T. Mason (44, Grade 2), electrical engineer, who is engaged upon the repair and maintenance of electrical plant at local mills, munition works, and at the U.D.C. sewage works. Three months were conceded, with leave to appeal again.

Market Drayton Tribunal has granted exemption until the end of September to an electrician in Grade 2.

At Ross (Herefordshire), exemption was refused to W. Maddy (24, Class B 1), electrical engineer at the electric light works.

Hereford Rural Tribunal has granted exemption until November 1st to S. F. Mitchell (43, Grade 1), electrician at the Burghill County Asylum.

Romford Tribunal has refused an appeal by A. E. Newman (44, Grade 1), electrician, of South Lodge, Hare Hall, the calling-up being suspended for 14 days.

Before the East Sussex Appeal Court, Mr. Hodgkinson, of Bexhill-on-Sea, appealed for R. E. Bennett (42, Grade 2), electrician. Mr. Hodgkinson stated that the man had been with him for 20 years, and was engaged on very essential work. From the point of view of public safety, electricians should be left. Three months were conceded.

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At Melton Mowbray, a National Service appeal against J. Adkins (Grade 2), electrician to Mr. C. W. Wright, of Grimstone, was disallowed, and the exemption confirmed.

Northants Appeal Court has given until July 31st (final) to T. E. Davies (43, Grade 2), who is in charge of the electrical plant of Mr. J. Lewis, at Little Brington.

The Swinton and Pendlebury Tribunal has granted three months' temporary exemption to an electrician aged 42, and in Grade 2.

At Widnes, an electrician (45, Grade 1), who appealed, said that he had lost one son in the war, and had financial obligations. He was given until July 18th to enable him to approach the Civil Liabilities Commissioners.

Before the Mansfield Tribunal there were reviews of the cases of W. Baguley (39, Class A), motorman, and H. Butler (36, Class A), inspector and motorman, with the Mansfield and District Tramways Co. Major C. F. Elliot Smith argued that the tramway service, even if it had to be reduced, was not as important as the Army. Butler's exemption was withdrawn, and Baguley was granted four months, without Volunteer service.

At Weybridge, Mr. H. J. Nicholson appealed for the retention of H. W. Harrington (45, Grade 2), electrician, as being indispensable, and three months were conceded.

At Kidderminster, Mr. G. N. Brown-Westhead, of Lea Castle, appealed for H. Thomas (44, Grade 2), electrical engineer, who, with the aid of a man aged 90, has to keep in running order the electrical plant. He was given to September 30th, with a view to his being replaced.

At Ilfracombe, Messrs. Friend & Son, electrical engineers, appealed for continued exemption for a partner, Mr. A. H. Friend (Grade 1). The latter said that he was willing to be made available on August 1st, and Mr. H. P. Woodcock, the National Service Representative, said that he liked to see patriotism of this kind. The exemption was granted to August 1st.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

B.T.H. Floodlight Projectors.

The British Thomson-Houston Company's Illuminating Engineering Department has recently designed for the English market an improved form of light projector employing the standard types of half-watt or gas-filled lamps for use in what is known as "floodlighting" work. This new floodlight projector is described in Price List No. 10.482, which has just reached us from the Publication Department of the company at Mazda House, 77, Upper Thames Street, London, E.C. 4, and which gives a full detailed description of the apparatus and its field of application and methods of use.

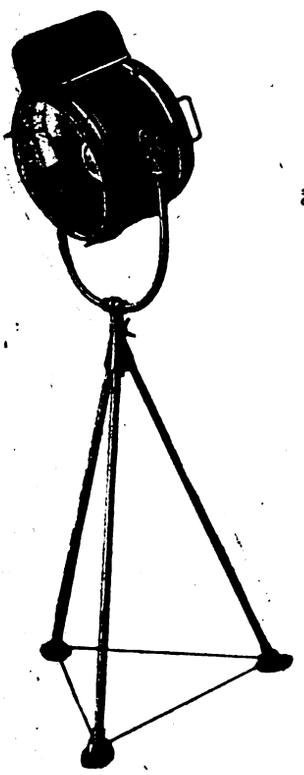

Fig. 1.—B.T.H. Floodlight Projector on Tripod.

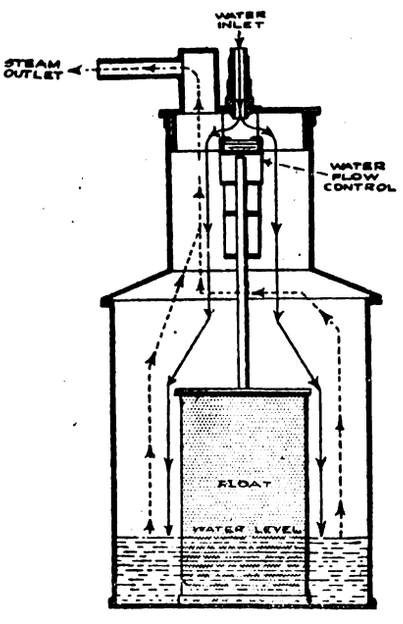

Fig. 2.—Section of Generator for Battery-box Steaming Apparatus.

With such a projector, operating with all the simplicity of the incandescent electric lamp, a flood of light can be thrown over any area, such as a works yard, shipyard, or upon any surface, such as the front of a building or the side of a ship under construction. There are very many practical applications for such projectors, they being particularly useful for night construction work.

As shown in our illustration, fig. 1, the projector consists of a body or casing and a supporting stand or bracket. The projector is suitable for standard patterns of half-watt type lamps in 300, 500 and 1,000-watt sizes, or can be, if desired, supplied to take even smaller sizes of these lamps. The lampholder is so supported as to permit of an easy independent adjustment laterally, transversely and vertically, so that the electric lamp can be accurately focussed in the reflector. When the lamp is correctly adjusted in focus, a powerful beam, giving a divergence of from 5 to 15° on each side of the centre is obtained, with a maximum C.P. of 50 to 100 times that of the lamp employed. The reflector is a silver-plated mirror of parabolic form, copper backed, and covered with a special enamel stoved on. It is secured to the back of the projector by means of steel springs, affording a resilient support and minimising any danger of breakage.

These floodlight projectors will be found to be a most useful equipment, as the lights can be conveniently mounted and employed to illuminate objects with a close approach to daylight conditions. They have all the simplicity, adaptability and convenience of the ordinary electric incandescent lamp, as there are no moving parts or mechanism in the lamp proper, and the only adjustment is simply the mechanical focussing of the lamp through the movement of the lampholder.

A Battery-Box Steaming Apparatus.

An arrangement for easily opening the joints of accumulator cases, when the plates require attention, which has lately been introduced by the American Bureau of Engineering, of Chicago, consists of a steaming apparatus, designed to soften the sealing compound so that the joints may be opened easily and quickly, and without the use of a gas flame or torch. The apparatus, which is claimed to eliminate the possibility of damage to the battery parts, is made up of three units—the steam generator, a steaming box, and the water supply tank. The generator, which is made of galvanised iron, consists of a cylindrical tank, which tapers at its mid-point to a straight sided cylindrical top of a smaller diameter than the lower portion. As will be seen from the accompanying sectional drawing, fig. 2, it is provided with a water inlet at the centre of the top, and a steam outlet at the side. The amount of water in the generator is controlled by means of a vertical valve, consisting of a rod with a float tank at the bottom. As the water enters it drops to the bottom, and as the level rises it carries with it the float, which has a vertical rod with a valve at the extreme top to close the water inlet pipe, when the level of the water in the tank has reached a point about 3 in. above the bottom. The comparatively shallow water is quickly brought to boiling point when the steamer is set over a gas or oil stove, and as steam is formed and passes off into the steaming compartment proper, more water is allowed to trickle in as the float sinks lower. This method of regulation has been adopted in order that, apart from the work which is to be done on the battery under treatment, no attention need be given to the rest of the apparatus, beyond seeing that the water supply tank is kept full, the water flowing to the generator by gravity.

The box in which the batteries to be steamed are placed is of wood, so as not to be affected by any acid that may be spilled, and is fitted with a steam-tight cover. When the apparatus is assembled, the steaming box is placed on the floor, and the batteries are placed in it. The cover is closed and the generator stove lighted. The operator can then leave the apparatus unattended for from 10 to 15 minutes, after which time the battery may be lifted out, and the softened joint-sealing compound removed by the point of a screwdriver.

A New Transformer.

We have received from the Brush Electrical Engineering Co., Ltd., Falcon Works, Loughborough, a bulletin (No. 130) describing their static transformers. The accompanying illustration, fig. 3, p. 12, shows a transformer designed for 900 K.V.A., 40 cycles, three-phase, and for a voltage ratio of 11,000 to 2,750. The temperature rise measured by the increase of resistance of the windings is 40° C. after continuous full load, or 65° C. after 50 per cent. overload for 10 hours. Tappings are provided on the high-tension side to give 3 per cent. and 6 per cent. variations in voltage on the low-tension side.

The windings are of the spiral type—*i.e.*, the coils have only one turn per layer, insulating material being inserted between individual turns.

Clamps are provided to enable the transformer to withstand the large forces set up when a short-circuit occurs on the secondary mains. These clamps consist of gun-metal rings on the top of the high-tension windings with bolts down the outsides of the windings, and pressure on the low-tension windings is maintained by means of a metal ring held in position by studs passing through the clamps on the top of the core. This construction has given every satisfaction under the most severe conditions.

The company has recently patented a construction of single-layer high-tension windings for medium-sized transformers, which secures the following advantages:—The whole of the high-tension winding is in a continuous length without a joint. The individual turns are taped during manufacture. The oil gap is arranged between layers: the oil circulating through this gap prevents the formation of hot spots, and keeps the insulation in perfect con

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dition. Any tappings required on the high-tension side are looped out; this avoids the weakness due to tappings being brought out

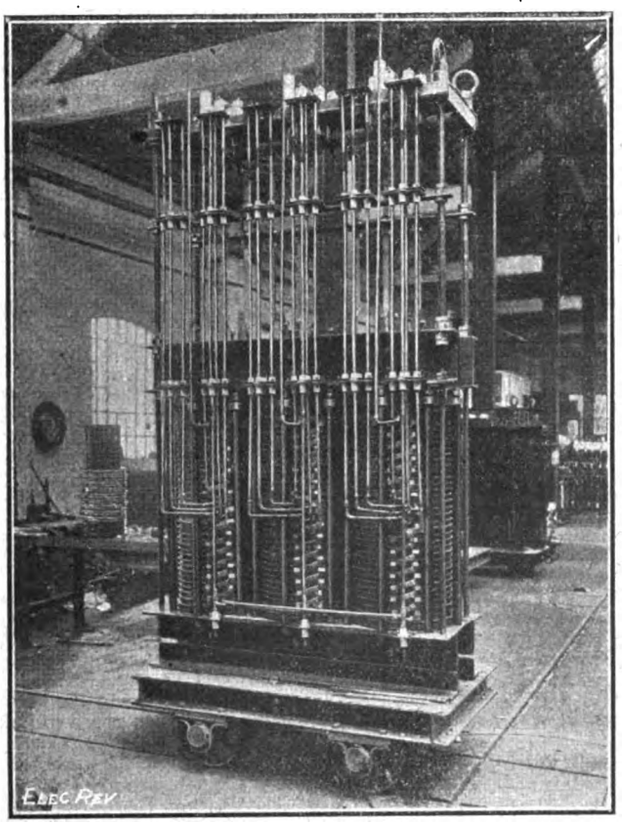

Fig. 3.—900-K.V.A. Transformer.

between sections. The construction requires a minimum quantity of insulation of a plastic nature, and reduces the shrinkage of the windings to a minimum.

BUSINESS NOTES.

German Trade Methods in Spain.—An inquiry into German trade methods in Spain before the war reveals certain points of interest. The trade itself was not very large, but it was thought worth while to erect an elaborate and costly commercial mechanism and to conduct a systematic propaganda. In 1913, the last complete year of peace, Germany exported to Spain goods to the value of less than 7½ millions sterling, and purchased Spanish goods valued at nearly 3 millons. Yet this comparatively insignificant volume of trade was most sedulously cultivated by Germany. By developing the local resources of Spain, German corporations acquired a considerable amount of control over the home and colonial trade. The electrical concerns, A.E.G. and Siemens, had a basis of profitable turnover in accessories of all kinds, mainly manufactured in Spain and sold through their numerous distributing agencies. In the case of steam engines, pumps, &c., close intercommunication of branches in France and Italy of German manufacturers with their agencies in Spain, was the source of considerable indirect trade. In the smaller trades an army of commercial travellers conducted a regular business, yielding high profits, in the sale of all classes of accessories for steam users. In many cases the origin of the goods (especially rubber and asbestos) was British for introductory purposes, subsequent supplies being a German substitute. The seat of this business was Hanover, whence half-a-dozen merchant firms conducted a profitable trade, employing travellers to visit personally every individual consumer of any material or article in common use. Another circumstance favourable to German trade was the use of British, French and Italian addresses for the purposes of declaration, whilst the actual origin of the goods was German. A close scrutiny of statistics would disclose the fact that a proportion of Allied exports to Spain was really contributed by German manufacturers and shipped at Rotterdam or Antwerp. In later years the value and importance of direct trading connections between Spain and South America have been recognised by Germany, and have been specially manifest in the activities of the Deutsche Ueberseeische Bank. The aim of the advertising section of the German trade organisation was to make translations of German engineering text-books of easy access to Spanish students, and to equip engineering colleges with German-made plant. The magnitude of the German propaganda effort was shown in the figures of imported publications printed in Spanish. A total of 200 tons of works, designs, plans, and photographs was sent to Spain from Germany in 1913. A large proportion consisted of trade advertisements in one form or another. It is worthy of notice that the technical works, descriptive of industries and their equipment, are not so much literal translations from German as studies of local conditions and the application thereto of German methods and plant. The Spaniard resents aggressive instruction and the glorification of other nations' enterprise, with its implied strictures on his own development. British trade propaganda was mostly of this crude kind, and the translations into Spanish aggravated the evil they were meant to avoid. Railway rolling stock and materials formed a considerable part of German imports into Spain. The steady growth in the sale of machine tools of German origin may be attributed almost exclusively to methods of propaganda. British makers held a priceless advantage over their competitors, which German ingenuity and British neglect had turned into a weapon of destruction of British trade. Any industry or workshop in Spain of 20 years' standing or more still has at work a British-made lathe, drilling-machine, planing-machine, or steam engine. It has served the present-day German salesman as a theme for the antiquated, effete standard of British manufacture, and it is now almost an article of faith with the modern Spanish engineer (educated in Germany or fed with German text-books) that the British pattern shop is 20 years behind its German counterpart.—*Board of Trade Journal.*

Electric Motor Industry in Spain.—The *Financial Times* states in its "Motor Notes" that "Spain is endeavouring to be independent of German electrical motor appliances by establishing an Institute of Electrical Industries at Barcelona, with a department specially equipped for research work in this direction."

American Aluminium Price.—The new United States maximum base price for aluminium, effective June 1st to September 1st, has been fixed at 33 cents per lb. f.o.b. United States producing plants for 50 tons and over of ingot of 98 to 99 per cent. This was announced by the War Industries Board.—*Financial Times.*

Italy.—Under the style of the Anonima Industrie Telefoniche Italiane D'Oglo, a company has been formed at Milan, with a capital of 5,000,000 lire, for the manufacture of telegraph, telephone, and radiotelegraph material, and the installation of like plants.

The Società per la Elettrocultura has been constituted at Milan, with a capital of 300,000 lire, for the construction and sale of electrically-driven agricultural implements.

The Società Unione Esercizi Elettrici has decided to increase its capital from 9,000,000 to 15,000,000 lire to defray the cost of new plant under construction.

Book Notices.—*The Motor Transport Year-Book and Directory*, Vol. III, 1918 (London: Electrical Press, Ltd., price 12s. 6d. net), contains a review of the omnibus position in 1918, by S. E. Garcke, official papers relating to road traction, the use of petrol, &c., and particulars of charging stations for electric vehicles and gas-filling stations in the United Kingdom, together with directories of motor transport services and of companies and local authorities engaged in the business, giving full particulars regarding their powers and constitution. A separate section deals with manufacturing and miscellaneous undertakings allied to motor transport services, and a directory of officials is included. A list of railless trolley systems for which powers had been granted up to February, 1917, shows that nine are working and one (Dundee) has ceased working, out of a total of 31, of which all but five are in the hands of local authorities. Like the "Manual of Electrical Undertakings," to which it is a companion volume, it will be invaluable as a work of reference to all who are interested in the subjects dealt with.

"The *Journal* of the Institution of Electrical Engineers," Vol, LVI, No. 275. June, 1918, contains the following papers:—"Diathermy," by Dr. E. P. Cumberbatch; "Single-Impulse Radiography: its Limitations and Possibilities," by Dr. R. Knox; "Overseas Distribution of Engineering Appliances," by Mr. L. Andrews; "Telephone Exchange Transfers and their Organisation," by Mr. F. G. C. Baldwin.

The April-May issue of *Russia* (6d. net) contains several very informing articles on such matters as the task awaiting the Allies in Russia, the great resources of the country, Russia's road to solvency, the activity of German propaganda agents, and the copper resources of Russia.

Munition Works.—Holidays.—It is not the intention of the Ministry of Munitions to interfere with such customary holidays as establishments engaged on munitions work think well to give their employés during the summer and autumn, subject to particular necessities.

Catalogues and Lists.—Walsall Hardware Manufacturing Co., Hatherton Works, Ablewell Street, Walsall.—Sixteen-page illustrated price list representing a number of their "Grid" multiple sunk switch fittings, watertight switches, wall sockets, interlocking switch-plugs, watertight inspection fittings, &c.

Enterprise Manufacturing Co., Gun Street Electrical Works, Bishopsgate, London, E.C. 1.—Price sheet of E.M.C. British-made D.C. motors, from ¼ to 25 H.P.

Dissolutions and Liquidations.—British Pneumatic Tool Co., Ltd.—Meeting of creditors, July 5th, at 5, Budge Row, E.C. 4 (W. H. Badams, liquidator).

Chapman & Co., electrical engineers, 41, Lewis Grove, Lewisham, London.—Messrs. G. J. Chapman and F. A. S. Wormull have dissolved partnership.

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Bankruptcy Proceedings.—W. D. BIRKETT, factor of electrical goods, Whitley Bay, Northumberland.—Supplemental dividend, 3¼d. in the £, payable July 9th, at 21, Mosley Street, Newcastle-on-Tyne.

The Straits Settlements.—ELECTRICAL IMPORTS, 1917.—According to the figures recently issued by the Imports and Exports Office, Singapore, the imports into the Straits Settlements of electrical machinery from Great Britain last year reached a value of £28,620. The United States was next on the list, supplying £17,290. Japan following with £8,180, and the Continent of Europe with £2,100.

LIGHTING AND POWER NOTES.

Abercarn.—The B. of T. has extended for a further year the Abercarn Electric Light Order of 1914 of the South Wales E.P.D. Co.

Aldershot.—YEAR'S WORKING.—The revenue of the District Council's electricity undertaking increased by about £1,800 during the past year. The gross profit was about £1,200, and, after clearing off a deficit of £625, there remained a profit of £600.

PRICE INCREASE.—The E. L. Committee has decided to increase the price of electricity for lighting purposes by one-sixth.

Australia.—WARIALDA.—The Municipal Council has decided to introduce an E.L. scheme.

SYDNEY.—The electric battery charging set at the Municipal Garage showed a profit of £113 for the three months ended March 31st.

The Municipal Council has decided, with a view to preventing bad and dangerous electric light installations, to refer to the E.L. Committee to consider the advisability of licensing all electrical engineers on similar lines to licensed plumbers and gasfitters, and to invite the Electrical Engineers' Association to express its opinions on such proposal.

Barrow.—WAR WAGES.—The T.C. has decided to pay workmen in the Electricity Department a war bonus equivalent to 20s. per week on pre-war wages, plus 12½ per cent. on earnings, in lieu of the present bonus, the award to date from the first full pay-day in May last. This includes the assistants on the technical staff and the two members of the clerical staff who hold Scheduled Occupation Certificates.

Birmingham.—PRICE INCREASE.—The E. S. Committee has decided to recommend the City Council to increase the charges for electricity to low-tension lighting and power consumers by 5 per cent., as from the June reading of the meters.

Birr (King's Co.).—HYDRO-ELECTRIC SCHEME.—The Urban Council has decided to proceed at once with an E.L. scheme. Facilities for water power, granted by the late Earl of Rosse, have been confirmed.

Bolton.—PRICE INCREASE.—The T.C. has approved the recommendation of the E.L. Committee to increase the price of energy by 15d. per unit.

Bromley (Kent).—PRICE INCREASE.—The E.L. and Power Co., Ltd., and the Chislehurst Electric Supply Co., Ltd., have, from the date of the Midsummer readings of the meters, advanced the price of energy for lighting to 8d. per unit net; and to 4d. for the first 100 units per quarter, plus 30 per cent., and to 2d. beyond, plus 30 per cent.

The World's Power Industry.—A digest of the reports of the United States Consuls on the power situation in Norway, England, Spain, Italy, South America, Africa, Japan, China, and India, and the influence of the war upon this important industry, is given by L. W. Schmidt in *Power* (Vol. XLVII, No. 23). He says that most existing central stations report increased business, and they could do more had they the necessary equipment. In Europe extensions have been made where urgently needed, so as not to cripple the activity of the national industries. Everywhere development has been held back; Norway seems to be the exception to the rule, as the expansion of hydro-electric enterprise in that country continues. The two factors which have influenced the industry are the increasing demand for power and the lack of funds to make the urgently-needed extensions.

Continental.—SPAIN.—HYDRO-ELECTRIC DEVELOPMENTS.—Don Fernando de la Guardia, of Gijon, has applied for the use of 36,000 cb. metres of water per hour derived from the River Trubia, and destined for the production of energy for industrial purposes. The power house will be situated near the town of San Andrés.

Don Arturo Bernardo, of Oviedo, has applied for the use of 1,400 litres of water per second derived from the River Esquiero, for the production of electrical energy, and undertakes to build a dam 1·2 metres higher than the river bed.

The Compania de Caminas de Hierro, Saltos y Minas de Cataluna, has been authorised by the Office of Public Works to unite into one the four waterfalls which have been conceded on the River Baliva Lérida.

GERMANY.—A great scheme for the utilisation of water power available on the Upper Rhine is now in course of realisation. It consists in canalising the Rhine between Strasburg and Basle, with a view to using the water power to generate electricity. On account of complications of ownerships and local authority, the Government has taken the work in hand.

DENMARK.—Bills are to be laid before the Rigsdag relating to schemes for the development of the peat deposits at Vildmos, with a view to their utilisation for the production of electricity; and for the erection of power stations at Harte, Gudenaaen, Tange, and Kongensbro by the respective local authorities.—*Den Tekniske Forenings Tidsskrift.*

The British Minister at Copenhagen reports that a scheme is under consideration by the Danish Landthing for the production of hydro-electric power by the damming of the River Guden. It is estimated that 600,000,000 cb. metres of water can be obtained per annum with a fall of about 9 metres, and that 10,000,000 KW. will be obtainable, of which 8,000,000 KW. will be utilised. The cost of the scheme is put at nearly 4,000,000 kr., or about £225,000 at par.

Coventry.—ANNUAL REPORT.—At the City Council, on Tuesday, Councillor Orton submitted the annual report of the electric light department. It showed an available surplus of £16,321, and the Committee recommended that £6,000 be given in aid of the rates.

Croydon.—The T.C. has decided to supply energy to approved war charities (hospitals, &c.) at 2d. per unit, as from the end of the June quarter. Formerly the supply was gratis.

Deal and Walmer.—STRIKE.—The workers at the gas and electricity works are now on strike, and the supply has been greatly curtailed.

Derby.—NEW PLANT.—Requirements in connection with the works of the British Cellulose Co. have led the Electricity Committee to ask the Council to grant £20,000 for the provision of an additional boiler and incidental plant, in place of the amount previously voted for, a scheme involving an estimated ultimate expenditure of £90,000. The Munition Works Board has now given a guarantee as to the works covered by a loan of £40,000 against such works being at the expiration of two years after the termination of the war redundant, or having cost more than their valuation at that date.

The Corporation Committee has arranged with the British Cellulose Co. to meet a maximum demand of 3,000 KW., the company to pay for a minimum of a million units per month when the full supply is available, with a temporarily reduced minimum. The agreement is to run for three years, and to be then determinable by 12 months' notice.

Exeter.—PRICE INCREASE.—The T.C. has advanced the price of energy for lighting by 10 per cent., and for power, public lighting, and tramways by 15 per cent. In the case of lighting the amended price is 5½d. per unit, there having been a previous increase from 4d. to 5d.

Fleetwood.—PRICE INCREASE.—From July 1st the price of electricity will be increased by 25 per cent.

Ilford.—The Electricity Committee has authorised the electrical engineer to accept the offer of the War Office of £450 for a 100-KW. synchronous motor-generator, which is now disused, at the Tavistock Place sub-station.

Kirkcaldy.—ANNUAL REPORT.—The annual report of the electricity undertaking for the year ended May 15th, 1918, shows a gross profit carried to net revenue account of £5,186, or 5·9 per cent. of the capital expenditure, as against £4,711 last year, and, after payment of interest and sinking fund charges, there is a net deficit of £12 on the year's working. The receipts from energy sold were £17,616; other receipts, £21; total income, £17,637; and the working expenses were £12,451; interest on capital, £2,785; sinking fund, £2,414. Energy for the tramways has been charged at 1½d. per unit, against 1½d. last year. The coal consumed per unit sold over the year was 9·75 lb., against 9·4 lb. last year, the cost being 0·64d. against 0·56d. last year. The total costs per unit sold were:—Generation 0·98d., against 0·81d.; distribution 0·04d., against 0·03d.; total works costs 1·25d., against 1·09d. The request for new generating plant was refused, but borrowing powers for £7,000 for converting plant and cables were sanctioned, in order that the Pathhead district might be supplied from existing spare plant. When the spare plant is loaded there will be no security of supply, and it will be necessary to install new generating plant before the B. of T. Regulations can be again complied with. The units sold were:—Tramways 719,438, an increase of 6·55 per cent.; private lighting 235,338, an increase of 5·48 per cent.; public lighting 33,057, against 7,384; and power 1,391,767, or a decrease of 1·22 per cent. Total units sold and average price obtained were 2,379,600 at 1·78d., against 2,314,591 at 1·59d., an increase of 2·81 per cent. Number of consumers connected was 786, an increase of 8; total B.H.P. of motors connected, 2,224, a decrease of 61; equivalent in KW. of motors connected, 132. The maximum load recorded amounted to 1,003 KW., against 1,034 KW. last year, and the load factor was 27·1 per cent., against 25·5 per cent. The capital expenditure amounts to £83,568, the sinking fund repaid to £26,841, and the interest charges total £30,803.

London. — HAMMERSMITH. — LINKING-UP SCHEME.—The B.C. has agreed to the borough electrical engineer of Fulham being appointed to prepare the plans and specifications, and to superintend the work in connection with the Battersea-Fulham-Hammersmith linking-up scheme. Tenders for laying the mains are to be invited as soon as the draft agreement has been approved.

ST. PANCRAS.—The chief electrical engineer has reported that the Ministry of Munitions has now definitely approved of only one

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3,000-KW. Ljungström turbine being installed at the King's Road station, and that he is still in communication with the Ministry with reference to the supply of steel for the completion of the coal-handling plant at the King's Road station.

Manchester. — YEAR'S WORKING. — The Electricity Department had a surplus last year of £58,284, compared with £62,889 in the previous year. Sales of energy amounted to £861,078, compared with £742,073, and the working expenditure was £559,941, compared with £447,398. The whole of the plant and the mains had been kept in a high state of efficiency out of revenue, notwithstanding the extreme shortage of labour. There was a difficulty in maintaining coal supplies, and the outlook for the future causes much anxiety. The average price paid during the year was £1 9s. per ton.

Mansfield.—PRICE INCREASE.—The T.C. has decided to increase the price of electricity from July 1st to ordinary customers by a further 15 per cent., making 25 per cent. in all.

Pembroke (Co. Dublin).—PRICE INCREASE.—The D.C. has increased the charge for electricity by ½d. per unit for lighting purposes, and by ¼d. per unit for cooking, heating, and power. The new scale came into operation on July 1st.

Ramsgate. — PRICE INCREASE. — The Ramsgate and District E.S. Co., Ltd., has advanced the tariff, from the quarter ending September, 1918, to 8d. per unit for lighting; 4d. up to 100 units per quarter, and 2d. beyond, plus 20 per cent., for power; and an additional 1d. in the 1s. for supply through slot meters.

Rotherham.—CORPORATION BILL.—The Corporation Parliamentary Bill was considered by the Local Legislative Committee of the House of Commons recently, resulting in the Corporation obtaining practically all the powers asked for, one of the most important being powers to utilise water from the River Don, a concession which was refused the Sheffield Corporation last year.

The Corporation has been given powers to extend its area of supply to include the urban districts of Greasboro', Rawmarsh and Swinton, the Blackburn Valley in the Ecclesfield parish and that portion of the parish of Brinsworth which covers all the possible extensions of Messrs. Steel, Peech & Tozer's Works. It has also obtained powers to construct a dam across the River Don near the power station, and to construct a wharf and to carry a railway bridge over the canal and road. An agreement had been reached before going to Committee, by which the Yorkshire Electric Power Co. did not oppose the Corporation's proposals to extend its area of supply, the Corporation on its part agreeing to enter into an agreement with the company to link-up its power stations with the company's, and supply them with electricity for their requirements in South Yorkshire; the terms on which the supply is to be given are to be agreed between the parties, and, failing agreement, to be settled by Sir John Snell.

The result of this arrangement is that there will be a linked-up electrical supply from Sheffield to Bradford, Rotherham being for the present the largest of the power stations and the central pivot. The Corporation will also secure a big customer for power. With regard to the water clauses, the Corporation has obtained powers to take water from the River Don for the condensers, the condition imposed being that the discharged water is to be returned to the river at an average temperature not exceeding 90° over a period of 24 hours, an equivalent quantity to be returned to that taken out. It is estimated that 50 million gallons will be required daily when the new station is fully running.

Power has also been granted the Corporation to purchase crude gas or any gas produced by coke ovens or by-product works, or any description of waste heat, in an area comprising the rural districts of Rotherham and the U.D. of Greasboro', Rawmarsh, and Swinton, the Corporation not to purchase crude gas in the area of the Wath and Thurnscoe Gas Board. The Corporation will thus be able to purchase a large supply of power now running to waste.

The Parliamentary Committee has also granted powers to the Corporation to borrow the necessary money to pay for the purchase of the Mexborough and Swinton Tramways Co., and it is also authorised to expend £600,000 for the extension of the electricity station, and, in addition, £150,000 on mains, sub-station extensions, &c.

The Corporation is also granted further powers to use any of the polluted sources of water for manufacturing and business purposes, and has powers to expend £24,000 on utilising such a supply.—*Rotherham Advertiser.*

Stalybridge.—PRICE INCREASE.—The Joint Tramways and Electricity Board has decided to increase the charges for electricity as follows:—Lighting, from 4½d., less 5 per cent., to 5d., less 2½ per cent.; power, from present scale plus ·25d. to present scale plus ·35d.; mill and factory lighting, from 3d. net to 3½d. net; heating and cooking, from 1½d. net to 1½d. net; theatre tariff, ½d. addition to present scale.

Stone.—The B. of T. has granted an extension of 12 months from July 6th, 1918, to the Stone Gas and Electricity Co. for the completion of its undertaking.

Tasmania.—ELECTROLYTIC ZINC.—In their report for the last half-year the directors of the Amalgamated Zinc (De Bavay's), who control the operations of the Electrolytic Zinc Co. of Australasia, the works of which are at Risden, near Hobart, state that the first unit of plant, with a nominal capacity of 10 tons of zinc per day, was put into operation on January 7th. The Hydro-electric Department of Hobart has, so far, been unable to deliver the full "first block" of power under the contract (4,000 H.P., at 11,000 volts), and the plant has had to be modified to take the reduced quantity of 2,500 H.P., at 6,000 volts. The attention of the Tasmanian Government has been specially called to the state of affairs. So far, no intimation has been received as to when the full "first block" will be supplied. In the meantime, considerable loss is being sustained. When the Hydro-electric Department delivers the first "full block" of power, continuous running for a few months will afford sufficient data to enable the company to give notice of its intention to take the "second block" of 26,000 H.P. from the Hydro-electric Department, and to increase the capacity of the plant to 100 tons of zinc per day.

Taunton.—PRICE INCREASE.—The T.C. has advanced the price of energy to general consumers, as from the Midsummer readings of the meters, to 50 per cent. over the pre-war scale.

Thornton.—The B. of T. has extended the E.L. Order, 1914, by one year.

TRAMWAY AND RAILWAY NOTES.

Belfast.—INCREASE OF FARES.—The Corporation has increased the tramway fares to a basis of 1d. per mile, but including a few at 1½d. per mile. At a meeting of the Corporation, the chairman of the Tramway Committee stated that power was double pre-war price and bonus awards to employés amounted to £50,000.

British Columbia.—STRIKE.—The electrical workers and the Street and Interurban Railway employés in the service of the B.C. Electric Railway Co. decided to cease work on Monday, although the Conciliation Board had not given its award. The men's demands are entirely excessive. The chairman of the Board of Conciliation has reminded the men of the illegality of their action in striking before the award is given, but without avail. The electrical workers of other utility companies have also decided to go out.—*Financier.*

Continental. — SPAIN. — Our correspondent in Spain informs us that some of the Spanish steam railways are considering the electrification of those parts of their lines where the gradients are heavy.

Urban transport finds its solution in the electric tramway; secondary interurban railways (which are really only slightly heavier tramways) are being installed in districts where there is water power; traction with single-phase current will solve the problem of interurban lines of more than 100 km. in length, employing high-tension current in the trolley wire. The great railway systems which have miles of rough and mountainous track can make considerable economies by electrifying these difficult hauls. One of the most difficult pieces of road in Spain is that near Puerto de Pajares, on the railway from Leon to Gijon, whose electrification to the extent of some 70 km. will shortly be realised. The Pyrenean range has vast hydraulic riches to-day practically untouched; for this reason the future railways in the north of Spain will be almost entirely electrical.

Plans for the building of an electric railway between Nájera and Torremontalbo are almost completed. The railway will have a length of 10·8 km. The power house will be situated in the town of Hormilleja, on the River Nagerilla, where there is a fine waterfall, at a point approximately equidistant from the two termini of the line.

The difficulties in regard to the supply of materials for the Vigo-Mondariz Tramway have been overcome, and headway is now being made in the construction of this line.

Doncaster.—RESTRICTED SERVICE.—A restricted tramway service has been decided upon at the request of the B. of T. Commencement of the new service is to be made on the Avenue Road, Hyde Park, and Racecourse routes, on which the Sunday service is suspended, and that of week-days reduced, except Saturdays.

Halifax.—REVISION OF FARES.—The Corporation has revised the tramway fares, including the shortening of some of the present 1d. stages and the introduction of 1½d. stages.

Kirkcaldy.—ANNUAL REPORT.—The results of the year's working for the year ended May 15th, 1918, show gross profit carried to the net revenue account of £6,092, or 6·1 per cent. of the capital expenditure, as against £6,109 last year, and after payment of interest, sinking fund, and depreciation there was a net surplus of £396. The traffic receipts were £20,936; total income, £21,350; working expenses, £15,258; interest on capital, £3,023; sinking fund, £2,153; depreciation, £501. The total car-miles run were 429,382, a decrease of 5,588; the total traffic receipts were £20,936, at 11·7d. per car-mile, against £18,399, at 10·2d. Passengers carried numbered 5,705,520, against 5,272,292 last year, and the operating costs were 8·5d., or an increase of 1·5d. per car-mile. Receipts from passengers' luggage amounted to £147, against £135 last year. Capital expenditure amounts to £99,787; sinking fund repaid to £28,130; depreciation fund to £7,136; and the interest charges total £40,969.

London. — SUBSIDISED 'BUSES.—Sir L. Worthington Evans, for the Ministry of Munitions, stated in the House of Commons that financial grants amounting to £44,312 had been

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made for motor-omnibus services in S.E. London in the year ended June, 1917. No claim had been put forward by the tramway companies supplying special services for munition workers, but if a claim was made he would be bound to consider it, though the services rendered appeared to him to be different.

HAMMERSMITH.—The B.C. has instructed the town clerk to take all possible steps to oppose the third reading of the London United Tramways Bill in the House of Commons.

L.C.C. FARE REVISION.—New fares are now in operation on the tramways north of the Thames on the same basis as those in operation south of the Thames. Every route will be divided into sections, any three of which may be traversed for a penny, six for twopence, and so on. Workmen's penny fare stages will consist of four sections, with a return fare of twopence. The single workmen's penny fare stages will be raised to twopence, and the twopenny return fare to threepence. These fares will apply to a continuous journey from any one of the London termini to the London County boundary. Through running routes with other tramway undertakings have been divided into sections in the same way, and the same system of arriving at the fares chargeable will be in operation so far as ordinary fares are concerned.

Shipley.—RESTRICTED SERVICE.—The Bradford Corporation Tramways Committee has asked the approval of the District Council to a curtailed service during the war—a one-hour service between Shipley and Thackley and the closing of the service between Briggate and the car depôt at Saltaire. The Council objected to the proposed closing of the Saltaire road service, and appointed a Sub-Committee to interview the Bradford tramway manager on the matter.

Stalybridge.—FARE REVISION.—The Joint Tramways and Electricity Board has decided to make application to the B. of T. for power to increase the tramway fares.

Weston-super-Mare.—The Electric Supply Co., Ltd., has applied to the B. of T. for an extension of time until May 6th, 1920, for the completion of the tramways authorised by the Order of 1900.

Worthing.—ELECTRIC VEHICLES.—The Sanitary Committee is considering the introduction of motor vans for dust collection. The dust destructor is 3¼ miles from the most distant part of the borough, and with 11 horses and carts collecting 1½ tons per working day the cost worked out at 6s. 6d. per ton. The Committee states that an electric vehicle with a capacity of 2 tons, and costing £1,033, could be filled three times a day, and that the cost of collection would work out at 5s. 6d. The experience of Cheltenham gives the saving at 10d. per ton.

TELEGRAPH AND TELEPHONE NOTES

Germany.—The Drahtlose Ubersee Verkehr Gesellschaft is the name of a new company which has lately been formed in Berlin, with a capital of £500,000, under the auspices of the Gesellschaft für Drahtlose Telegraphie, the Siemens & Halske Co., and the Allgemeine Electricitäts Co., to take over the large wireless telegraph station at Nauen and its connections.

New Zealand.—The *New Zealander* quotes Sir Joseph Ward to the effect that owing to congestion on the cables, messages sent at other than ordinary rates were showing a delay of four to six weeks. There had been a blockage of 20,000 messages at one station between London and New Zealand.

United States.—President Wilson has asked Congress for authority to take over the telegraph and telephone lines, in order to guard military secrets and Government communications.

CONTRACTS OPEN AND CLOSED.

OPEN.

Glasgow.—The Electricity Committee is to order two 2-ton electric motor vehicles for the general carting work of the department, at an estimated cost of £1,268 per vehicle.

London. — FULHAM. — July 10th. Borough Council. Cables, ducts and accessories for the linking-up of the Fulham and Hammersmith Electricity Works. See "Official Notices" June 21st.

Manchester.—July 10th. Education Committee. Electric lighting installation at Nansen Street Municipal School, Ashton Old Road. Ardwick. Education Offices, Deansgate, Manchester. (£1 1s. deposit.)

Salford.—July 8th. Electricity Department. Coal supplies for 12 months. Borough Electrical Engineer, Frederick Road.

CLOSED.

Glasgow.—Trustees of the Clyde Navigation. Accepted offers :—

General Electric Co., Ltd.—Electrical stores for 12 months.
Johnson & Phillips.—£535 for the electric cable installation at the Graving Docks.

Hammersmith. — Electricity Committee. Additional boiler plant. Tenders received :—

J. Thompson	£3,925	plus £390	for fittings.
Stirling Boiler Co.	**4,660**	**500**	(recommended).
Babcock & Wilcox	4,694	499	
Clarke, Chapman & Co.	5,235	374	
Richardsons, Westgarth	6,187	390	

In view of the satisfactory service given by the three Stirling boilers at present installed the Electricity Committee recommends the acceptance of the tender of the Stirling Boiler Co.

London.—Southwark Borough Council has accepted the quotation of Booke & Co., at £37, for repairing the dynamos at Lavington Street Baths.

Reigate.—T.C. Crankshaft with overhauling and necessary replacements for Diesel Engine. Mirrlees, Bickerton & Day, Ltd., £915.

Salford.—Tramways Committee. Tender accepted :—

Four pairs manganese steel points and 12 manganese steel crossings.—Hadfields, Ltd.

Electricity Committee. Accepted tenders :—

Glazed stoneware pipes and tiles.—Albion Clay Co., Ltd.
E.H.T. switchgear.—British Westinghouse Co., Ltd.
Fuel economisers.—E. Green & Co., Ltd.
E.H.T. cable and telephone cable.—Callender's Cable Co., Ltd.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, July 6th. Visit to Messrs. Crossley Motors, Ltd., Manchester.

Junior Institution of Engineers.—Tuesday, July 9th. At 7.15 p.m. At the Mining Institute, Neville Street, Newcastle-on-Tyne. Paper on "Raw Hide Gears," by Mr. T. A. Henderson.

Midland Section.—Saturday, July 13th. Visit to Ocker Hill Pumping Station. Meet 1.50 p.m., Snow Hill Station (Birmingham).

Tramways and Light Railways Association.—Friday, July 12th. At 3 p.m. At Caxton Hall, S.W. 1. Tenth annual congress.

OUR HALF-YEARLY INDEX.

As it is necessary to effect every possible economy in paper consumption, the Index to Vol. 82 of the ELECTRICAL REVIEW, which will be printed in the course of a few weeks, will be supplied only to those who, through the post, specially apply for it. To such it will be supplied for 3d., post free. Any reader or advertiser at Home or Abroad, who requires a copy for binding, or for other purposes, is asked to make application therefor promptly to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

NOTES.

Gas Standards Order.—The Minister of Munitions has issued regulations controlling the operations of gas works throughout the United Kingdom. The gas produced, whether coal gas or a mixture of coal and water gas, is to have a calorific value of "as nearly as possible 500 B.TH.U. gross," before scrubbing. All gas works having scrubbing facilities are to scrub their gas to the fullest possible extent for ammonia, toluol, and benzol. Where these conditions cannot be fulfilled, owing to lack of capacity of the plant, the calorific value of the gas as delivered to the consumers must not fall below 450 B.TH.U., the gas being carburetted with gas oil if the standard cannot be maintained without this.

The Gas Light and Coke Co. has raised the price as from the June readings to 4s. 4d. per thousand cb. ft., thereby reducing the dividend payable to ordinary shareholders from £2 18s. 8d. to £2 2s. 8d. per cent. per annum.

Slag Manipulation in Electric Steel Furnace.—Mr. F. T. Snyder, inventor of the Snyder electric furnace, has secured a United States patent for a steel-making process, in which the slag used for taking up the impurities from the bath is not removed at the end of a heat, but is retained in the furnace as the initial slag of the next succeeding heat, obviating the necessity of preparing a fresh slag. Later this slag is removed, and a new one added to the partly purified bath. In this way each heat is subjected to the action of two distinct slags. A tilting electric furnace is recommended. The process is claimed to be economical, because rapid in operation and utilising to a high degree the heat developed in the furnace, and requiring less than the usual time and amount of basic slagging material.—*Iron and Coal Trades Review.*

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Health and Working Hours.—The Minister of Munitions has appointed a Committee, with Mrs. H. J. Tennant as chairman, to advise him in connection with the welfare and health work of the Ministry. The final report of the Health of Munition Workers Committee has been issued, and states that the conditions of employment throughout the country are now far better than they were 2½ years ago, though there is still much room for improvement. The average weekly hours of labour for men and boys, limited in January, 1916, to 65 or 67, and for women and boys under 16 to 60, are still too long, and can be substantially reduced without loss of output. The three-shift system is recommended, especially for women. Work before breakfast should be avoided, and five hours' continuous work without a break is too long for women and young folk. All workers should be allowed periodical holidays, and Sunday labour has been conclusively proved to be unproductive; night work is uneconomical, and in the case of females and boys under 15 should be stopped. In munition works and docks 840 canteens have been provided, and have been highly beneficial to the workpeople. Welfare supervisors should have at least one year's training.

War-time Boy Influence in Sheffield Factories.—The Sheffield correspondent of the *Engineer*, in one of those communications which every week form so interesting a feature of our valued contemporary, makes some observations upon the influence of the boy in Sheffield industries which are worthy of reproduction. From what we can gather, the same sort of influence is at work in certain engineering and other factories of war-time importance. The difficulty is to know whether anything tangible can be done to deal with the situation while the war position continues critical. The writer says:—

"The chairman of one of the leading steel firms here has just drawn my attention to a situation which he says is becoming very serious—viz., the attitude of boys engaged in rolling mills, and the lamentable indifference of parents in exercising any sort of influence or control over them. The withdrawal of youths of 18 years and over from the mills for military service is causing employers grave concern. They have had to be replaced by boys just from school, who commence work with wages of 25s. per week and upwards. The result of this sudden change in their lives, this accession of wealth undreamt of, seems to unhinge their half-matured minds, with the inevitable result. They treat their position in industrial life as a huge joke, with plenty of pocket money to sweeten it. 'The week before last,' said the director referred to, 'we had five rolling mills standing idle, night and day, last week two mills, and this week three, all through boys failing to turn up to work, leaving without notice, or declining to make a "set" when we are a hand short in another mill.' Quite apart from the inconvenience and loss thus caused, he was anxious to find some means of attracting to the works the kind of boy who would reap the greatest real advantage from the opportunities now offered. In these days, when the labour supply is far behind the demand, advertisements appear to have brought him but little response, and his experience is probably that of a great many steel firms. Yet no local industry offers a wider field or better-paid employment than that of the rolling mills and forging and tilting—the old Sheffield staple key trade to the steel production side. Boys are afforded an opportunity of learning a trade, without premium, and whilst doing so earning good wages, and have the assurance that high wages await the skilled workman, whilst the prospects of becoming foremen or managers later on are almost unlimited. 'If parents have any thought for the future welfare of their sons,' the director added in conclusion, 'now is the time to embrace the opportunities which present themselves, instead of allowing them all to rush into what are virtually blind alleys for the sake of very highly-inflated and quite temporary wages for various kinds of "war work." Parents should instil into the minds of their boys that these big wages will not last. The war must end some day, and with it some of the ridiculously high wages that are being paid. The veneer will then be revealed, but the lads may have passed the period when apprenticeship to a sound permanent business is possible. In the meantime the loss of output in the direction I have indicated is a serious matter, for the material is required for war purposes. In the three cases specifically mentioned, the loss of output through the action, or inaction, of boys aggregated to 460 tons—and, of course, they were only three of a large number of similar instances.'"

Charging Electric Vehicle Batteries.—At a meeting of the Council of the Motor Trade Association and the Executive Committee of the Agents' Section, Ltd., on June 7th, a report was submitted of the meeting between representatives of the A.S.L. and the Electric Vehicle Committee of Great Britain, called to consider Clause 23 of the Supply of Electricity Bill. It appears that the distributing companies do not wish to give up their right to charge electric vehicles. They are apparently willing to surrender the repair and maintenance of electric vehicles to traders (motor or electrical). They pointed out, however, that it would not be to the interests of the electrical vehicle generally if they were not able to undertake repair and maintenance under certain conditions, and the arrangement suggested by the Joint Committee of the A.S.L. was that the conditions should be that after giving them notice, if there was no trader within a certain distance of their undertaking who was willing to equip himself, they could undertake the work. In the event of their having to undertake the work, separate accounts would be kept. The understanding with regard to separate accounts applied to charging as well as to repair and maintenance. With regard to charging, a suggestion was made that some additional payment should be made over and above the actual cost of the energy to repay either the supply companies or the traders for the work involved in charging the batteries of vehicles.

A report was also made of the conference between representatives of electric vehicle makers and the Agents' Section. On this occasion the agents gave the vehicle manufacturers information on specific points which they raised as to the position between agents and petrol vehicle manufacturers. The electric vehicle manufacturers were unable to give any undertaking that they would conduct their business through the channels of the retail motor trade or that they would bring their terms to such as agents would consider reasonable or remunerative, but they were evidently quite sympathetic towards agents, and went away with the intention of conferring together on the subject generally.—*Motor Trader.*

Electrical Power Engineers' Association.—A general meeting of the Association (Sheffield and District Branch) was held in Atkinson's Café, Sheffield Moor, on June 25th. The chairman dealt with the work done by the Divisional Executive Committee and the National Executive Council, and other members of the Committee gave short addresses. A vote of thanks to the chairman and Committee was recorded. Mr. A. T. Nixon, 79, Southgrove Road, Sheffield, is the hon. sec. for this Branch.

A meeting of Electrical Engineers (Central Supply) was held in Glasgow, on June 29th, under the auspices of the Electrical Power Engineers' Association, with the object of forming Scottish Branches of the E.P.E.A. There was a fair attendance of engineers from Glasgow and district, representatives from Greenock, Motherwell, and Dundee being also present.

Mr. Lunn, president of the Northern Division of the E.P.E.A., gave a detailed explanation of the operations of the Association since its inception, and was assisted by Messrs. Thomas and Holt, secretary and assistant secretary of the E.P.E.A. The various speakers were very well received, and at the conclusion of the address the meeting was thrown open to discussion, which was vigorously taken up by those present. The points discussed were:—Qualifications, training of younger members, salaries, and the latest development—viz., the proposed formation of the A.B.E.E. All these points were amicably settled.

The meeting concluded with a resolution, which was carried unanimously, "That this meeting of electrical engineers gives its entire support to the Electrical Power Engineers' Association, which in all ways satisfies our desires, and that a link with the I.E.E. be in some way arranged."

Volunteer Notes.—LONDON ARMY TROOPS COMPANIES, VOLUNTEER ENGINEERS.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Corps Orders No. 27 by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Captain of the Week.—Capt. E. G. Fleming.
Next for Duty.—Capt. W. Hynam.
Sunday, July 7th.—Commandant's Parade at Waterloo Station, 8.45 a.m. for work at Esher. Dress: Drill order, with haversacks and waterbottles. Mid-day and tea rations to be carried.
Monday, July 8th.—Adjutant's Technical Lecture ("Earthworks"), 6.30—7.30; Signallers, 6.30—8.30.
Tuesday, July 9th, to Thursday, July 11th.—Drills as usual.
Friday, July 12th.—Adjutant's Technical Lecture ("Earthworks"), 6.30—7.30.
Saturday, July 13th.—Engineering Reconnaissance Scheme for officers.

C. HIGGINS, *Capt.* R.E., *Adjutant.*

Books for British Prisoners of War.—We commend to the attention of our readers the letter of Sir Alfred T. Davies, which will be found in our "Correspondence" columns, appealing for books and donations for the British Prisoners of War Book Scheme (Educational). We would remind our readers of the fact that this is the sole war charity supplying educational books to our men interned in enemy and neutral countries, and that in view of the educational reconstruction after the war, the value of its work to the nation can hardly be exaggerated. In the course of last year this organisation distributed over 55,000 books, and its rate of output this year is still larger. This scheme is entirely dependent for its resources on donations from the public, and is mainly worked by voluntary labour. We suggest that our readers should go through their shelves and see what they can spare in the way of up-to-date books, especially of the kinds asked for in Sir Alfred's letter, though books on any educational topic are always in demand.

Decimal Coinage.—The Government has decided to appoint a Royal Commission consisting of members of both Houses and other persons with special qualifications to consider the desirability or otherwise of a change in our coinage system. They will be invited by the terms of reference to consider the proposals embodied in Lord Southwark's Decimal Coinage Bill.

The Association of Chambers of Commerce of the United Kingdom, which has been prominently identified with the movement throughout, will probable be represented by Lord Southwark, and possibly also by Sir Algernon Firth, the late president; the Bank of England, the Treasury and the B. of T. will also have special representatives.

Apprenticeship in War Time.—At the annual meeting of the National Institution of Apprenticeship, York Place, Baker Street, on Monday last, Mr. Francis W. Pixley, who presided, said that since 1905 the Institution had bound 2,351 apprentices to masters in a large variety of skilled trades. In 1917 the number was 123, the Institution paying premiums to the amount of £730. During that year 156 apprentices completed their indentures, and most of them joined the Colours, together with many whose apprenticeships were not completed. A regrettable feature was that a large number of parents withdrew their applications on learning that the wages paid to apprentices during the first year or two were lower than those paid to errand boys and the like, which disadvantage, added to the cost of the fares to and from the workshop, entailed a sacrifice they could not afford to make.

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The Institution, however, secured higher wages for many apprentices, and took every opportunity of pointing out that much of the remunerative work occasioned by the war was only of a "blind-alley" character, and those who grasped at it would after the war be in a worse position than before.—*The Times.*

Glasgow Tramcar Accident Claims.—In the Glasgow Courts, last week, a brass turner was awarded £500 damages and a toolsmith £200 for injuries received in an accident to a Corporation tramcar on December 5th last. The car left the rails, dashed on to the pavement, and was overturned. The driver was 16 years of age.

Whitley Councils.—Local authorities of Greater London south of the Thames are conferring with a view to setting up Whitley Councils for the tramway, gas, electricity, water, and public works industries.—*The Times.*

Air Inventions.—The establishment of the Air Inventions Committee (now part of the Air Ministry) nine months ago let loose a torrent of suggestions, the vast majority of which, of course, were wholly impracticable or even fantastic. Over 5,000 ideas have been submitted to the Committee: all are carefully considered, but nine-tenths of them are useless. Nevertheless, the labour of scrutinising the suggestions is abundantly repaid by the occasional discovery of a novel and practical idea. An article in the current number of the *Ministry of Munitions Journal*, while it carefully avoids disclosing any of the useful inventions, affords valuable warning to inventors of the "man-in-the-street" class, who know little of physics or engineering, and are subject to brain-waves on utterly fallacious grounds; when their proposals are politely declined by the Committee, they are apt to stigmatise that body as a collection of incompetents, whose crass ignorance and unconquerable prejudices are responsible for the rejection of an effort of genius. Amongst the really astonishing flights of fancy on the part of such inventors are the following items:—

The clouds are to be frozen artificially and guns mounted on them; heavy guns are to be suspended from captive balloons; the moon is to be covered with a big black balloon; heat rays are to be projected for the purpose of setting Zeppelins on fire; electric waves to paralyse the magnetos; a balloon carrying magnets hung on strings to attract the rifles out of men's hands; the throwing of live cables carrying a high voltage among advancing bodies of infantry by means of rockets. One of the most popular suggestions of all is to attach a searchlight to an anti-aircraft gun, get the light on the object, and shoot along the beam; but, unfortunately, the path of a shell is quite different from that of a ray of light.

Suggestions are also frequently received in connection with coloured searchlights. But colour cannot be imparted to a beam, as by passing it through a coloured screen, without reducing its intrinsic brilliancy. Colour is, in fact, obtained by a process of subtraction from the total light. At great distances all the brilliancy possible is required for effectiveness, so that coloured beams are of no value for general purposes. Flame arc lamps for searchlights give coloured light, generally slightly yellow, but this source of light is too large for the efficient optical projection of a parallel beam, and a parallel beam, or one nearly approaching parallelism, is essential in order to reach the great distances involved. The most remarkable proposition of all in connection with searchlights is perhaps that of a "black beam," whatever that may mean, for obscuring the moon!

Parliamentary.—ROYAL ASSENT.—The following have received the Royal Assent:—

Brixham Gas and Electricity Act, 1918.
Yorkshire Electric Power Act, 1918.

Employment for Discharged Army Officers.—The Lord Mayor of Birmingham presided at a meeting of the Federation of British Industries at 5, Bennett's Hill, Birmingham, on Monday. It was reported that the Ministry of Labour had approached the Federation with reference to the problem of reinstating ex-Army officers in civil life. The Appointments Department of the Ministry has now set up registers all over the country by which it can supply firms suffering from depleted staffs with up-to-date lists showing the qualifications and experience of men who are ready to take up the desired work. The discharged officer who was immune from further service was the safest man to fill permanent appointments. It was estimated that there were some 40,000 officers convalescing and awaiting occupation, and manufacturers were earnestly invited to co-operate with the Federation by offering facilities for employment.—*Birmingham Post.*

Extension of Patent.—An application by Sir James Dewar for the prolongation of Patent No. 13,638 of 1904, for "an improved method of absorbing gases and the application thereof to the production of high vacua and the separation of gases" (by the use of the absorptive properties of charcoal at low temperatures), has been granted by Mr. Justice Sargant, the patent being renewed for a period of five years.

Appointments Vacant.—Engineer-in-charge for the Egham and Staines Electricity Co.; charge engineer (48s. + 20s. + 12½ per cent.) for the Ashton-under-Lyne Corporation Electricity Department; engineer and clerk of works for Worcestershire Asylum, Bromsgrove; shift engineer (£170 + 12½ per cent.) for the Twickenham and Teddington Electricity Supply Co.; shift engineer (£195) for the Accrington Corporation Electricity Works; shift engineer for the Lancashire Electric Power Co.; assistant engineer telegraph operator for the Government wireless station, Penang (£200 + £60). See our advertisement pages to-day.

New Fuel and Light Order.—A notice to consumers, issued on Tuesday last, differs in some respects from the statement which we published last week. The allowance of coal per room above four rooms is less, being 5 to 14 tons for 6 to 15 rooms, unless there are more than 6 residents, in which case an extra ton is allowed. The gas allowance for lighting is unchanged, but the electricity allowance is increased to 120 units for 1—3 rooms, 180 units for 4—6, 240 for 7—9, 300 for 10—12, and 360 units for 13 to 15 rooms. Only furnished rooms may be counted. Rooms exceeding 4,000 cb. ft. in size, or 16 ft. × 20 ft. carpet area, count as two rooms. The conversion factors for gas and electricity are unaltered. Above certain minimum requirements, application must be made for supplies of fuel and light within six weeks from July 1st, on forms which will be available on July 28th. All applications must be lodged before the end of September.

Fatality.—Mr. W. H. Kershaw, an electrician, was on Monday repairing electrical plant at the engineering works of Messrs. Thwaites Brothers, at Bradford, when he became enveloped in flames. Assistance was quickly forthcoming, but it was found that death had ensued instantaneously.

Protected Electrical Men and National Service.—The July issue of the *Electrical Contractor*, just to hand as we go to press, contains copies of correspondence that has passed between Mr. L. G. Tate, secretary of the National Federated Electrical Association, and the Ministry of National Service. In a letter dated June 18th, the Deputy Commissioner for Trade Exemptions says that the protection afforded by the List of Certified Occupations (R. 136) extends to men of ages now made liable to military service. "Such men will not be called up even for medical examination pending further instructions, if they are engaged in an occupation specified in R. 136, and if they comply with the conditions as to date of entry upon the occupation stated in Paragraph 8 of the Introduction to the List. . . . If a notice should be sent in error to such a man, he should call at the office of issue, taking his Registration Card showing his occupation, and ask for the notice to be cancelled.

The City's National Kitchen.—On Wednesday, last week, the new national kitchen and restaurant in New Bridge Street, E.C., opened by the Ministry of Food, commenced serving the public with cooked food and complete meals. The kitchen—which, by the courtesy of Alderman C. F. Spencer, we were recently able to inspect—occupies the extensive ground floor and basement of premises taken over from Messrs. Spiers & Pond, and has been started with the object of showing what can, and ought to, be done in running a restaurant in conjunction with a national kitchen. There is accommodation for 170 people at one sitting, and it is expected that each chair will be occupied several times during the day. Customers will be expected to wait upon themselves, following the canteen principle, and those who wish to do so may bring their own vessels and carry away cooked portions of food. Prices substantially lower than those ruling in City restaurants and teashops will be charged, a good mid-day meal being served for about 10d. or 1s. The prices, although low, will cover all capital and running charges, and it is expected will yield a substantial surplus.

The staff numbers about 30 persons, and the hours of business are from 11.30 to 8 p.m., but if there should be any demand in the future the hours will be extended for night workers in the newspaper and printing trades.

The equipment has cost between £800 and £900. Cooking is carried out by steam, gas, and electricity—roasting by electricity and boiling by gas. The electrical apparatus installed by the Jackson Electric Stove Co., Ltd., consists of the following:—One two-tier pastry oven, each tier having a clear cooking space of 40 in. × 30 in. × 10 in. high, with a loading of 5·5 KW., or a total loading of 11 KW. Each compartment is fitted with top and bottom heating elements, controlled by two D.H. series-parallel switches. This apparatus is made of mild steel plate, double-cased and lagged, and each compartment could be lifted from its angle iron support and used as a separate unit if required. There are also two No. 11 roasting ovens, each measuring inside 36 in. × 22 in. × 25 in. high, fitted with side and back elements with a maximum loading of 7 KW. each roaster. These roasters are capable of cooking ten 12-lb. joints at once; they attain their maximum heat in 30 minutes, and remain hot for one hour after the current is switched off. Three-heat regulation is provided for, controlled by three D.H. switches, and all switchboards are of the illuminated type. This firm also installed one of its 5·5-KW. grills with draw-off for fat, and a 2·5-KW. fish fryer.

Further apparatus installed consists of a three-tier pastry oven supplied by the Brompton and Kensington Accessories Co., which is used exclusively for cake making; three hot-plates rated at 1 KW. each used for serving purposes: a meat-mincer gear driven by a ¾-H.P. D.C. motor; and an electric belt-driven potato scrubber.

Both the chief cook and the restaurant superintendent speak highly of the electrical apparatus, no trouble having been experienced, and the cooking results obtained are excellent. There is a gas as well as an electric fish fryer installed, but the latter is preferred on account of the fat used going much further and the colour of the fish when cooked being much better than when gas is used for the purpose.

Patents and Alien Enemies.—Application has been made to the Board of Trade by Messrs. John Musgrave & Sons (1913), Ltd., Messrs. Willans & Robinson, Ltd., and Messrs. Daniel Adamson & Co., Ltd., to avoid or suspend Patent No. 20,216/09 granted to Josse for a process and apparatus for removing gases and vapours from surface condensers.

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The Work of the Post Office.—In the House of Commons recently, the Postmaster-General stated that nearly 80,000 Post Office employés had been called up, and about 3,000 had returned to work. In connection with air-raid warnings, which sometimes entailed from 10,000 to 20,000 telephone calls, volunteers had been called for, and 32 telephone operators had been awarded the British Empire Medal for meritorious services. War bonuses granted to the staff cost 6 millions per annum, and a recent claim for an all-round increase of 20s. per week, if granted, would cost several millions.

Several members urged that the Whitley Report should be adopted by the Post Office, and Mr. Pike Pease, in reply, stated that the matter would shortly come before the Cabinet.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Accrington Electricity Committee has decided to increase the salary of Mr. A. W. CLEGG, electrical engineer for the borough, from £400 to £500 per annum as from April last.

Mr. H. H. SUTCLIFFE, assistant at the Hebden Bridge electricity works, has been appointed engineer and manager of the department, at £200 a year, in succession to the late Mr. J. W. Garside, who died recently.

Mr. W. JESSOP, of Eastbourne, has been appointed engineer-in-charge at the Hammersmith Borough electricity station at a salary of £175 per annum, plus £1 per week and 12½ per cent. on earnings.

Mr. MUNTZER, temporary engineer-in-charge at the Hammersmith electricity works, has resigned his position, having obtained an appointment at Cheltenham.

The York city electrical engineer has been appointed district engineer to assist the technical local representative of the Controller of Coal Mines.

Mr. S. C. MIDWINTER, station superintendent to the Sunderland electricity department, has been appointed to a similar post under the county borough of Eastbourne.

The Hackney Borough Council had before it a few days ago a letter from its electrical engineer, Mr. L. L. ROBINSON. The proposal for advancing the salary of the latter to £1,000 when before the Council recently failed to secure the necessary two-thirds majority. In his letter, Mr. Robinson stated that his previous requests to join one of H.M. Services had met with the reply that his work in Hackney was of such importance that it would not be advisable for him to transfer his services. He now finds that there is a probability of his application for a commission being accepted, and he says that, judging from the Council's recent action respecting his salary, the Council does not now set any great value upon his services, and that it can, therefore, reasonably be asked to spare him for the duration of the war. He accordingly asks for permission to accept a commission, and in doing so presumes that any difference in income will be paid by the Council, whether such difference be between Service pay and his present salary or between Service pay and what his salary may be raised to as a result of the pending decision of the London Electricity Wages Conference.

General.—Stop-press news pasted in a copy of Callender's Staff Service Gazette, referring to the honour recently conferred upon the managing director, wishes Sir Tom and Lady Callender "long years of happiness to enjoy the distinction."

Mr. G. E. CHADWYCK-HEALEY has been appointed Director of Materials and Priority at the Admiralty.

In the Civil List pensions for 1918 there appears the following grant.—Mrs. BERTHA J. MANN (£120). Valuable services of her late husband, Mr. R. F. Mann, to science and medicine in the development of radiography, in the course of which he received injuries which resulted in his death.

Ald. JEPHCOTT, chairman of the Birmingham Electric Supply Committee, has been invited, and he has consented, to become the Unionist candidate at the next general election for the new Yardley Parliamentary Division (Birmingham). For about 40 years he has been a member of the Amalgamated Society of Engineers.

Mr. T. CHRISTIE, Royal College of Science, Dublin, has been appointed Lecturer in Electrical Engineering in the Belfast Municipal Technical Institute.

Roll of Honour.—Private LIONEL HEAD, R.A.M.C., youngest son of Mr. W. J. Head, of the I.R., G.P. & Telegraph Works Co., Ltd., Newcastle-on-Tyne, is officially reported as missing since May 27th. His elder brother, Lieutenant A. E. Head, was killed July 1st, 1916.

Second-Lieutenant BENJAMIN H. B. HENDERSON, formerly an apprentice electrical engineer at Glasgow, has died of wounds.

Gunner F. YATES, R.F.A., who was employed by Messrs Dick, Kerr & Co., Ltd., Preston, has been awarded the Military Medal.

Captain E. MANNOCK, M.C., R.A.F., who has been awarded the D.S.O. and bar, enlisted early in the war after returning from Turkey, where he was engaged with a firm of telephone contractors to the Government there. He has brought down 50 German aeroplanes, and last September won the Military Cross, and later the bar.

Corporal C. DUFFIN, Lancs. Fusiliers, formerly on the Salford Corporation tramway staff, has been awarded the Military Medal.

The Meritorious Service Medal has been awarded to Lance-Corporal F. W. MUNCEY, Royal Fusiliers, who was in business as an electrician at Bridgwater when the war broke out.

Sec.-Lieut. F. H. M. JOYCE, 99th Siege Battery, R.G.A., formerly in the head office of the India-Rubber Co., has been awarded the Military Cross. Private G. D. LAMBERT, London Regiment, who was in the general office of the same company, is in hospital with trench fever. Sergeant A. HALSEY, Machine Gun Corps, who was at the company's Silvertown works, is a prisoner of war in Germany.

Obituary.—MR. W. PERREN MAYCOCK.—We regret to learn that Mr. Wm. Perren Maycock, M.I.E.E., passed away on June 29th, after an illness extending over several months. For many years past Mr. Maycock had been a lecturer in electrical engineering subjects, and his activities in this capacity at the South-Western Polytechnic in Manresa Road, and at Croydon, had naturally brought him into touch with a large number of students. It was, however, through the medium of his books that he reached a far larger audience. Since the appearance of his first book, on "Electric Light and Power Distribution," in 1892 from the house of Whittaker & Co., a practically continuous stream of electrical works was produced under his direct authorship. These dealt with subjects such as electricity and magnetism, A.C. work, C.C. work, electric wiring tables, electric wiring diagrams, electric wiring fittings, switches, and lamps. The aggregate number of books issued bearing his name in the 25 or 26 years since his literary efforts began must run to six figures, which we should imagine is a record. The firm of Whittaker & Co. is now merged into Messrs. Pitman, who will continue to be responsible for the Perren-Maycock works. The deceased gentleman some years ago held the position of technical editor in the Westinghouse Companies' Publishing Department, and in more recent times he has been identified with Messrs. Lundberg & Sons in respect of their literary communications and switching competitions. The passing away at a comparatively early age of so assiduous a worker in his special field of electrical authorship, where he was able to so admirably meet the needs of large bodies of learners, can only be regarded as a loss to the electrical profession. We are ure that our readers will desire to join us in an expression of deep sympathy with his widow and family in their bereavement.

MR. J. ALLEN BAKER.—We regret to record the death of Mr. J. Allen Baker, M.P. (Joseph Baker & Sons, Ltd., engineers, Willesden) who, as some of our readers will remember, was chairman of the L.C.C. Highways Committee during the electrification of the London tramways system. He was 66 years of age. Death took place as the result of a seizure at the House of Commons on Tuesday night.

Mr. A. T. KEEN.—The death has occurred suddenly, at Birmingham, of Mr. Arthur T. Keen, chairman of Guest, Keen & Nettlefold, Ltd.

MR. R. SELLARS.—The death occurred on June 8th of Mr. Robert Sellars, who had been for the last six years superintendent canvasser in the sales department of the West Ham Corporation electricity department. He had been in failing health for two years.

Mr. W. HARRIES.—Mr. W. Harries, temporary chief clerk at the Hammersmith B.C. electricity works, died on June 14th after a long illness.

MR. W. H. PICKLES.—Mr. W. H. Pickles, of Morecambe and Bradford, who for some time past has been the chairman of the Morecambe Tramways Co., died at Bowness on Friday last, aged 68 years.

CITY NOTES.

Callender's Cable and Construction Co., Ltd.

For the year ending on December 31st, 1917, the directors report that the balance at credit of profit and loss was £121,784. The balance is £81,051, plus £249,207 brought forward, less £150,000 transferred to reserve, leaving £180,259, out of which a dividend of 20 per cent. and a bonus of 5s., both less income-tax, making 25 per cent., are declared. There is carried to reserve £25,000, and £111,509 is to be carried forward, subject to excess profits duty. Out of the available reserve (£250,000) it is proposed that £175,000 shall be capitalised against a new issue of ordinary shares. The capital is to be reorganised so as to bring the nominal capital more into accord with the sum actually engaged in the business. The capital is to be increased by the issue to existing ordinary shareholders, as a bonus, one new fully paid-up share of the nominal value of £5 for each £5 ordinary now held. The necessary authority of the Treasury has been obtained. It is intended that the £5 ordinary shares shall in due course be sub-divided into £1 shares. Meeting: July 11th. We shall quote the report more fully next week.

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United Electric Tramways of Monte Video, Ltd.

The gross receipts of the tramways for the year ended October 31st were $1,691,217, an increase of $56,680; the operating expenses were $1,236,993, an increase of $114,278. The net receipts were $454,224, a decrease of $57,598. At exchange of $4.7 to the £, the net receipts are £96,641, a decrease of £12,254. Passengers carried: 44,883,520, an increase of 2,136,450. Car miles run: 7,511,883, a decrease of 306. Percentage of operating expenses to gross receipts: 73.14, an increase of 4.45. The heavy increase in operating expenses (practically all due to high cost of fuel) is more than double the increase in gross receipts. Economies of every possible nature are still being practised, but it is impossible to keep the expenditure down. Difficulty of obtaining maintenance supplies continues. There is no prospect of such conditions improving until after the war. Owing to abnormal conditions the recommendations for a distribution on the preference shares is postponed, but the dividend is cumulative.

Oriental Telephone and Electric Co., Ltd.

Mr. G. PARKER NESS presided at the annual meeting on June 28th He said that the experience of the company had been restricted operations, owing to inability to accept all the subscribers offering, due to scarcity of materials and comparative lack of transport to convey them. High prices for equipment of all kinds had unfavourably affected the net profits. The sum of the year's business was a considerably increased gross profit, and an increase of over £3,000 in net profit, when allowance was made for the special bonus received from the China Co. in 1916. They had every reason to expect satisfactory developments when the present embargo on materials was removed. It was, therefore, prudent to keep in hand reserves to meet the heavy expenditure that would then have to be made. The chairman referred at some length to the details of the purchase of the Egyptian business by the Government, and to the measures for the increase of the capital. The meeting passed a vote according £2,500 to the board for their special services in connection with the sale of the Egyptian business.

General Electric Co., Ltd.

The directors' report for the year ended March 31st, 1918, shows that the net profits were £348,861, plus £89,786 brought forward. After deducting debenture stock interest £8,000, normal and special depreciation £39,716, grants to dependents of men on active service, £13,664, managing director's and employés' bonus £25,914, dividend 6 per cent. on preference shares £42,000, reserve for income-tax on ordinary share dividend £12,813, transfer to reserve account £100,000, there remains an available balance of £196,540. A dividend of 10 per cent., free of tax, on the ordinary shares requires £51,253, leaving to be carried forward (subject to excess profits duty, if any) £145,286. It is stated that the results of the year have justified the anticipation of the directors, and are largely due to their conservative policy in the past. Electrical equipment of all kinds has played an important part in the prosecution of the war, and in consequence all the works of the company have been fully employed throughout the year. The difficulties created by the continued process of dilution of labour have been admirably overcome by the energies and whole-hearted co-operation of the staff.

Nearly 2,000 employees have joined the colours, and 166 have made the supreme sacrifice.

The increase in the capital expenditure is mainly due to the acquisition of a freehold site for the erection of future factories near Coventry. The Conner Magneto & Ignition, Ltd., in which this company holds the controlling interest, has recently erected a factory on an adjoining site.

The increase in the investment account is due to the acquisition of the whole of the ordinary share capital of Chamberlain & Hookman, Ltd., one of the most prominent electricity meter businesses in the country.

As is evident from the income from investments all the allied and subsidiary enterprises of the company have worked with satisfactory results, although the continued necessary restrictions of export are likely to affect seriously the overseas companies in the coming year.

The company has recently entered into an agreement for the purchase of the whole of the works of Fraser & Chalmers, Ltd., at Erith. The actual purchase price will only be ascertained after the valuation of the assets has been completed.

For the purpose of carrying out these, as well as other, transactions, deemed necessary to raise the productive capacity of the company to the high level aimed at by the directors, it is proposed that the capital should be increased to £3,000,000 by the creation of a further 100,000 preference shares of £10 each, and 600,000 ordinary shares of £1 each.

The directors suggest creating a fund for the superannuation, pensioning off, and benefit of the employees or their families or dependents. For this purpose they contemplate allotting to trustees shares to the value of £25,000 —the unissued balance of the ordinary share capital.

The reserve account now stands at £500,000, and the directors propose to capitalise £300,000 of this reserve, by converting it into 300,000 ordinary shares of £1 each, and distributing such shares amongst the existing ordinary shareholders in the proportion of five £1 shares for every one £10 share now held.

This would entitle the above-mentioned trustees to an allotment of 12,500 bonus shares, but owing to the legal difficulties in the way of doing this, it is proposed in lieu thereof to pay out of the reserve £37,500 in cash to the trustees who will invest the same in ordinary shares of the company of £1 each at par.

To avoid the difficulties which would arise in dealing with a fraction of a share, the directors propose, in the first place, that the existing ordinary shares of £10 each should be converted into 10 shares of £1 each.

The directors propose shortly to raise £1,000,000 further capital by an issue of preference and ordinary shares, for which the sanction of the Treasury has been obtained. In view of this issue it is thought desirable to raise the dividend both in respect of the existing preference shares and of the new preference shares from 6 per cent. to 6½ per cent.

Having regard to the position which the company has now attained, the Articles of Association are to be brought up to date and consolidated. New Articles have been prepared.

The creation of the bonus shares, for which Treasury sanction has also been obtained, will have to be effected under the new articles of association.

Major-General the Hon. Sir Newton J. Moore, K.C.M.G., late Prime Minister of Western Australia, and Mr. Arthur Chamberlain, chairman of Messrs. Kynoch, Ltd., have joined the board.

Since the receipt of the directors' report we have received the following communication from the company:—

"We have received a communication from H.M. Treasury refusing for the present to sanction the division or issue of the ordinary share capital of this company into shares of a lower denomination than £10.

"This does not introduce any alteration whatsoever in the programme as set out in the directors' report, except that the denomination of the ordinary shares will remain £10, instead of £1.

"To avoid any possible misconception, we shall be obliged if you will give publicity to this statement.

The General Electric Co., Ltd.,
"HENRY P. WELLS,
"Secretary."

London, E.C., *June 29th*, 1918.

Vigo Electric Tramways.—The profits for the year 1917 amount to £3,600, which the directors propose to distribute as follows:—Dividend of 5 per cent., £4,000; tax (3.3 per cent. on dividend), £132; amortisation fund, £1,356; reserve fund, £307; remuneration to directorate, £505. The directors declare themselves satisfied with the result, obtained in spite of increased cost of material and higher wages to employés.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be quoted in the Official List:—

British Insulated and Helsby Cables, Ltd.—500,000 additional ordinary shares of £1 each, fully paid (Nos. 500,001 to 1,000,000).

Ruston & Hornsbys, Ltd.—In the Chancery Court on Tuesday, Mr. Justice Astbury sanctioned the scheme of arrangement between R. Hornsby & Sons, Ltd., and Ruston, Proctor & Co., Ltd., already mentioned in these pages.

Chile Telephone Co., Ltd.—Final dividend 5s. per share, free of income-tax, making 8 per cent. for the year, and a distribution of 22,000 fully-paid ordinary £5 shares to the existing shareholders in the proportion of one in three.

National Electric Supply Co., Ltd.—Dividend 5 per cent. per annum, less tax, on ordinary shares for half-year (interim).

Telegraph Construction & Maintenance Co., Ltd. — Interim dividend 5 per cent. (12s. per share), free of tax.

STOCKS AND SHARES.

TUESDAY EVENING.

BUSINESS in the Stock Exchange this week was broken by the unwanted and unnecessary holiday on Monday, but when members got back to work they found a good deal of accumulated business to occupy their energies. Buyers are in evidence in various departments, and, this time, the imminence of a German onslaught has not exercised the same restraint —or not to the same extent—that it has done on former occasions. Bonus declarations in shares or cash are the order of the day in the Industrial market. Home Rails remain strong. Further rises have occurred in most of the Mexican Utility descriptions.

The big increase in London tram fares has given point to the idea that the 'buses will put up their rates again, and on the strength of this the Underground group shows up well. Districts again have been favoured, but the main advance is that of 3 points in Underground Electric Income bonds, which has taken the price over 80. The £10 shares are 7s. 6d. up, and the Bus "A" variety strengthened to 5s. 6d.

The General Electric Co.'s report is a good one; the chief interest lies in the directors' proposals to divide the £10 shares into new shares of £1 each, and to give the ordinary shareholders five new shares for every 10 old, so that the present proprietor of one £10 General Electric ordinary would have received 15 new shares of £1 each, five being by way of bonus. The preference dividend, it is proposed, shall be increased from its present 6 per cent. to 6½ per cent. The Treasury, however, have vetoed the splitting idea, and the company will have to distribute £10 shares, in the same proportion. This will necessarily involve fractions, and the Treasury's intervention is not relished in the Stock Exchange. The ordinary have risen 30s. to 25½, and the preference are better at 10½ xd.

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The Chile Telephone Co. also proposes to make a bonus distribution to its shareholders of one new share for every three now held. The previous dividend, making 8 per cent. for the year, free of tax, is repeated, and the price has gone up a sovereign to 9¼. British Insulated are now quoted 37s. 6d., ex the bonus shares.

Chadburn's (Ship) Telegraph has declared a dividend of 8 per cent., a reduction of 1 per cent. on last year, when nearly a decade of 8 per cent. dividends was beaten. The ordinary have not changed hands in the Stock Exchange for a score of months, and the last business marked was at 20s. 7½d. Oriental Telephones have had a big jump to 4¾. Callenders are 5s. better at 18½. India-Rubbers at 16⅛ are ex dividend.

Electricity Supply shares remain quiescent, and there is no movement in prices to record on the week. Manufacturing issues are firm, with ⅛ rise in Electric Constructions as something of a feature.

Gains in Mexicans are as common as influenza in London. Hard upon their material improvement of last week, there have come fresh rises in the various descriptions of the Mexico Tramways, Mexican Light & Power, Pachuca, Monterey, and Mexican Electric Companies. Brazilian are also firm. Anglo-Argentine Tramways are unaffected by the meeting on Monday. British Columbia Electric Rails are dullish in tone upon the news that, although the Vancouver City Council have eliminated the jitney competition from this month, the companies' employés have made a "most serious demand" for increased wages.

Rubber shares remain dormant. The iron and steel group is active and, on the whole, strong. Armaments are rather undecided. There is not much doing in the shares of the base-metal companies.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price July 2, 1918.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6⅜	—	£7 13 10
Charing Cross Ordinary	5	4	3½	—	6 8 1
do. do. do. 4½ Pref.	4½	4½	3¼	—	6 18 6
Chelsea	3	5	3⅜	—	8 0 0
City of London	8	8	11¼	—	7 2 3
do. do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
County of London	7	7	10¼	—	6 16 7
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	6	7	5¼	—	6 13 4
London Electric	Nil	Nil	1⅜	—	Nil
do. do. 6 per cent. Pref.	4	5	3½	—	7 13 10
Metropolitan	3	4	3⅜	—	6 8 0
do. 4½ per cent. Pref.	4½	4½	3½xd	—	7 4 0
St. James' and Pall Mall	8	9	6⅞	—	6 11 0
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6⅛	—	7 7 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	94½	—	6 7 0
do. Def.	1½	1½	22	—	6 14 10
Chile Telephone	8	8	9½	+1	4 6 6
Cuba Sub. Ord.	7	7	9⅜	—	*7 3 7
Eastern Extension	8	8	15⅝	—	5 1 7
Eastern Tel. Ord.	8	8	159½	—	*5 0 4
Globe Tel. and T. Ord.	7	—	14⅜	—	*4 15 0
do. do. Pref.	6	6	10	—	6 0 0
Great Northern Tel.	24	22	37xd	—	5 19 0
Indo-European	13	—	49½	—	6 5 1
Marconi	15	—	3⅜	—	4 17 10
Oriental Telephone Ord.	10	—	4¾	+ ⅜	2 5 9
United R. Plate Tel.	8	8	7⅞xd	—	*5 10 5
West India and Panama	6d.	9d.	1⅛	—	*3 6 8
Western Telegraph	8	8	15⅞xd	—	*5 0 10
Home Rails.					
Central London Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	1	1	22½	—	4 10 0
do. District	Nil	Nil	18½	+ ½	Nil
Underground Electric Ordinary	Nil	Nil	2½	+ ⅜	Nil
do. do. "A"	Nil	Nil	5/6	+6d.	Nil
do. do. Income	6	4	80½	+3	*4 19 5
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4¾	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3	—	—
do. do. 2nd Pref.	5½	—	2½	—	—
do. do. 5 Deb.	5	5	63	—	7 18 10
Brazil Tractions	—	—	43	—	—
Bombay Electric Pref.	6	6	9¼	—	6 6 4
British Columbia Elec. Rly. Ptce.	5	5	62½	—	8 0 0
do. do. Preferred	Nil	Nil	47½	—	Nil
do. do. Deferred	Nil	Nil	40	—	Nil
do. do. Deb.	4½	4½	63	—	6 15 0
Mexico Trams 5 per cent. Bonds	Nil	Nil	45½	+1½	Nil
do. 6 per cent. Bonds	Nil	Nil	36½	+2	Nil
Mexican Light Common	Nil	Nil	22	+1	Nil
do. Pref.	Nil	Nil	82½	+3¾	Nil
do. 1st Bonds	Nil	Nil	47	+3	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅜	—	4 9 0
British Aluminium Ord.	10	10	1¼	—	5 18 6
British Insulated Ord.	20	20	1⅞xd	—	5 6 8
British Westinghouse Pref.	7½	7½	2⅜	—	5 14 3
Callenders	20	—	18½	+ ½	5 8 1
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	3⅞	—	5 16 0
Edison-Swan, fully paid	—	—	3⅜	—	Nil
do. do. 4 per cent. Deb.	4	4	74½xd	—	5 7 5
Electric Construction	7½	10	1⅞	— ⅛	7 12 4
Gen. Elec. Pref.	6	6	10½xd	+ ⅛	5 14 3
do. Ord.	10	10	25¼	+1½	*3 18 6
Henley	25	25	21¼	—	5 17 8
do. 4½ Pref.	4½	4½	3⅜	—	5 12 2
India-Rubber	10	10	16⅛xd	—	*6 4 0
Telegraph Con.	20	20	42½	—	*5 13 0

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, July 3rd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£80	..
a Ammonia, Muriate (large crystal)	"	£75	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£48	..
a Copper Sulphate	"	£65	£2 10/- dec
a Potash, Chlorate	per lb.	2/6	..
a " Perchlorate	"	2/-	..
a Shellac	per cwt.	£17 5/-	10/- inc.
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	"	£35	..
a " Lump	"	£25	..
a Soda, Chlorate	per lb.	1/1	..
a " Crystals	per ton	170/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c " Tubes (solid drawn)	"	..	..
c " Wire, basis	"	..	..
c Copper Tubes (solid drawn)	"	1/7 to 1/7½	..
g " Bars (best selected)	per ton	£147	..
g " Sheet	"	£147	..
g " Rod	"	£147	..
d " (Electrolytic) Bars	"	£125	..
d " " Sheets	"	£152	..
d " " Wire Rods	"	£138	..
d " " H.C. Wire	per lb.	1/4	..
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/6	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	3/0⅜	¼ dec.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£37	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	6d. to 8/-	..
e " " " medium	"	8/6 to 6/-	..
e " " " large	"	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/6⅜	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	..	..
n " Wire, Nos. 1 to 16	per lb.	4/6	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Electric Power and Commercial Heating. — The immense amount of coal consumed under very inefficient conditions for domestic purposes, and the resulting pollution of the atmosphere, involve the nation in heavy cost and enormous waste of natural resources, and yet received but scant attention in the report of the Sub-Committee on the Conservation of Coal. Impressed with the importance of this subject, Mr. W. M. Selvey, the well-known Sheffield expert, has devised a scheme by which he aims to bring about reform in this respect. In a pamphlet, issued in March last, describing the method which he advocates, he points out that under the best conditions attainable about 70 per cent. of the heat supplied to steam turbines will always be rejected at a low temperature. Calling the rejected heat "low-grade heat," and the heat available in the form of mechanical work "high-grade heat," he states that industries, as a whole, require both kinds, whilst for domestic purposes only low-grade heat is used. Yet while the power stations produce both kinds, they only supply the former.

With a 12-in. pipe properly lagged, water at a maximum temperature of 160° F., moving at 3 ft. per second, can be transmitted four miles, with a loss of only 13 per cent. Delivered at 140 to 120° F., this hot water would serve for the heating of all communal types of buildings, and for all cleansing purposes, and could be economically re-heated to boiling point by electricity. Heating water from 50° F. by electricity cannot compete with heating by combustion, obviously because high-grade heat takes as much fuel to develop its 30 per cent. as low-grade heat takes to develop the whole 100 per cent.; if the 30 per cent. is reduced to, say, 22—25 per cent., in order to make the bulk, or as much as necessary, of the 70 per cent. available, there is no justification for a separate scheme for each. Mr. Selvey, therefore, proposes "combined high-grade and low-grade heat stations," manufacturing low-grade heat by means of "bleeder" turbines (tapping the steam at such a vacuum as corresponds to the hot-water temperature required).

Various methods of carrying out the scheme are mentioned, and it is proposed to distribute the hot water at a considerable pressure through mains, preferably in subways. The water not used would be returned and kept in circulation; that consumed would be equivalent to what is now drawn from the ordinary town main service. The essential feature of the system is the electrically-driven water-pressure station, which is obviously a sub-station; only with a system of pressure distribution and collection does such a scheme offer favourable prospects. Figures are given in the pamphlet, with a plan of the system, showing how it might be carried out.

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THE ELECTRICAL TRADES AFTER THE WAR.

Report of the Departmental Committee.

Section III.—Manufacturing.

(*Concluded from page* 608.)

Great emphasis has been laid on the unfavourable conditions of railway and steamship transport in this country as compared with those in Germany, where very low export rates are quoted direct from the factory in Central Europe to destination in Great Britain, her Dominions, or other countries.

It is the practice of the German Railway Administration to foster by every means in its power the full loading of all trucks forming its trains, special reduced rates being granted for lots of 10 tons and upwards. Much of the carriage in Central Europe has, as a result, passed into the hands of the forwarding and collecting agents who occupy so prominent a place in the business life of those countries. By combining individual parcels so as to form 10-ton loads, by playing off the railways against waterways, by bargaining with steamship owners, and by other methods available when large quantities are handled, the German agents can quote to any part of the world, through rates considerably lower than those which the unassisted British consignor is obliged to pay, even when a so-called through rate is obtainable. Further concessions in rates are granted by the Railway Administration in Germany on all goods destined for export.

British railways claim to give equal rates to all who bring equal traffic, and they are ready to arrange special rates with anyone having large quantities of goods for conveyance between specified stations. A German forwarding agent, acting for many manufacturers, has a large quantity of traffic to offer to the British railway company at port of arrival, in lots more convenient to the railway company for handling than is the case with any individual British manufacturer. He can therefore make use of the railway companies' most favourable rates, and especially of those from import dock stations to destinations inland. Although these rates may not theoretically be preferential rates, they are so in reality, for a reduced rate on goods, say from Hull Docks to Liverpool, although open to everyone, is of no practical use to any British manufacturer, and thus constitutes a substantial preference in favour of foreign goods.

In regard to maritime transport, the case is even more unfavourable to the British manufacturer. The existence of agreements between shipping companies by which rates of freight are maintained to South Africa, Australia, and elsewhere, is well known, and these are rigidly enforced against British shippers. Such agreements do not seem to be so scrupulously kept in Germany, for more advantageous terms are often conceded to shippers at Hamburg, Bremen, and Antwerp. Witnesses have stated that at times it has been cheaper to ship from Great Britain to Hamburg, and there tranship to the outward-bound steamer, than to load in this country into a vessel going direct to the same port of discharge. Specific instances have been cited where this difference in freight represented a large sum to the detriment of the British manufacturer.

The Committee considers that the preference so afforded calls for immediate correction. It is of opinion that no railway rates on imported goods should be less per mile than the standard rate charged for similar British goods, and recommends that it be made impossible for any steamship, whether British or foreign, which makes use of British ports, to charge lower rates to foreigners than are made to British shippers for equal distances.

Attention has been called to the unsatisfactory position of canals and waterways in this country as compared with those in Germany and elsewhere abroad. The Committee directs attention to the report and recommendations made by the Royal Commission on Canals, and urges that greater use be made of inland water transport. The inadequate facilities for handling cargo at many of our ports should be remedied.

A better understanding between employers and employed is essential if the country is to take advantage of the business which will undoubtedly be forthcoming after the war.

The Committee was asked to prepare an interim report regarding measures against enemy trade to be adopted on the conclusion of peace. This interim report was submitted on October 11th, 1916, and is set out in an Appendix. Evidence since received has strengthened the Committee in its opinion that even more stringent means should be taken to restrict, after the war, the importation of such manufactures as can be made in British factories.

To summarise:—The advantages possessed by the German industry, none of which had its counterpart in this country, were the absence of detrimental legislation, the coincidence of industrial development with the advent of applied electricity and its earlier use in the home market, protection by import duties, State influence exerted on official departments to buy within the country, concentration of control and organisation in the hands of powerful corporations, effective standardisation, a favourable system of financial and governmental support, and preferential shipping and railway rates.

The evidence leads the Committee to the following conclusions:—

1. That the earnings of electrical manufacturing concerns have been insufficient, in most instances, to attract capital for development.
2. That electricity has not been used in this country to the same proportionate extent as in Germany or America.
3. That the necessity of retaining the home markets as a basis of overseas trade has never been properly recognised in this country.
4. That our fiscal system has in the past operated adversely to our manufacturers.
5. That the dependence of manufacturing upon finance has not been generally appreciated, and, in contrast with German practice, British financiers, when providing funds for enterprises, have not been accustomed to impose conditions ensuring the use of British-made goods for original equipment, extensions, and renewals.
6. That the Government and public of this country have been unduly influenced by the fear that combination or association might result in enhanced prices, and have lost sight of the advantages attending combination or association—such as reduced cost by producing in large quantity in standard patterns, and the united front which can be presented in competing abroad against foreign manufactures.
7. That in Great Britain the facilities for cargo handling and transport, including carriage by canals and waterways, compare unfavourably with those of Germany and America.
8. That a better understanding between employers and employed, and better working and housing conditions are essential.
9. That after the war a large increase in every branch of electrical industry at home and abroad may confidently be expected, and that measures on the lines indicated in this report should be taken to secure the business for British manufacturers.

Section IV.—Financial: Interdependence Between Manufacture and Finance.

The Committee was asked to submit an interim report on the questions of banking and finance, as they affected the electrical industry in all its departments. This appears as an appendix to the report.

While every industry requires for its development the outlay of new capital, that of electrical manufacturing is perhaps more dependent than any other on the help of a powerful financial system. The major part of its activity is connected with enterprises involving heavy expenditure which may not become immediately remunerative, and the concessionaire, inventor, contractor, or manufacturer must, therefore, for such projects as the construction of a new electric railway, the electrification of an existing line, the introduction of new processes and apparatus, or the equipment or extension of a generating or transmission system, have facilities for recourse to financial organisations prepared to stand a temporary capital lock up of considerable magnitude.

In Great Britain such facilities do not exist in an adequate degree, . . . there has never been created any organised co-operation between her finance and her manufacture. So far as British joint stock banks are concerned, their liabilities to the public, large as compared with their capital, forbid their lending, except with a safe margin on security readily realisable. Obviously it is outside the province of such institutions to provide money for an enterprise, whether at home or abroad, involving a heavy and possibly a long immobilisation of funds, no matter what its prospects may be, or however great the employment it may provide for British industry. That this principle is sound does not admit of doubt, for notwithstanding many recurring periods of industrial depression no financial crisis has occurred in this country for many years.

In default of assistance from the banks help must be sought from other great financial institutions whose immense aggregate wealth could, by organised co-operation, easily enable them to handle propositions too large for any of them individually, but such organisation has been wanting. The usual practice of our financiers being to place the enterprise with the public through the Stock Exchange, limiting themselves to the function of underwriters, they naturally tend to confine themselves to projects likely to be attractive in the near future, looking askance on those involving any lengthened lock up. Such enterprises, usually the most important from the national or Imperial point of view, often either miss fire altogether, or, as the only alternative, fall into the arms of banks abroad who lay themselves out for such business.

The British manufacturer suffers from another disability. He might naturally expect that when the aid of British capital is obtained, the orders for the plant purchased with it would be placed at home. But, paradoxical as it may seem, he is often baulked of his hopes through the very fact that London is the financial centre of the world and has attracted to it so many foreigners as to have created an atmosphere more cosmopolitan than national. The British financier has not only lost any sense of obligation to apply British capital for the benefit of British industry, but has allowed his activities, whether as a capitalist or a company promoter, to be constantly exploited in the interests of German industry.

In Germany the conditions are totally different. There, a thoroughly organised alliance, offensive and defensive, has been elaborated between manufacture and finance. Banks and manufacturing concerns have common directors, and on the boards of both there sit technical and commercial experts. The banks link themselves together to provide facilities for industrial expansion, and co-operate with each other and with the great manufacturers in forming subsidiary banks and financial institutions for special purposes. The German financiers do not, at the start, attempt to place an enterprise on the market as is the practice in England. Guided always by expert advice they seldom touch a project in itself unsound. They find the money themselves or through their allied groups and, not afraid of the lock up, wait till success is shown before they unload on the public.

An important instrument in the development of the system of so-called "peaceful penetration" has been the Schimmelpfeng Institute, a commercial intelligence agency with branches in all the principal business centres of the world, which has supplied detailed information regarding business firms to its head office in Berlin, and has practically acted as a spy system for the benefit of German industry. The Board of Trade has made an order to wind up the business of the Schimmelpfeng Institute in this country.

By these means, and by agreements with foreign concerns, the German manufacturers have secured a commanding in-

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fluence in the electrical business in the neighbouring countries, notably in Russia, Italy, Belgium and Switzerland, and if measures are not taken in time this penetration will certainly continue to progress everywhere after the war. The great German concerns have large funds available for this purpose.

The attention of the Committee has been drawn to the balance sheets for the year 1915 of the A.E.G., the Siemens-Schückert Co., and the Bergmann Co., which show cash balances of 6½, 2½ and 1½ millions sterling, respectively. This accumulation of funds is recognised as ready and available for peace products, and the fact emphasises the necessity for financial assistance being at the disposal of British manufacturers who, owing to excess profits duty and other taxation, find great difficulty in making provision for trade after the war.

That which has been done in the past by German financial institutions and recently by French and American syndicates or industrial banks could undoubtedly be achieved by one or more British financial institutions specially concerned with engineering enterprise.

Mr. Runciman gave practical effect to his opinion by arranging for Government assistance in the creation of a bank designed to aid in the commercial and industrial development of Italy. The Committee is strongly of opinion that the establishment of industrial banks is essential not only for the purposes mentioned in the interim report but in order to provide capital both for the reorganisation and expansion of the engineering industry. Such institutions assisted by the advice of expert assessors would help to protect the public against unsound speculative ventures and would exercise a profound influence in placing industrial enterprise on a stronger financial basis.

SECTION V.—IMPERIAL CONTROL OF SOURCES OF ELECTRICAL ENERGY.

Striking evidence has been submitted of the manner in which German or American control has been secured in existing companies in the British dominions and possessions. The committee is impressed with the necessity for legislation, enacting that a company registered in Great Britain or its Dominions should, unless otherwise clearly expressed, be really British, and that no control, direct or indirect, should be exercised otherwise than by British subjects. Companies of foreign origin or under foreign control should be clearly indicated as such. It is suggested that in particular India and the self-governing dominions should take stock of their facilities for generating electricity, whether from water-power, coal, oil, or other sources of energy, and should appreciate their permanent and ever-increasing importance to the Empire. The Canadian Government has already taken an active part in broad questions of this kind, more especially in connection with the water-power available from the St. Lawrence river.

The committee urges that electrical supply ought to be considered as a matter of Imperial importance upon which other manufacturing trades, all forms of railway traction, munition works, the production of fertilisers and other aids to agriculture will largely depend, and that the Empire's available resources for this purpose should not be allowed to pass into alien hands or under alien control. The same considerations apply to the conservation of natural products and raw materials essential to our electrical manufacturing industries.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Instruments for Central-Station Switchboards.

With reference to the article by Mr. G. W. Stubbings in the ELECTRICAL REVIEW of June 14th, many of his statements appear to be incorrect and to require some counter-balancing.

Feeder Ammeters.—Cheapness must not be the ruling feature; robustness is of primary importance. The instrument should not go out of action the first time it has to withstand a short. So many ammeters fail and are useless for this reason. The moving-iron pattern appears to be most likely to stand up to shorts, as the forces do not go up proportionately, seeing that long before this point is reached the iron is saturated. Really good British moving-iron ammeters can now be obtained that are an ornament to any board, and are as good inside as they look. Such will read a low percentage of full-load current, are excellently damped, and will stand repeated applications of 50 times full load for say ½ second without appreciable zero shift, and with no permanent damage whatsoever.

Integrating Wattmeters.—The writer thoroughly agrees that reliable and accurate watt-hour meters for main switchboards of generators are essential; otherwise how can the cost per unit be obtained? Many cases have come to the writer's knowledge in which all other instruments were provided, but not integrating meters, or if provided, they have perhaps not been checked or examined for ten years, and the cost-per-unit figure is in consequence little better than guesswork. The writer takes strong exception to Mr. Stubbings's remarks as regards the type of watt-hour meter to be used, Mr. Stubbings having placed the Aron clock type first, and the remainder merely "also rans." Brake magnets are not such terrible things as they are made out to be, and surely, if any degree of accuracy is required, integrating instruments, whatever their type, of any importance should be calibrated at least once per annum, when any deterioration of the brake magnets is at once apparent. As a matter of fact the occasional weakening of the brake magnet has a tendency to counteract the effect of dust and wear, etc., on the meter. The writer has experienced many magnets which have not shown 1 per cent. deterioration in five years, some less than 1 per cent. in ten years. Generally speaking, the magnets, *if* they do age, settle down to a fairly permanent value at the end of the first three years, and much of this change has been due to war conditions and the difficulty of obtaining material and of keeping them long enough in stock before using them.

For D.C. work, the mercury type of watt-hour meter, particularly for large powers, is, in the writer's opinion, by far the best on the market. The Aron meter, with its multitudinous parts, to give reasonably accurate results must be periodically removed for complete overhaul and cleaning of clockwork by a real expert. Even then the shunted type, as used in such cases in which the pendulums act as the current element, necessitating large shunt drops—generally .2 V.—and many connections and contacts in the shunted current circuit, has been proved by a very complete and careful series of tests recently carried out to *lack* a reasonable degree of *consistency* in registration, which, in a pair or more of meters in series, is essential to give a consumer or engineer confidence in their accuracy. These tests, which lasted over many weeks, showed that two exactly similar Aron meters, specially built to run together, when tested under the same conditions *with every precaution*, would vary against each other by over 2 per cent. from day to day, whereas a pair of mercury watt-hour meters tested at the same time did not show more than one-tenth of this divergence.

With reference to three-phase work and the suggested use of two single-phase meters, this the writer strongly condemns, and the only alternative to the two-wattmeter-element meter is three single-phase meters with pressures connected to neutral, or a triple-element meter in which the elements are quite distinct and preferably each has its own disk.

A well-made induction meter is a most simple and reliable instrument, and where an extremely high degree of accuracy is required, it can be obtained on this pattern with some detail modifications. The writer has seen figures showing that several pairs of meters so modified have run day after day at various loads with no greater divergence than 1 in 2,000, and a maintenance of their original accuracy over months better than 1 in 1,000. The complicated clockwork of the Aron meter does not, admittedly, permit of anything approaching this sustained high accuracy.

Another point which tells heavily against the Aron meter for D.C. or A.C. is the question of routine testing *in situ*. The Aron meter does *not* lend itself to fairly easy and accurate testing, and it needs it as much as and probably much more than other types.

It appears, therefore, that Mr. Stubbings's advocacy of Aron meters for all and every supply is scarcely justified, and that he is very unduly biased in its favour. The writer is led to believe that there are several engineers about the country who would give favourable consideration to moderate offers for various Aron meters for which they have no further use.

However, the phrase, "usually it is possible in modern central stations to keep the power factor of the system in the neighbourhood of unity," is perhaps the special tit-bit of the article.

June 26th, 1918. **A.M.I.E.E.**

Books for Prisoners of War.

I venture to appeal through your columns on behalf of the British Prisoners of War Book Scheme (educational). The principle of our work is to send out to British prisoners educational books of all grades and kinds in response to and suited to the capacities of individual applications. Among such demands there are naturally a large number of requests for scientific and technical works, and, in particular, for books on electrical theory and engineering practice from the most elementary manuals to the latest and most advanced treatises.

Our appeal, therefore, is especially for donations, either of books or of money, to enable us to continue to meet these requests.

In view of the probable considerable development in the near future of the use of electricity in many spheres, notably as motive power in factories, and of the creation of large central stations for such purposes, and of hydro-electric undertakings, it is clearly to the interest, not merely of individual firms, but of the engineering industries of the country as a whole that every encouragement should be given to such prisoners as are anxious to begin or to extend their studies of these subjects.

Apart, of course, from this commercial side of the question, there is the other, the humanitarian and psychological side, of providing for active intellects congenial occupation as a distraction from the circumstances of prison camp existence. The value of this is not a matter of imagination but of frequent confirmation by the prisoners themselves.

Your readers will appreciate the importance of all books

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they can offer being up to date. The demand for books will continue and almost certainly increase owing to the number of prisoners that have been taken in the recent fighting.

Donations of books or money should be addressed to me at the Victoria and Albert Museum, South Kensington, S.W.7, and marked "Prisoners of War."

Alfred T. Davies,
Hon. Director.

London, S.W., *June 26th*, 1918.

National Electric Power Supply.

The time at the disposal of the members of the I.M.E.A. at the meeting in Manchester last week was obviously quite insufficient for a discusion of this matter in all its aspects, and I desire to seek the indulgence of your columns at some length, as I feel that a subject which is of such supreme importance cannot be too freely ventilated.

Reverting to the Manchester discussion, two points were prominently brought out: (1) that there is an economical limit to the size of power stations; (2) that overhead lines in this country are not desirable. These considerations are bound to have an important bearing on the financial aspect of the proposals.

Now as to the parrot-cry of "cheap electricity"; it is fortunate that the reports of the departmental committees of the Board of Trade in regard to our staple industries have been issued in synchronism with the power supply report, as they throw an interesting light on the requirements of such industries to meet the after-war conditions.

In the report on the engineering trades we find the following:—

1. *British Outlook.*—"From the point of view of this country, if not only peace, but cordial relations, between capital and labour be established, if restriction of output can be abolished, if raw materials can be obtained at reasonable prices, and the plants of the engineering trade worked to their full economic capacity, we see no reason to doubt that it should be possible to maintain wages at a high level, to maintain the present hours, and yet to produce an increased output at a lower price than heretofore."

2. *Neutral Countries.*—"No heroic measures are required. It is merely a question of constant attention to business, great care in manufacture, and prompt delivery. We have already referred to the assistance he needs by the proper extension of credit. Given this and due diplomatic support we think the British manufacturer can be relied upon to put up a good fight in competition in neutral markets."

3. *Freight Combines and Rates.*—"That British traders have rates for shipping goods at any United Kingdom port not higher than those at any North Sea or Channel port. That special facilities be given by railway and shipping companies on trade for export."

Then in the report on the iron and steel trades we read: "The fundamental thing is to gain control of large deposits of iron ore as far as possible within the Empire. To develop these resources large sums must be expended, not only in the working of the mines, but also for the construction of railways, the building of special ships for the transportation of ore, of large docks and discharging and loading appliances."

Supplementary to this we are told as follows: "One thing is certain. No industrial reconstruction involving heavy expenditure can be undertaken unless during the period of growth at least the industry thus reborn can be protected from the external attacks of full-grown competition, whose one object will be to maim and cripple a new British iron and steel industry."

The following dissension by a member of the committee to the principles which the latter paragraph enunciates is noteworthy, and applies with equal force to the "State aid" proposals for power supply: "I specially deprecate using the funds of the taxpayer for the purpose of private enterprise under any circumstances, and all the more when in all probability this will involve heavy depreciation of capital values.'"

In the same report the following important statements occur:—

Means of Transport.—"The evidence of many witnesses has brought prominently to the notice of the Iron and Steel Industries Committee the great advantage in world competition which is conferred upon foreign competitors by the possession of cheap and efficient means of transport, both of raw material and of manufactured goods. Cheapness of internal transport often outweighs serious disadvantages of geographical position."

Railways.—"Internal transport in the United Kingdom is almost wholly in the hands of the railway companies, and the carriage charges of these companies have an influence upon the cost of raw material as well as upon the selling price of the finished product. A comparison of railway rates upon iron and steel products and the materials used in their manufacture proves that British railways charge much more heavily than railways in the U.S.A. and Germany, as may be seen clearly from the appended statistics, page 40."

"The Committee consider that, as the railways are holders of monopolies granted by the State, and as their service is of a national character, they should be regulated by the State to the utmost advantage of industry, provided that their shareholders are guaranteed a return upon capital invested."

Coming to the report on the textile trades, the importance of the Manchester district in regard to the cotton trade is emphasised as being due to various national advantages, including "an abundance of cheap coal."

In reference to production after the war, it is stated: "We must, however, in the main rely upon continuous improvements in our methods of production—the drastic scrapping of out-of-date plant and the adoption wherever possible of labour-saving machinery, the organisation of our industries with a view to the highest collective, as well as individual, efficiency, production on a large scale and combined selling in such industries as admit of them, efficiency of management in all branches, higher and more widespread commercial and technical education, and, perhaps most important of all, high efficiency of labour, so as to attain the maximum output both in quantity and quality. High wages must be accompanied by high output."

In a later paragraph the following occurs: "We find that electricity is not very largely used for driving textile machinery. This may be due to the relatively high cost of current, owing to the absence of large central power stations in the industrial districts. We consider that the establishment of such central power stations producing current from large generating units with a maximum of economy might prove of great advantage to some of the textile industries."

Notice the qualification "might prove of great advantage to some . . ."

The reason for this is not far to seek, and indeed is contained in a former paragraph in the report as follows: "We notice that electric power is very little used in Lancashire for driving textile machinery. Whether this is due to the absence of large central power stations in the industrial districts, or to the cheapness of coal and the relatively small part the cost of motive power plays in the total cost of production, we are not prepared to say."

Now the above quotations are in striking comparison with the conclusion of the Electric Power Supply Committee, wherein they state that: "A highly important element in reducing manufacturing costs will be the general extension of the use of electric power supplied at the lowest possible price, and it is by largely increasing the amount of power used in the industry that the average output per head, and, as a consequence, the wages of the worker, can be raised."

The only reference to electric power in all the departmental reports is in connection with the textile trades, as quoted above. Therefore in regard to existing trades it has not been, and could not be, proved that the price of electricity has hindered our industrial concerns.

Apart from the extracts quoted above, many other matters are dealt with in the reports, which clearly indicate that it is not cheaper electricity, but other more vital questions which are life and death to the industries.

Certain new industries which relatively require large amounts of power may be established in the future, and I am certain that their requirements would have been met had such industries been proposed in the past, as adequately as they can be met in the future without the drastic proposals contained in the report.

Coming to the question of the financial proposals, there is no doubt that State aid must be invoked if the intentions of the Committee of substantially reducing the present charges for electricity are realised.

The framers of the E.P.S. report appear to imagine that theirs would be the only claim upon the State funds, but in all the reports referred to above, State aid for some purpose is recommended.

The following from the textile trades report will be sufficient: "Almost complete unanimity is expressed that the dye-producing industry should be fostered by State assistance in order to render the cotton trade independent of external sources of supply."

In addition to these claims, the cost of the war will be more than we care to think about, and the claims of education and housing will be very pressing, so that unless the power schemes can be proved to be financially sound without State aid they should be ruled out.

After all, State aid amounts to greed and selfishness, for the folk who will ultimately benefit will be the shareholders of the industrial concerns who use the subsidised power supply.

The E.P.S. report definitely states "that there should not be restrictions in regard to ownership or the setting-up of private installations." Obviously, therefore, industrial concerns will not take the national supply because it is a national supply, but because it suits their pocket better to do so.

Consequently if it is imperative that the power supply which is only a small percentage of the total costs of an industrial concern be subsidised by the State, how much more imperative must it be that the other factors in the cost be subsidised, or, to take the argument to its logical conclusion, all industries should be nationalised.

Briefly, then, (1) no case has been made out for a substantially cheaper supply of electricity than at present exists; (2) no case has been made out that such cheaper supply can be produced without State aid, and (3) no case has been made out that electricity should have a paramount claim for State aid.

Despite these defects in the E.P.S. report, the recommendation in regard to the new body of Electricity Commissioners

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is excellent, provided a suitable selection is made, and that properly defined and not unlimited powers are conferred upon them.

The proposed district boards may be a compromise, and a good idea, but why not give extended powers to existing authorities or confer powers upon County Councils? The latter have excellent opportunities of knowing the requirements and resources of their areas, together with means of raising the necessary capital. Existing authorities or County Councils or both in co-operation, if endowed with the powers and privileges which are proposed for the district boards, would, without doubt, be able to effect the desired conservation of coal, and provide any extended supply required with an equal conservation of capital, and without despoiling municipalities and others of that which they have toiled long and patiently to attain.

There are other points which space forbids me from touching upon, but I trust the foregoing will help to counteract some of the exaggerated claims and statements put forward in connection with this very debatable subject.

Fredk. W. Purse,
City Electrical Engineer.

Carlisle, *June 27th*, 1918.

A Question of Competition.

Permit me to thank you for the publicity given to my letter of May 31st on the above matter. Owing to Mr. Tate's letter appearing in this week's REVIEW, it is necessary for me to point out that although I had sufficient evidence, I thought it better to have an interview with the electrical engineer and manager of the supply company and point out the consequences of the statements complained of continuing; he having admitted one of my complaints to be justifiable and giving an undertaking that the matter would not occur again, I did not trouble the solicitors of the Contractors' Association, but would like to say how promptly they brought the matter forward.

The question of competition remains; the gentleman mentioned above remarked that they have the Parliamentary powers to do contracting and contractors are not wanted in this district. What an ideal balance sheet this concern would have if their engineer's ambitions were realised. It is to be hoped that these extraordinary powers given to private companies will be withdrawn when the new supply scheme materialises.

Watson, Marsh & Co. (Brondesbury), Ltd.
M. COHEN, *Director.*

London, N.W., *July 1st*, 1918.

Trade Associations.

Your leader in to-day's issue is most interesting, and I see in your "Correspondence" columns that the number of associations is legion; but I wonder how many of your readers remember the first electrical association formed in this country on December 14th, 1881?

Can you, Sirs, help me to find the minute book which was kept by the secretaries, in turn, of the companies at whose offices the meetings were held?

I remember that Brush, Edison, Maxim Weston, Siemens and Swan were members of the association; and some good was done by these firms at a time when cutting each other's throats was the order of the day; but, when Gooch took up the Westminster Aquarium Exhibition, certain parties found ways of getting agents to do that which members had agreed should *not* be done; and the association fell to pieces about 35 years ago.

Some of us were younger then, and many of us were not yet born. Are we any better?

W. H. M.

June 28th, 1918.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

9,915. "Electric switches." C. C. GARRARD, A. H. RAILING & A. F. SEARLE. June 17th.

9,916. "Electric contact devices." J. BEIN. June 17th.

9,918. "Electric ignition plugs." C. B. HURST & J. McBROOM. June 17th.

9,938. "High-tension magneto-electric machines." G. BULLOCK. June 17th.

9,943. "Electric circuit breakers." BRITISH THOMSON-HOUSTON CO. (General Electric Co.). June 17th.

9,959. "Electric ignition apparatus." AKT. GES. BROWN, BOVERI ET CIE. June 17th. (Germany, June 16th, 1917.)

9,965. "Electric traction." H. M. E. MATHE. June 17th.

9,973. "Signalling systems." W. PRIOR. June 17th.

9,976. "Electric condensers." PHILIPS-BRINTON CO. June 17th. (United States, July 20th, 1917.)

9,978. "Searchlights, &c." W. PRIOR. June 17th.

9,980. "Lock-out switches." IGRANIC ELECTRIC CO. (Barnum & Date.) June 17th.

10,007. "Continuous electro-magnetic wave synchronisers." N. LEA. June 18th.

10,025. "Apparatus for concentration of electric waves in a single direction or upon a fixed point." E. BINETTI & L. ROTA. June 18th.

10,031. "Electric storage batteries or accumulators." W. PETO. June 18th.

10,033. "Recording-machines for wireless, &c., telegraphs." E. J. MEAD. June 18th.

10,037. "Electrical service installations." A. GUASTAVINO & E. SIGNORINI. June 18th.

10,049. "Reverse current electric devices of the Weatstone relay type." E. B. WEDMORE & BRITISH THOMSON-HOUSTON CO. June 18th.

10,059. "Electrodes for electric arc welding." E. LANGUEPIN. June 18th.

10,075. "Electric transformer arrangements for producing two-phase current from three-phase supply or vice versa." J. BIBBY. June 18th.

10,081. "Electrical oil switches." FERGUSON, PAILIN & CO., S. FERGUSON & G. PAILIN. June 19th.

10,099. "Telegraph systems." AUTOMATIC TELEPHONE MANUFACTURING CO., H. H. HARRISON & S. R. SMITH. June 19th.

10,104. "Differential electric relays." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. June 19th. (United States, June 19th, 1917.)

10,105. "Electric welding." H. D. MORTON. June 19th.

10,108. "Automatic telephone exchange systems." WESTERN ELECTRIC CO. LTD. (Western Electric Co.). June 19th.

10,119. "Electric reactances." BRITISH THOMSON-HOUSTON CO. & E. B. WEDMORE. June 19th.

10,120. "Electric motor-control systems." BRITISH THOMSON-HOUSTON CO. (General Electric Co.) June 19th.

10,126. "Dynamo-electric machines." A. B. FIELD & VICKERS, LTD. June 19th.

10,131. "Electric steam-generators." A. BOLDORONI & F. REVEL. June 19th.

10,160. "Electric switches." S. FERGUSON, FERGUSON, PAILIN & CO. & G. PAILIN. June 20th.

10,183. "Electric furnaces." A. E. WHITE (Industrial Electric Furance Co.). June 20th.

10,187. "Battery electrode made up of tapering cellular elements." C. ZORZI. June 20th. (Italy, October 9th, 1916.)

10,188. Electro-mechanical arrangement for distant working of searchlights, &c." G. REBORA. June 20th.

10,201. "Multiple-filament electric incandescent lamps." BRITISH THOMSON-HOUSTON CO. (General Electric Co.). June 20th.

10,203. "Searchlights." G. McCULLOCK. June 20th.

10,205. "Electrolytic cells." H. C. JENKINS, East Stratford Works. June 20th.

10,212. "Electric transformers." J. R. BEARD, ELECTRICAL IMPROVEMENTS, LTD., & S. A. STIGNANT. June 20th.

10,229. "Electric motor control and switch gear." E. SCHATTNER & J. R. WALTON. June 21st.

10,256. "Systems of electric power transmission." BRITISH THOMSON-HOUSTON CO. (General Electric Co.). June 21st.

10,286. "Generators of electrical oscillations." E. MURPHY. June 21st.

10,289, 10,290. "Ionic relays." E. W. JORDAN & W. H. ECCLES. June 21st.

10,306. "Electric signalling systems for use in mines, &c." AUTOMATIC TELEPHONE MANUFACTURING CO. & C. REMINGTON. June 22nd.

10,309. "Director for X-ray of normal incidence." G. C. CAMPION. June 22nd.

10,349. "Electric condensers." W. H. GOODMAN. June 22nd.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

7,230. SYSTEMS FOR TELEGRAPHIC AND TELEPHONIC COMMUNICATIONS. J. H. Claus. May 20th, 1916. (116,107.)

1917.

7,034. MAGNETO-IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. Akt. Ges. Brown, Boveri et Cie. May 16th, 1916. (107,000.)

7,487. ELECTRIC CABLES. A. Paxton. May 24th, 1917. (116,122.)

7,563. TIME-ELEMENT ELECTRIC CIRCUIT CONTROLLING DEVICES. Relay Automatic Telephone Co. & L. C. Bygrave. May 25th, 1917. (116,126.)

7,680. MEANS FOR SUPPORTING ELECTRODES IN IONIC TUBES, FOR USE MORE PARTICULARLY IN WIRELESS TELEGRAPHY. Osram-Robertson Lamp Works & F. P. Driver. May 29th, 1917. (116,133.)

7,681. MEANS FOR SUPPORTING ELECTRODES IN IONIC TUBES, FOR USE MORE PARTICULARLY IN WIRELESS TELEGRAPHY. Osram-Robertson Lamp Works & C. H. Harvey. May 29th, 1917. (116,134.)

7,682. MEANS FOR SUPPORTING ELECTRODES IN IONIC TUBES, FOR USE MORE PARTICULARLY IN WIRELESS TELEGRAPHY. Osram-Robertson Lamp Works & O. Durdle. May 29th, 1917. (116,135.)

9,579. ELECTRIC LANTERNS FOR HAND SIGNALLING. S. D. White & H. Burge. July 3rd, 1917. (116,179.)

9,855. SPARK-DISCHARGERS PRODUCING IMPULSE-EXCITATION AND HIGH-FREQUENCY SPARKS. A. Kowalski. July 25th, 1916. (108,309.)

10,335. ELECTRIC HOT PLATES. F. P. Fletcher. July 17th, 1917. (116,183.)

11,457. IGNITION APPARATUS FOR AVIATION ENGINES. Soc. Lorraube Des Anciens Establissements de Dietrich et Cie de Luneville. August 16th, 1916. (109,438.)

12,158. CORD GRIP FOR ELECTRIC LAMP HOLDERS. F. H. R. Neville & J. P. Kavanagh. November 11th, 1916. (111,283.)

1,367. TELEPHONE RECEIVERS. M. S. Conner. September 14th, 1917. (116,201.)

18,731. MEANS FOR COOLING THE COMMUTATORS OF ELECTRICAL MACHINES. E. C. R. Marks (Akt. Ges. Brown, Boveri et Cie). December 17th, 1917. (116,226.)

1918.

1,540. ELECTRIC LAMP HOLDERS. A. P. Rutherford. January 26th, 1918. (116,239.)

1,697. ELECTRICAL IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. Akt. Ges. Brown, Boveri et Cie. February 13th, 1917. (113,784.)

2,592. INTERRUPTER FOR ELECTRIC CIRCUITS. R. Bosch (firm of). February 13th 1918. (Addition to 25,880/11.) (116,242.)

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THE

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NOTICE TO READERS.

In view of the Order recently issued by the Paper Controller, readers are urged to place a definite order with their newsagents for regular supply of the ELECTRICAL REVIEW weekly. In the event of difficulty arising in so doing, a subscription rate order should be forwarded direct to these offices, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4

HEATING AND COOKING BY ELECTRICITY.

WE learn from the *Irish Builder* that in a circular letter to their clients the firm of Messrs. G. N. Haden & Sons, Dublin, say that as some firms recommend the use of electricity for heating and cooking, they take the opportunity of pointing out the waste involved by such a system in these days, when fuel is not only so costly, but is getting more scarce every year. They quote a statement by the chairman of the Dublin Tramway Co. to the effect that by the introduction of new coal-saving devices they were now able to generate 14,309,000 units by the consumption of 21,996 tons of coal. This is equivalent to 650 units per ton of coal, so that out of every 100 tons of coal consumed, only 8 tons can be effectively utilised for heating purposes. Messrs. Haden add that they feel sure that these figures will convince people of the enormous waste involved in heating and cooking by electricity, without going into the further inefficiency by losses in transmission, &c.

On the other hand, it is a significant fact, as shown by Mr. H. C. Hopkins in a paper on "Electric Cooking and Electric Ranges," which he recently read before the N.E.L.A. at Reno, that in spite of the war, with its attendant rise in prices, and the fact that power companies as a whole have not pushed their domestic business, electric range sales have steadily increased throughout the U.S.A. In this country the same phenomenon has taken place, and, in addition to numerous very large installations in the provinces, we can point to the National Kitchens established at Poplar and in New Bridge Street respectively, where public appreciation of their advantages has been manifested by their rapid growth in popularity. The results that have been obtained are all that could be desired, and the success of these establishments is assured. Inspectors from the Ministry of Food, while preferring steam for boiling on the score of economy, cannot speak too highly of the merits of electric cooking, on account of its cleanliness, convenience, uniformity, and other well-known advantages. In particular, they fully endorse the claim that the electric oven effects a material saving in the case of meat, besides retaining the flavour and succulence of the joints in the highest degree.

The advantages and benefits to be derived from the use of electric ranges are numerous; they are sanitary and clean, and the products of combustion—ashes, soot, and fumes—are entirely eliminated, with a resultant saving in labour and cost of house cleaning. Practically all of the heat generated is used efficiently; cooking can be performed with mathematical precision, eliminating guesswork entirely, due to the perfect control and easy regulation of temperature. The time ordinarily spent in watching the cooking of food in a coal or gas range is considerable, and can be saved when cooking is done by electricity. The saving in meat shrinkage is quite considerable, an important feature in these days of food shortage and high costs; and, lastly, the quality of the food cooked is greatly improved, the natural flavours being retained instead of being allowed to escape with the products of combustion.

Statements issued by Messrs. Belling & Co. show that to cook 100 lb. of meat in a coal range requires 100 lb. o

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coal; in a gas range 30 lb. of coal (in the gas works), and in an electric range 25 lb. of coal (in the electricity works). If only half the total amount of roasting and baking done each day were done by electricity, the daily saving would approximate 10,000 tons of coal. With regard to meat saving, they say that every 100 lb. of raw meat cooked in a coal range weighs 86 lb. when done. The same amount cooked by gas weighs 70 lb., and by electricity 90 lb. when finished. If only half the total weight of meat consumed each day were cooked by electricity, the daily saving would be approximately 350 tons of meat.

Then we have the statement set forth in a leaflet distributed by the engineer and manager of the Horsham U.D.C. electricity works to his customers, that cooking for a family of 10 with a coal fire from June, 1915, to June, 1916, consumed $4\frac{3}{4}$ tons of coal, whereas from June, 1916, to June, 1917, cooking by electricity, the coal consumed (at the electricity works) amounted to only $1\frac{3}{4}$ tons, showing a saving of 63 per cent. Similarly in a household of seven persons, the substitution of electric for coal cooking in 1917 resulted in a saving for 12 months of 64 per cent. Other examples showing the saving of meat are also quoted.

The pity of it is that very few people seem to be aware of these astonishing figures, and the vast saving which can actually be effected. Those in the electrical industry do not push electrical cooking forward as they should do, and those outside the industry seem to try to retard it. Why is there not some co-operative movement amongst manufacturers to drive these points home, when it is so obvious to all who are willing to see it that electric cooking effects an enormous saving in coal, labour, and many other ways? While the conditions may not be favourable at the moment for such a movement, at any rate preparations should be made to set it going at the earliest opportunity.

Any device that will add to the safety of the house is commendable. The use of electricity for heating displaces matches and open fires; there is no gas to explode and no flame or flare-up to start fires or to burn the operator. No business man would think for one moment of going back to the old office methods and discarding the use of modern labour-saving devices such as typewriters, billing machines, and adding machines. These devices are considered necessary to the proper and efficient management of one's business. Electricity in domestic service is simply a modern labour-saving device—saving also money, time, and worry—and, therefore, should be considered as part of the modern housekeeper's equipment.

The points cited above, and others which are readily available, should be thoroughly understood by the range-user or prospective user. Any sales campaign or sales effort calculated to promote the use of electric ranges must of necessity be of an educational nature. Unless the advantages of electric cooking are thoroughly understood and appreciated by the customer, the inevitable result is that the user limits his inquiries to a comparison of the cost of operation with that of the fuel previously used for cooking.

The result of such a comparison is not always favourable to the electric range, particularly where the cost of electricity is higher than 1d. under pre-war conditions per KW.-hour. The customer does not think of comparing the cost of his electric light with the cost of gas or oil lamps, simply because he thoroughly understands that he is obtaining a better light and greater convenience than he formerly enjoyed, and this represents to him a definite value in personal comfort and physical well-being.

Raw Materials and Co-operative Buying.

The control exercised by the Ministry of Munitions over establishments producing war materials, while it has perhaps been associated with many drawbacks and unnecessary restrictions, has pointed the way to several much-needed reforms as regards centralisation, distribution, and especially of co-operative buying of raw materials. Whereas, in many trades, under the old competitive system, the staple raw materials were purchased from a great variety of sources, and with very little conformity to standard requirements, the view is becoming more and more confirmed that the policy of approximating the total quantities required and ordering under one head will prove the most economical as regards purchase price, the most equitable as to fair distribution and prevention of manipulation by outside agencies, and the best means of combating the difficulties that will ensue as a result of the world's depletion of stocks and means of conveyance.

The leading German manufacturers have been organising to this end for some considerable time, and not, perhaps, without good reason. The benefits of this system were becoming more thoroughly realised by them a few years before the war broke out; and, according to their showing, the results justified the experiment. They are now, of course, more concerned than ever about the sources of their future supplies of raw materials, and it is possible that for some years after the war, if not permanently, the German Government, or its trade leaders, will carry out the purchasing of the whole of the nation's requirements in imported raw materials.

During the present difficult period this country has furnished several successful examples of this system. The Cotton and Leather Control Boards, among others, have proved of great benefit to their respective trades. So, also, in a larger measure, has the Ministry's later control of the imports and distribution of copper, upon which the electrical industries so largely depend. There may perhaps have been a good deal of mismanagement in this section in the past, but it is conceivable that no private sources of distribution could have enjoyed the same preference as regards supplies, shipment, and finance as that obtained by the influence of a representative head supported by the Government of the nation.

We are not advocating an indefinite continuance of Government control, but rather that the system, wherever it has proved itself of advantage to trade, should be continued in the future under the control of the respective trades' representatives, with the support of the Government behind them.

This, we believe, is a problem of far-reaching importance, the solution of which must not be left to Government officialism, nor even to Parliament itself in its present state as regards the representation of trade. It must be solved, and a satisfactory policy must be determined upon by the nation's business men, who throughout the war have proved themselves the best legislators in matters of trade. We are glad to notice that much is being done by commercial men throughout the country to promote a closer co-ordination of purchasing facilities as regards post-war importation of raw materials.

Nationalisation of Electricity Supply in Germany.

As mentioned in this journal on former occasions, apprehensions have been entertained in electrical circles in Germany for a few years past that the Government might seek to convert the supply of electricity into a State monopoly within a period not remote from the present time, and these fears have become accentuated during the course of the war. All doubts on the question, however, have now been removed, at least in the case of Prussia, by the speech which was delivered by Dr. Sydow, Prussian Minister of Commerce, on the occasion of the celebration of the twenty-fifth anniversary of the formation of the Verband Deutscher Elektrotechniker, at the beginning of last month, at the Technical High School, Charlottenburg. The Minister is reported to have stated that, having regard to the important and successful undertakings of a private economic and municipal kind, and to the considerable financial demands which would be generally made upon the State after the conclusion of the war, the Prussian Government did not propose to exclude such undertakings from the production and distribution of electrical energy, or to limit their development. Dr. Sydow added that the State would only tender a helping hand as occasion arose by the erection of special Government works or by State participation in joint undertakings, where this appeared to be appropriate or desirable on account of the nature of the sources of power at the disposal of the State, or for the supply of parts of the country which were weak from an economic point of view.

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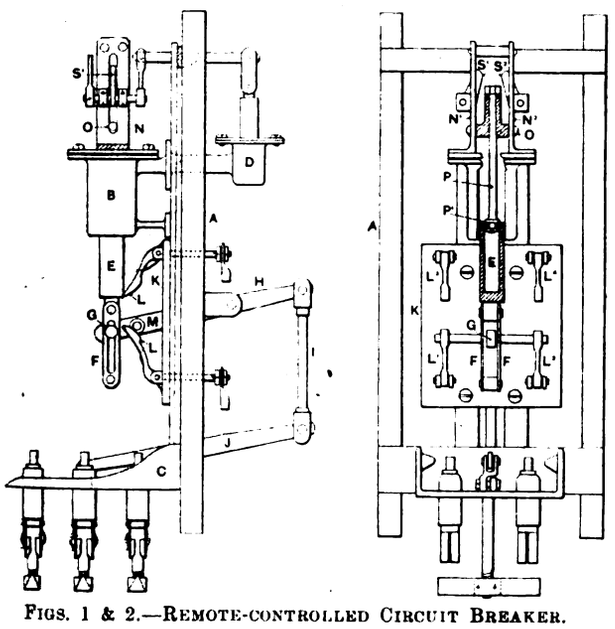
REMOTE CONTROL FOR SQUIRREL-CAGE MOTORS.

BY L. E. WOOD.

THIS article describes the advantages of a remote-control system over the ordinary ones usually met with, and relates solely to squirrel-cage motors. The installation about to be described is that of a bleachery in Canada, consisting of 16 motors ranging from 12 to 25 H.P., and supplied from a three-phase system at 600 volts, 60 cycles.

It may not be generally known that bleacheries rank along with collieries, inasmuch as the plant receives very rough handling and accidents are very liable to happen.

The liability of accidents happening is due principally to the following reasons :—First, the floors of such places are always wet, more often than not in running water ; secondly, the operators in the warmer weather go about bare-footed, so that they are very susceptible to shock ; thirdly, as the cloth travels from one process to another, usually through pot eyes hung from the ceiling, it often breaks, or when the end is reached it has a tendency to whip, and in so doing, of course, pulls down whatever it may have whipped around, unless that something is firm enough to resist the strain until the cloth breaks or is seen in time by a workman. A fourth reason is that the very damp, usually steam-laden atmosphere, together with the various chemicals used, has a very injurious effect on all apparatus.



FIGS. 1 & 2.—REMOTE-CONTROLLED CIRCUIT BREAKER.

FIG. 3. WIRING DIAGRAM.

Of the risks described the two most serious are the third and fourth, as they involve risk to life. In the one case the cloth may very easily attach itself to an earth wire, breaking or pulling it from its fastening ; it is not always possible to place or secure the wire so that cloth cannot damage it.

In the second case, corrosion may take place between the joint of the earth wire and the earth plate, if of metal, though to casual inspection it may appear perfect ; in any case, it may introduce a high-resistance joint, and, when an earth fault does occur, it does not effectively protect the apparatus with which it is connected.

In looking for a remedy for the risks just described it occurred to the writer that the only real solution was to remove the risks, which has been done in the following manner :—

Sixteen motors ranging from 12 to 25 H.P. each, of squirrel-cage type, and thrown directly on the line without any compensator or other current-reducing device, are provided with switchgear arranged in groups as near as convenience allows to the motor they are to control.

Each group is fenced in by means of expanded metal and locked, so that none but authorised persons can get in.

Each switch is operated from a push-button control located as near the motor as possible. The control consists of a push-button switch specially made for solenoid-operated switchgear, and has silver contacts ; this, together with a 5-C.P. lamp, is enclosed in a cast-iron box, the lid of which is provided with a small ruby glass, which is illuminated when the switch is closed.

The solenoids are operated by D.C. at 110 volts ; some may consider the use of D.C. a disadvantage, to which the writer would say that, in all industrial plants of any size, D.C. is always available, as it is used for many minor purposes for which A.C. cannot be used.

From the foregoing, it will be seen that by adopting this system of control the handling of apparatus dealing with the working pressure is entirely avoided ; should such a risk occur as that previously mentioned the effect on the workman would be harmless, in any case only a little unpleasant.

It also obviates the rough treatment apparatus usually gets in these places ; furthermore, the system has all the desirable features—such as inverse time relay, overload and no-voltage protection.

A full description of the switchgear designed and made for the job is given below, as this switchgear has several features not usually associated with remote-control solenoid-operated apparatus ; also a diagram of the wiring is given. The accompanying sketches, figs. 1 and 2, show the construction of the circuit-breaker.

A is a frame which carries a solenoid B for closing the oil switch C ; D is a solenoid for releasing C ; E is a plunger to which are connected links F, which in turn are connected by pin G to lever H, and again to rod I and lever J ; K is an insulated base on which are mounted contacts L, 1, 2, 3 and 4 ; M is a rod insulated from H, and bridges contacts L^1 and L^2, fig. 2 : N^1 and N^2 are guides fastened to the solenoid B, in the slots of which O is free to slide up and down. Attached to O is a rod P which is free to turn at P^1 and is attached to the plunger E, shown in cross-section in fig. 2. The switch operates as follows :—When the button marked "Switch on" is pressed, current is conveyed to solenoid B by contacts L^1 and L^2 through rod M, plunger E is drawn up and is under momentum, or travels the length of the slots in links F, before it commences to lift lever H and closes switch C, and by the time plunger E is in its correct position in relation to the field of solenoid B, O has forced its way past props S^1 and S^2, and rests on top of them, much in the same manner as the cage of a pit shaft does to relieve the rope of its weight whilst undecking. Rod M is now bridging contacts L^3 and L^4, so that when a push button for opening the switch is pressed it closes the circuit of solenoid D, which, on drawing in its plunger, opens out props S^1 and S^2, releasing plunger E, which falls the depth of the slots in links F (inverse action to closing), and strikes the end of lever H a smart blow, causing it to rupture the circuit very rapidly.

No auxiliary relay is used to deal with the main current of the solenoid, and no condensers or buffers are used to protect contacts L, 1, 2, 3, and 4. These switches have been opened and closed many times a day without damage to contacts L, the push buttons, or rod M. As seen in fig. 3, the switch is entirely automatic, and independent of push buttons.

This switch has some features not usually met with in other types. It will be noted that the oil switch is closed by a pull, and not a blow closing a toggle joint, as is usual, and has this advantage, that it is easily adjustable by means of rod P for any length of stroke, without in any way interfering with the plunger, and need not be so precise as a toggle, which must not be a fraction over or under ; furthermore, by the use of links F the plunger is in its most powerful position before it commences to close the switch ; with the other type, the plunger is at its weakest point, *i.e.*, the end of its stroke.

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In switches that operate on the toggle principle the opening of the circuit is accomplished by the smaller solenoid tripping the toggle, weight, movable contacts, wooden rods, and cross-bar. If, as is often the case, the movable contacts go in a little too far, or are frozen in by a small blob, an opening toggle switch fails to fall, and it is usually necessary for the operator to hit the cross-bar so that the switch shall open; use is also made of v contacts, which have a repulsion effect, thereby assisting in opening the circuit.

In the switch just described v contacts are used only because they are practically the only type that can be used on this class of switchgear; but the repulsion effect is not relied on so much, for should the blades stick for any reason, the weight of the falling plunger never fails to open the circuit very rapidly. No springs are used to assist the opening.

THE HOUSEHOLD FUEL AND LIGHTING ORDER, 1918.

By T. W. COLE.

The Household Fuel and Lighting Order is of a somewhat complicated nature, and a few notes in elucidation may not be out of place.

In the first instance, the chief point of immediate interest to electricity supply undertakers is Part VIII, which deals with the "Duties of Undertakers of Gas and Electricity Supplies and Other Clauses Applicable Thereto." As the Order takes effect from July 1st, we might consider, first, any provisions which call for immediate observance. A clause which contains such provisions is 99, which reads as follows:—"An undertaker of gas or electricity supply shall not, after the date on which this Order comes into effect, without the previous assent of the Local Fuel Overseer, make any new supplies for the purpose either of lighting or fuel, nor shall it fit or equip or permit or authorise to be fitted or equipped any premises with additional appliances for the purpose of using gas or electricity for fuel without such assent. This clause shall extend to any other persons undertaking the fitting or equipping of premises with appliances for the use of gas or electricity for fuel.

"Where premises have been fitted or equipped for the purpose of using gas or electricity for fuel since May 1st last, the Local Fuel Overseer may, in his discretion, refuse to permit an additional supply of gas or electricity for such premises in respect of such new fittings or equipment."

This clause is very drastic. It applies, be it noted, to all electrical contractors as well as to electricity supply undertakers. It cuts straightway into the business of the former. How far it puts a stopper on all business seems to rest with the Fuel Overseer. Installation work and apparatus sold (and to be sold), therefore, since July 1st, needs careful consideration, for if the same is not sanctioned by the Fuel Overseer the question arises whether the customer can refuse to pay for it, since in such circumstances the work has been done, or goods delivered, in contravention of an Order under D.O.R.A. Presumably, however, the Fuel Overseer will take a common-sense view of all work done in this interregnum, as it were, until the Order is fully understood and in full operation.

From this it would appear advisable for everyone interested to get into touch with the Fuel Overseer for the district at an early opportunity. As the Order provides that the Local Authority must appoint the Fuel Overseer within 14 days (that is, before July 15th), the names of the officials must very shortly be forthcoming, if not already out in some districts.

In the London area, the existing list of Local Fuel Overseers (referred to previously as the Local Coal Overseers) stands as at present, without express confirmation. But we understand that a revised set of appointments will be made shortly. In fact it seems obvious that the gentlemen in the present list (Borough Surveyors, Public Librarians, &c.) cannot fulfil the now very onerous duties they are allotted under the present Order.

With regard to further instructions to Electric Supply Authorities, the most important clause is that which provides that undertakers must within six weeks of the close of the quarter furnish the Local Fuel Overseer with a list of all consumers who have exceeded their ration, as shown on the certificates sent to the undertakers by the Overseer; this is a matter quite simple in theory but entailing, in big undertakings, a prodigious amount of clerical work, and possibly a shoal of correspondence. Still, however troublesome, it is unavoidable for the due working of the Order. The interesting point will be to see how long it will take the Fuel Overseer to send the necessary certificates to the undertakers, an unenviable job, considering the peddling detail labour involved in deciphering and the hotch-potch character of many of the requisitions sent in by the more illiterate and non-arithmetical of the householders.

A difficult problem to deal with will be that of the slot meter consumers. However, as these cover usually quite small consumptions, electricity supply authorities will, perhaps, not be unduly pressed over the detail working in these cases.

The clause providing that electricity undertakers shall maintain reserve stocks of coal seems somewhat superfluous. The trouble in this direction is not being unwilling to do so, but being unable to do so. Still, the clause may be taken as conferring on the undertakings a certain advantage, since they can claim obligations under D.O.R.A. when pressing for deliveries.

The foregoing by no means exhaust the obligations, but are merely a summary of the chief ones from the undertakers' point of view. Finally, as the undertakers will be constantly called on by consumers for advice, there is the further obligation on them to digest, and have at their finger ends, the details of the Order in every particular.

TRADE UNIONS AND INCORPORATED ASSOCIATIONS.

The following is an abstract of an address given to the Electrical Power Engineers' Association at St. Bride's Institute, London, by Mr. A. C. Bostel, chairman of the Southern Division, Mr. C. H. Wordingham, president of the I.E.E. being in the chair:—

Because of the veiled and unveiled objections which exist to our choice, for the Electrical Power Engineers' Association, of trade-union registration, I have felt it essential that at as early a stage as possible in our reconstruction an explanation should be given of the causes which have weighed in our decision for registration in preference to incorporation.

Trade unions may be defined shortly as associations of workers for regulating the relations between craftsman and craftsman, craftsman and employer, or employer and employer, and for imposing conditions on the conduct of any trade profession. Their legislative strength of to-day, which in the hands of some of their leaders approaches a menace to the welfare of the state, was not attained without great effort, and one cannot but admire in the history of trade unionism the spirit of those men who for their principles were prepared to make bitter sacrifices.

It is clear that trade unions are a sort of corporation, incorporated by statute, and very closely resemble incorporated associations such as railway companies, but the freedom of a trade union to add to its objects by altering its rules is very much narrower than that of an incorporated association. Under the Companies Act, 1908, a company may alter its articles of association subject to certain conditions, but a trade union must not exceed the powers given to it by the Trade Union Acts of 1871-76. It appears, therefore, that this is the most important difference between a trade union and an incorporated association; the latter may be formed for any lawful object desired by its promoters; these objects are set out in its articles of association, and to them the association must confine itself. It may at any time, by the approval of the Court, alter or add to the original objects, to carry on its business more efficiently or to maintain or improve its conditions. Under the Trade Union Acts, however, a trade union may only be established by strictly conforming to the objects defined by the Act; these objects the union must state, but they must not include any object not defined by the Trade Union Act.

It is a mistake to assume that trade unions are not liable to tort, because they certainly are, except in cases bearing directly on any action for the furtherance of a trade dispute, but as no self-respecting trade union would be so foolish as to commit any action which would be liable to criminal prosecution, other than in the interests of a trade dispute, I do not propose to dwell on this. It must be understood,

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however, that this protection from tort is the strongest power given to trade unions.

With reference to benevolent funds, the majority of trade unions and many incorporated associations offer to their members sick benefit and superannuation allowances, but trade unions cannot give to their members any legal security that they will enjoy these benefits, unless funds collected by subscriptions or optional levy are put aside for such purposes, and expressly specified as such. The subscriptions nearly always go to the common fund, and are used primarily for trade purposes, and such benefits as are offered are only forthcoming when there is money to spare and the society has power to pay it. To get over this difficulty, our national executive has decided to encourage the members of the Electrical Power Engineers' Association to subscribe to an incorporated society—The Electrical Trades' Benevolent Institution.

We now come to the vicious principle of a strike, which is always associated with trade unions, but under a different word it is often practised by associations and companies. Surely if it is practicable for a combination of, say, milk dealers, to sell milk only at their agreed price, it is no scandal for a body of craftsmen to say that they will only sell their skill and labour at a price which they decide on; but whereas in the former case the hardships are inflicted on others, in the latter it is on the strikers. I do not give this example to mean that to strike is the proper thing to do, it certainly is not, any more than it is right for a combination to form rings to lift up prices and eliminate competition. The power to strike is, however, a very powerful weapon, and should never be unsheathed except after every possible method of friendly arbitration has failed, and I am sorry to say that this method is forced on craftsmen by the attitude adopted by employers of labour. It should be borne in mind, however, that some of the greatest strikes have been carried out without the aid of trade-union organisation; and, on the other hand, many trade unions have never resorted to such methods. It must be understood, therefore, from the foregoing remarks that our association, the Electrical Power Engineers' Association, holds broad views on the subject of the title of this paper, but I do not feel that there is need for any side to take drastic action. The whole trouble in the past between employers and employés has been the want of education in the value of one another, each to each. The employers have not, until recent years, made a study of their men, nor have the men made a study of their employers, and hence the sole object of one is to get as much out of the other as possible. Now all this is very wrong; it has always been the differences, the alleged wrongs, never the broad-minded principle—the great common interest of the industry itself.

An industry is something far greater than the men who make up that industry, it calls for the mutual co-operation of all who make it what it is. Its success depends largely on this co-operative feeling existing between the workers, both manual and intellectual, and it is this mutual feeling which in the future will no doubt exist in all industries. We have seen it in an indirect way during the present struggle.

Were this co-operation to be carried out on broad principles we should not only avert strikes and lock-outs, but should witness a vast increase in the prosperity of our Empire, such as has never been seen in the course of our history.

ELECTRIC POWER SUPPLY.

On June 11th a deputation of members of the Trade Union Congress Parliamentary Committee and officials of the Electrical Trades Union interviewed Sir Albert Stanley, President of the Board of Trade, with regard to the proposals of the Committee on Electric Power Supply. The E.T.U. was represented by Messrs. J. Rowan (General Secretary), J. Muir (Executive Council), and H. H. Morton (Secretary of No. 1 Branch, London Station Engineers, from whom copies of the full report can be obtained, price 2d.). From the quarterly report of the Parliamentary Committee we learn that Mr. W. THORNE introduced the deputation, and said that Labour had repeatedly declared in favour of public control as against uncontrolled State ownership; it believed that if the huge concern referred to in the report was set up and put in the hands of private enterprise, it would mean the exploitation of the workers and of the private consumer. It would be much better to have a number of huge generating stations instead of so very many small plants; but the interests of Labour and the public generally must be thoroughly safeguarded.

Mr. J. H. THOMAS said there was common agreement as to the advisability of a large scheme and generation in bulk. The first governing principle must be public ownership, as distinct from municipal ownership; Parliament would be the ultimate authority, and there would have to be some form of central authority on which Labour must be adequately represented. Provision should be made for compensating workers for loss of employment. Electric power was wanted not only for industrial purposes, but also for the purpose of bringing comfort to private homes.

Mr. J. ROWAN said that his society held that bulk supply was necessary in the interests of Labour, which could only be safeguarded by public ownership and public control. Labour should be represented on both the National and the District Boards; consumers were to be represented, and would have the right to say what the conditions of employment should be. Before the Report would be acceptable to his members it would have to be considerably modified. Compensation for displacement should be extended to workmen as well as officials.

In reply, Sir ALBERT STANLEY said the Government looked upon this matter as one of the most important of the many reconstruction problems; a cheap supply of electricity would go far to improve the industrial situation, and he was glad to know that they would have the support of Labour on that point of principle. The Board of Trade intended to press this matter forward as rapidly as possible, and would endeavour to bring in a Bill to deal with it as soon as time could be found in the House of Commons to do it. It seemed imperative that if a national scheme of electricity supply was going to be established, no extension should be made, other than what was absolutely necessary, unless it could be made to fit in with the national scheme. The Sub-committee of the Coal Conservation Committee had reported that such a scheme would mean a saving of 50 million tons of coal and 100 millions sterling a year; there was therefore a colossal waste now, and because that sub-committee decided to make certain recommendations the Board of Trade appointed a committee on the subject. He had no doubt but that this country could produce electricity just as cheaply as any other. He thought the right course to follow was to appoint an Electricity Commission which should be responsible to the President of the Board of Trade, who was responsible to Parliament; but it would not be proper for him to give any indication of the policy of his department and of the Government until they had had an opportunity of considering the recommendations and consulting some of the interests whose advice would be beneficial. They hoped to be able to draft a Bill very shortly, and the three points raised would be carefully borne in mind, namely, that the power stations should be publicly owned; that Labour should be represented on any scheme providing for the administration of this undertaking; and that provision should be made for compensating any employé whose position might be disturbed. There was every probability that people would be benefited by the new arrangement and secure electricity much cheaper.

Mr. ROWAN pointed out that the Report suggested that 50 per cent. of the capital should be provided by the State, and there was no guarantee that private profits would not be made by the other 50 per cent.; but Sir Albert replied that criticism should be directed towards the Bill when it was brought in; the Report could only be taken as a guide in framing the measure.

LEGAL.

RIO TINTO CO., LTD. *v.* A. E. G. ELECTRIC CO., LTD., AND A. E. G. ELECTRIC CO., LTD. *v.* RIO TINTO CO., LTD. (Consolidated).

(*Continued from p.* 9.)

Mr. GRANT, K.C., in continuation of his opening, raised the question of an amendment of the pleadings in relation to the interpretation of the contract in regard to special damages.

Mr. COLEFAX, K.C., for the Board of Trade, said the proposed amendment brought in the allegation of breach, and the pleadings must not be so altered as to go outside the arbitration decision.

The OFFICIAL REFEREE said he would allow the amendment to the pleadings. There was nothing in the proposed amendment which was going to enable the plaintiffs to take any such course as Mr. Colefax seemed to be afraid of.

Mr. ARTHUR STEBBINS CLIFT, the agent of the Rio Tinto Co., gave evidence as to the proposed alteration in the plant at the company's works and the arrangements which were made in June, 1912, for the supply of the new turbo blowers. At that time, he said, letters inviting tenders were sent, amongst others, to the A.E.G. Co. He had a discussion with Mr. Adler as to the practicability of making turbines for the required pressure and volume which would have an efficient steam consumption. He also desired information about an alternative scheme for driving the blowers by electric motors. Witness then went on to describe in detail the various interviews which he had had with Mr. Adler in reference to the transaction, and was cross-examined by Mr. Colefax as to the dates at which the various orders had been given in reference to the machinery and the evidence which he had given before the arbitrator. Asked as to the nature of the claim in regard to damages, witness said that he had based it upon the actual production during 17 months from July, 1915, to December, 1916; the total amount of copper extracted from the ore during the 17 months he had mentioned was 10,161 tons.

Witness was cross-examined at great length upon the details of the work done at various dates as shown by the tabulated statements and upon the claim of £184,000 loss of profit consequent upon the failure of the machine.

On Monday, July 8th, the sixth day of the hearing, defendants' counsel, by permission, interposed a witness named Ronie. He said that he was in 1915 employed by the A.E.G. as an erector, and he was now employed by Dick Kerr & Co. He went to Rio Tinto with Mr. Doughty in March, 1915, in connection with the trial of the turbine. The second attempt

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to start the turbine with the new shaft took place in February, 1916, and his expenses were paid by the A.E.G. Co. Before he went out he attended several times at Fraser & Chalmer's works where the new shaft was being manufactured, and his charges for those attendances were paid by the defendants.

In cross-examination by Mr. Grant, K.C., the witness said that Dick Kerr & Co. took over such business as the A.E.G. Co. had left in England, and he acted for them in connection with the Rio Tinto business. He was not examined before the arbitrator as to what took place at the second trial. He did not have money advanced by the Rio Tinto Co. while he was in Spain. In all he had done he had acted under the orders of the A.E.G.

Mr. Clift, whose cross-examination had already occupied four days, was recalled and further cross-examined by Mr. Colefax, K.C., as to the refusal of the Rio Tinto Co. to make the second payment. He said that at the time of the refusal the defendants had been pressing for payment.

Questioned upon the correspondence which had passed between the mines manager and the agents in London in reference to the delay in payment, he said that the Rio Tinto Co. would have been willing to carry out the test if it was so desired, but they preferred that the defendants should have a man there when the tests were made. It was originally intended that two engineers from Berlin should be present at the mines, bringing with them Pitot tubes to carry out tests as to the volume of air.

Mr. Colefax: And we gave you warning that if you started without us, yours would be the responsibility.

Witness: Yes.

Mr. Colefax: You, as works manager, think it was unnecessary that the machine should be overhauled before it was put under steam?

Witness: I do not think detailed overhauling was necessary.

A letter from the defendants was read disclaiming all liability if the machine were put under test without overhauling by competent men, and witness said he was told by the defendants that the company would prefer that their representative should be present at the tests. It was not, he said, their intention to make tests without reference to the defendants. They would rather have had them there at the time. They said that they would have an engineer present when the equipment was started.

(To be continued.)

Charge of Fraud.

Albert Middleton, cabinet maker, Borough Road, Seacombe, was summoned last week for fraudulently consuming Corporation electricity. It was stated that when a previous tenancy expired the defendant connected his sitting room and workroom with the main wires left in the building, a thing which could only be done by a person possessing technical knowledge. A fine of £10 was imposed.

Theft of Current.

At Musselburgh Police Court, Helen Walker, or Thompson, 48, Market Street, Musselburgh, was fined £1 for the theft of 10s. worth of electric lighting current which had been passed round the meter by means of pins and wire.

Breach of Lighting Regulations.

The Penarth Electric Lighting Co. has been fined 20s. for a breach of the Lighting Order. The police evidence showed that when a visit was paid to the electric light station at 1.40 a.m. on May 31st the windows of the premises had not been obscured. There were also two standard lights in the yard which could be seen from the sea.

Isaacs *v.* Hobhouse.

In the King's Bench Division (Mr. Justice Darling) last week it was arranged that July 16th would be a convenient day for the trial of this action between Sir Godfrey Isaacs and Sir Charles Hobhouse.

WAR ITEMS.

Women Electrical Workers after the War.—According to the Manchester *Daily Dispatch*, delegate meetings of the Electrical Trades Union were held in various centres throughout the country on Sunday to consider a series of resolutions dealing with armature winding after the war, which were adopted at a recent general conference held in Blackpool. The Manchester meeting endorsed the policy recommended by the Blackpool conference. Under this programme, at the conclusion of the war the Electrical Trades Union will refuse to allow women to perform armature winders' work, and they will also ask for the removal of all cheap labour. One proposal that found acceptance at Manchester was that a secret mark should be placed on all machines made or wound by women or assembled by cheap labour. An attack will also be made on the premium-bonus and piece-rate systems.

Exemption Applications.—At the Hull Tribunal recently, Mr. Rowan, secretary of the Tramwaymen's Union, in supporting the application of a grade 2 man for exemption, stated that 300 men had joined the colours, and they desired to keep the remainder of the men to avoid the introduction of women drivers, to which they were strongly opposed. The application was refused.

Before the Kesteven Appeal Court, the Urban Electric Supply Co., Ltd., appealed against a final month's exemption granted by the Grantham Tribunal to T. H. Heritage (28, grade 1), superintendent, and A. W. Lockton (30, grade 1), stoker, and the National Service Representative appealed against three months each allowed to W. J. Copsey (40, grade 1), engineer; J. E. Edmundson (39, grade 1), manager; W. J. Mann (33, grade 1), labourer; J. Tazzyman (39, grade 1), labourer; A. Parnham (33, grade 1), wireman; and P. A. Baxter (28, grade 1), wireman. The appeal for Lockton was withdrawn, Edmundson was exempted until December 31st, and in each of the other cases the men were given extended exemption to the end of September.

At Stratford-on-Avon an appeal was made by P. W. H. Dove (46, grade 1), electrical engineer. He stated that he supervised several private installations, and had a contract for a plant at Elmdon Hall and at another place to be utilised as a hospital for wounded American officers. The National Service Representative contended that the work at Elmdon Hall could wait until after the war, and appellant replied that before he took the contract he called at the recruiting office, and was given to understand that men over 45 would not be wanted before October. He complained that two younger men engaged on electrical work at another place he named held protection certificates. The National Service Representative contended that Dove was not in a certified occupation, and it was pointed out that the contracts were taken prior to the Act affecting older men coming into force. Three months were granted.

At Sutton-in-Ashfield exemption was sought by R. W. Bance (38, grade 1), electrician with Mr. B. Walton. Applicant, who asserted that he was induced to part with his protection certificate under a misapprehension, had his appeal refused.

At Mansfield, the National Service Representative appealed against conditional exemption held by G. Cooper (grade 2), electrician. The Tribunal held that he was in a protected occupation, and the appeal was refused.

Before the Somerset Appeal Court, an occupational claim was made by Wallace Baker (31, Class A), electrician, with Messrs. Fox Bros. & Co., of Wellington, who has been de-certificated. It was stated that Baker held a protection certificate, and the firm asked for exemption or leave to reinstate an appeal for him in the event of the certificate being withdrawn. Six months were conceded.

Bermondsey Tribunal have adopted a resolution calling the attention of the Ministry of National Service and the Local Government Board to the fact that a large number of young men who came under the provisions of the earlier Military Service Acts still hold protection certificates or other forms of exemption to which no conditions were attached, either from the Munitions Area Recruiting Officers or the Port of London Authority, and that the Tribunal were of opinion as they were now called upon to decide applications for exemption from men graded 1 and 2 between 40 and 50 years of age, that all such certificates should be at once reviewed, and only renewable on applications by the employers and men to the appropriate local Tribunals.

At Ilfracombe, on July 2nd, appeals were made by H. J. F. Stewart, resident electrical engineer; T. H. Sanders, electrician; and A. J. Rudd, relief stoker, for the electric light works. Each was granted three months' exemption.

Mr. D. Munro, electrical engineer to Exeter City Council, appealed for the retention of A. G. G. Buchanan (32, Class A), shift engineer, and said that the staff had been reduced to a minimum. The man was exempted until October 31st or until an efficient substitute is found.

Watford Tribunal has referred to the County Appeal Court an appeal filed by W. R. Dyer (19, grade 1), electric fitter.

At the Norwich Tribunal, Mr. J. W. C. Daynes appeared on behalf of the employers to resist the appeal of the National Service Representative in respect to the exemption of the chief cashier and ticket clerk of the Electric Tramway Co. The man has been eighteen years with the company, has been responsible since 1906 for all takings and the issue of tickets and prepares all the office returns. It was held that a substitute could not be found because the work required special training. Lady clerks had been tried, but could not do this man's work. The application of the National Service Representative was dismissed.

Price of Coal.—The Board of Trade has made an order providing for an increase of 1s. 6d. per ton in the price of all coal dispatched from the colliery for consumption in the United Kingdom, on and after Monday, July 8th, to meet the cost of the increased war wages recently granted to the miners. The price of coal had already been raised by 2s. 6d. per ton on June 24th. On June 28th an advance of 1s. 6d. a day was granted to miners over 16 years old, and 9d. a day to those under 16.

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CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Instruments for Central-Station Switchboards.

It was only to be expected that Mr. Stubbings's article in your issue of June 14th should call for a rejoinder from a champion of the motor meter, but I am surprised to note the form which this reply has taken. Very rarely indeed does one see in the "Correspondence" columns of the technical Press such a spiteful and personal attack against the productions of a particular manufacturer as that made by "A.M.I.E.E." in your current issue. In this connection, I need only refer to the penultimate paragraph of his letter.

Mr. Stubbings is accused of *undue* bias in favour of the "Aron" meter, and perhaps, therefore, he will excuse me if, as engineer of Aron Electricity Meter, Ltd., I state that he is entirely unknown to us, except by reputation. Presumably, therefore, any bias which he may possess must be the result of his experience of meters under practical working conditions, and this is borne out by the fact that, until quite recently, he has been connected with a station in which, I believe, both mercury watt-hour and "Aron" meters have been used.

Thus, against the moderately-expressed views of an actual user of all types of meters, we have only the extravagant claims and criticisms of an individual who, for reasons best known to himself, prefers to hide his identity.

I am glad to see, however, that our anonymous friend does admit that brake magnets weaken, though he minimises the fault on the ground that this can be made apparent by calibration "at least once per annum," and that it tends to counteract another fault due "to the effect of dust, wear, &c., on the meter." On the other hand, your readers will note that the worst he can say against the "Aron" meter is that two of them, and these of a type now superseded and improved upon, differed on test by as much as 2 per cent.

I would like to mention, too, that the "series of tests" referred to by your correspondent covered other working conditions, such as, for example, accuracy under varying pressures, about which your correspondent is silent. Further, the test results were offered to ourselves and to our competitors conditional on each party agreeing that the other should receive the full report on *both* makes of meters, a condition which our competitors could not accept. These facts are, I think, significant!

F. A. Nield.

London, N.W., *July 9th*, 1918.

BUSINESS NOTES.

Erinoid, Ltd.—A further development in the commercial combat with German industrial monopoly was marked by the bringing into use on Friday, for the first time, of a new power installation which ERINOID, LTD., of Stroud, Gloucestershire, has found necessary to meet the demands made upon it both by the Government and by private firms. The company's product, "Erinoid" (see ELECTRICAL REVIEW, page 618, June 8th, 1917), a new British insulator and non-inflammable substitute for ivory, horn, tortoiseshell, ebony, &c., is claimed to be an improvement upon what was formerly a German product, "Galalith," which had a monopoly all over the world. Large quantities of Erinoid are being made by the company for export for war material purposes. After a brief opening ceremony in the new power house, a party of visitors was conducted over the works to inspect the various processes by which dried and powdered skimmed milk is converted into what, so far as the Erinoid Co. is concerned, is the finished article. It was pointed out that the factory derived its raw material entirely from abroad, and did not in the slightest degree affect the food products of this country. The raw material was drawn mainly from the Argentine, India, and New Zealand, and some of it came from France.

Book Notices.—*M. & C. Apprentices' Magazine* for July is well up to the high standard set by its producers; its literary qualities are such as would be expected of Scottish authors; the articles deal with a wide range of interesting subjects—technical and otherwise—and the illustrations are excellent. Not the least interesting feature is the list of workshop suggestions, for which bonuses have been granted ranging from 10s. 6d. to five guineas. We must again tender our congratulations to the "Apprentices."

"Détermination et Etude des Caractéristiques d'Eclairement des Projecteurs," and "Répartition de l'Eclairement produit à grande distance par les Appareils Optiques de Fresnet." By MM. A. Blondel and Ch. Lavanchy. Reprints from *Annales de Physique*. Paris: Masson & Cie.—In these papers, of which complimentary copies have been sent us by the authors, the theory of the searchlight projector is treated of, with special reference to the distribution of light over the cross-section of the beam, of which the importance, with regard to the visibility of the object illuminated, is very material. In the first paper reflecting apparatus are considered, and in the second dioptric and catadioptric lenses. Various cases are dealt with, corresponding to different conditions of focusing, &c., and simplified methods of calculation are developed by which the characteristics of a projector of given dimensions can be readily ascertained. The second paper extends the methods to the case of systems of lenses. These studies will be of value to those engaged in the design of such apparatus.

"Membership Booklet, 'C,'" issued by the Institute of Metals, contains a list of officers, an appeal for increased membership (the roll now exceeds 1,000), an account of the activities of the Institute and the advantages of membership, and numerous testimonies to the great value of its work, as well as portraits of the distinguished men who have presided over its proceedings. Copies can be had on application to the Secretary, Mr. G. Shaw Scott, 36, Victoria Street, S.W. 1. There will be a ballot for the election of members on July 17th.

"*Memoirs* of the College of Science, Kyoto Imperial University," Vol. II, No. 6, contains papers on the effects of an electric field on the spectrum lines of hydrogen and helium, the figures produced on photographic plates by electric discharges, and other electrophysical subjects, with many illustrations of the greatest excellence.

"Electric Motors and Control Systems." By A. T. Dover. London: Sir Isaac Pitman & Sons, Ltd. Pp. xvi. + 372; 315 figs. Price 16s. net.

Patents and Designs in South Africa.—By Order in Council, on June 25th, the provisions of Sec. 91 of the Patents and Designs Act, 1907, were made applicable to the Union of South Africa.

Catalogues and Lists.—KEIGHLEY GAS AND OIL ENGINE CO., LTD., Imperial Works, Keighley.—Forty-page catalogue containing very full information, accompanied by excellent half-tone and line drawings, regarding their "Imperial" vertical engines, petrol-electric generating sets, &c. Pictures of several bays at the firm's works are shown.

AUSTIN MOTOR CO., LTD., Longbridge Works, Northfield, Birmingham.—Publication of over sixty pages (art paper), containing excellent half-tone illustrations of their small electric generating sets (3, 3·5, 8, and 18 KW.), with full tabulated details of spare parts and instructions respecting ignition, carburation, cooling, starting, valve-timing, &c.

BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Descriptive list, No. 5.100 (12 pages), containing a full account, with illustrations, tabulated dimensions, and shipping particulars, of their hand-operated starting rheostats for C.C. motors.

Australian Industries.—Referring to our recent comments on the question of branch British factories in Australia we observe that Mr. Bonar Law has informed the Australian High Commissioner that everything will be done to meet the wishes of the Commonwealth Government in establishing Australian industries with the assistance of British capital.

The Straits Settlements.—The Imports and Exports Office, Singapore, has lately issued some figures which show that during last year telegraph and telephone material to a value of £21,490 was imported into the Straits Settlements from Great Britain, as against only £1,980 from Japan.

Manufacturers' Conference.—On Tuesday, July 23rd, at 2.30 p.m., at the Central Hall, Westminster, there will be a conference of British manufacturers, under the chairmanship of Mr. George Terrell, M.P., president of the National Union of Manufacturers (Inc.), who will be supported by Sir E. Carson and others. Firms who desire to receive tickets should communicate with Mr. G. R. Cheesman, the Secretary, at 6, Holborn Viaduct, E.C. 1.

Dissolutions and Liquidations.—STANDARD BITUMEN CO., LTD.—In voluntary liquidation. Mr. S. R. Sheppard, 20, Budge Row, E.C., liquidator. Meeting of creditors, July 17th.

MONOMETER MANUFACTURING CO., LTD.—Creditors must send particulars to the liquidators (H. T. Ledsam and G. G. Poppleton, 26, Corporation Street, Birmingham) by August 12th.

Bankruptcy Proceedings.—CONNOLD, R. E., Canterbury. —Order made June 11th discharging bankrupt conditionally.

LIGHTING AND POWER NOTES.

Accrington.—The T.C. has agreed to supply Messrs. Lang Bridge, Ltd., with a supply of 250,000 units per annum. The estimated annual revenue will be £1,000, and it will cost £260 to connect the works with the nearest main.

Argentina.—According to the *Morning Post*, the Buenos Aires Municipality has taken energetic steps to prevent the German Electric Supply Co. from suspending its services to the public on the pretext of the shortage of fuel.

Australia.—The Huntley (Victoria) Shire Council has applied for authority to supply electricity for public purposes.

The Lismore (N.S.W.) Municipal Council has decided to borrow £15,000 to finance an electric lighting scheme.—*Tenders*.

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Ballymoney.—PROPOSED E.L. SCHEME.—The U.D.C. has informed the Gas Co. that it is desirous that the proposed electric lighting scheme should be proceeded with at once.

Bedford.—YEAR'S WORKING.—The annual accounts of the borough electricity department for the year ending March 31st, 1917, show that the revenue amounted to £32,406, and the expenditure to £21,256. The total number of units sold was 4,115,733, including public lighting, 13,910; sewage pumping, 218,273; private lighting, 574,475; and power, 3,309,075.

Birmingham.—WAGE INCREASE.—With regard to the extension of the 12½ per cent. bonus to the employés of the non-certified departments of the Corporation, the Committee on Production has decided that the present advance be increased to 25s. per week.

Burnley.—YEAR'S WORKING.—The income of the borough electricity department for the year ending March 31st, 1918, was £38,044, compared with £34,341 in the previous year. The works costs amounted to £20,353, against £17,006, and the net profit to £4,101, against £3,464. Interest and sinking fund charges were £13,745, against £13,870. The number of units sold was 5,698,532, an increase of 159,888. The works costs per unit was ·699d., against ·622d., and the gross costs 1·436d., against 1·419d.; 48 new consumers were connected, against 58 last year, owing to the restrictions laid down by the Ministry of Munitions.

Coventry.—YEAR'S WORKING.—For the year ending March 31st, 1918, the income of the Corporation electricity department amounted to £197,987, or ·866d. per unit, compared with £169,787 in the previous year. The total expenditure (including interest, £20,358, and loan redemption, £20,161), was £181,666, or ·794d. per unit. The total number of units sold was 54,854,340, including power, 52,453,060; private lighting, 1,925,719; heating, 252,391; traction, 223,170; and street lighting, 14,009. The total works costs were £118,926, or ·563d. per unit.

Bristol.—STREET LIGHTING.—The Diesel engine at the electricity works, which has been the subject of much controversy, has been sold, and the engine is to be shipped to S. America.

The loan charges on the original street lighting system will be liquidated this year, and, in view of this, the Electricity Committee has been asked to modify the charges. At present the electric lamps, with certain necessary exceptions, are not lighted at night, but it has been resolved to resume the street lighting on September 1st.

Continental.—NORWAY.—Official statistics covering the period 1897-1915 show that the number of industrial plants increased from 9,422 to 15,754. During the same period the horse-power, both steam and electric, increased from 172,396 to 1,261,205. From 1900 to 1915 the number of electric motors increased from 391 to 18,313, and the horse-power roughly from 3,000 to 243,000.—*The Times.*

Elland.—LOAN SANCTION.—The Council has received permission to borrow £2,000 for the purpose of electricity works extensions.

Godalming.—PRICE INCREASE.—The tariff for energy has been advanced as follows by the Urban E.S. Co., as from the quarter ending September:—Lighting to 8d. per unit: power and heating by 10 per cent.; weekly payment consumers, an extra 1d. for all excess units.

Grantham.—PRICE INCREASE.—The Urban E.S. Co. has, from July 1st, increased the price of energy for power and heating by a further 10 per cent., making a total war advance of 40 per cent.

Halifax.—ANNUAL ACCOUNTS.—The working of the electricity department for the year ended March 31st last shows a profit of £12,033, compared with £12,694 for the previous year, and after providing for the 1½ per cent. contribution to the relief of rates and other special items, there was a net loss of £1,182.

Isle of Wight.—PRICE INCREASE.—The E.L. and P. Co. announces the following increased charges for energy for the quarter ending September:—Lighting to 8d. per unit; power and heating, 10 per cent. increase; slot meters, an additional 2d. in the 1s.; weekly payment consumers, 1d. per unit extra for eight months, and 2d. per unit for excess units during the four summer months.

Kendal.—The Council has decided to transfer £605 from the general district fund to the electricity account, to meet the deficiency for the year ending March 31st last.

Leeds.—EXTENSIONS.—Arrangements are being made for the formal opening, at the end of this month, of various extensions to the Corporation electricity undertaking, carried out during the past three or four years at a cost of nearly £250,000. These extensions are part of a larger scheme intended to enable the Whitehall Road works to meet a demand for 60,000 H.P. Since the commencement of the war the energy supplied for power purposes has nearly doubled in volume. Almost immediately the Corporation will find it necessary to expend about £120,000 upon further generating machinery, and extensions to the boiler house and circulating pump house. The average price of energy is 1·14d. per unit, about 20 per cent. above pre-war charges.

LOANS.—The Corporation has decided to renew its application to the L.G.B. for sanction to borrow £5,650 for the purchase of land adjoining the electricity works when the present restrictions on borrowing are withdrawn, and in the meantime to complete the purchase.

Lincoln.—EXTENSIONS.—At a meeting of the City Council, the chairman of the Electricity Committee reported on an interview with the directors of the Electric Power Supply, Sir John Snell, and the L.G.B. with reference to the proposed purchase by the Corporation of the power station of Messrs. Clayton and Shuttleworth. The Council decided to ask Sir John Snell to carry out the proposed scheme of extension of the power station, and to state his terms for doing so. The proposed scheme will involve a total expenditure of about £240,000.

London.—BETHNAL GREEN.—PRICE INCREASE.—The Electricity Committee has recommended the B.C. to increase the price of electricity from the present increase of 33⅓ per cent. to 50 per cent. on the pre-war charge.

Loughborough.—YEAR'S WORKING.—The gross profit on the past year's working of the electricity department was £5,274, and the net profit was £1,012. The output was 63 per cent. in excess of that of the previous year, constituting a record year's results. Total units sold were 2,566,826; revenue received, £14,222; works cost (units sold), ·837d.; and average price received per unit (sold), 1·26d.

Lymington.—PRICE INCREASE.—The E.L. Co. has increased the price of energy from 7d. to 9d. per unit, but no consumer is to be charged more than 8d. without the consent of the Corporation.

Market Drayton.—STREET LIGHTING.—The U.D.C. has accepted the estimate of the E.L. Co. for the lighting of the street lamps at £2 5s. per lamp, or if only the 39 lamps used during the winter months were used, at £2 10s. per lamp.

Middleton.—YEAR'S WORKING.—The revenue of the T.C. electricity department increased by £2,547 during the past year, and the expenditure by £1,461. The number of units sold increased by 47,914. The loss on the undertaking for the year was £518.

Nelson.—WAGES.—The enginemen, firemen, &c., at the Corporation electricity works have given notice that unless they receive an increase in pay of 20s. per week on their pre-war wages, plus 12½ per cent., to date from March 21st last, they will cease work on July 10th. They are at present receiving 16s. per week above pre-war wage.

Pontypridd.—YEAR'S WORKING.—The annual accounts of the U.D.C. electricity undertaking for the year ending March 31st, 1917, show an income of £12,684, whilst the expenditure was £7,151.

Queensbury.—PROPOSED E.L. SCHEME.—The U.D.C. has deferred consideration of a request from the Yorkshire Electric Power Co. to support its proposal to supply the Queensbury area with electricity, for which the company intended to apply to to Parliament for sanction.

St. Austell.—All matters in dispute between the Urban Council and the Electric Lighting Co. have been settled by the acceptance by the latter of £100 per year for three years.

Stamford.—PRICE INCREASE.—The Urban E.S. Co. has decided to increase the charges for electricity from July 1st as follows:—For power and heating, by an additional 10 per cent. upon the present charge; for supply through slot meter, by an additional penny in the shilling on the present charge; weekly payment consumers, by an additional penny per week, except during the four summer months.

Stoke-on-Trent.—PROPOSED EXTENSIONS.—The E.S. Committee has recommended that the generating plant in the central power house be extended by the provision of a 5,000-KW. turbo-generator, boilers, &c., at an estimated cost of £100,000. with £10,000 for contingencies, and that an extra-high-tension main be laid from the central power house to Liverpool Road, at an estimated cost of £2,400. At a meeting of the T.C., at which the work of the department was severely criticised, consideration of the proposals was adjourned pending a report by Sir John Snell.

YEAR'S WORKING.—The total revenue of the electricity undertaking for the past year amounted to £65,663, an increase of £6,000 on the previous year, but the increased expenditure was nearly £9,000. The gross profit was £19,664, but, after providing for the redemption of loans and payment of interest, the net loss was £3,769, increased to £3,993 after paying for new meters out of revenue. The total debit balance is now £10,829. The loss is accounted for chiefly by the increased cost of coal and higher wages.

Sutton (Surrey).—PRICE INCREASE.—The South Metropolitan Electric Tramways and Lighting Co. has amended the tariff for electricity as from July 1st, as follows:—Lighting, 6d. per unit, plus 10 per cent.; power and heating, an extra ½d. per unit. The minimum charge is to be 13s. 4d per winter quarter, and 6s. 8d. per summer quarter.

Walthamstow.—YEAR'S WORKING.—At a meeting of the U.D.C., the chairman of the E.L. Committee stated that the profit on the undertaking for the past year was £1,144, compared with a loss for the previous year of £6,665. The income increased from £45,788 to £53,722, and the output increased by 828,000 units. In spite of the increased output, the cost of coal was £381 less, being 2·81 lb. per unit, against 3·07 lb.

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Totnes.—Price Increase.—The Electricity Supply Corporation has applied to the B. of T. for consent to advance the price of electricity to 9d. per unit.

Wakefield.—Price Increase.—The Electricity Committee has increased the price of electricity by 1½ per cent. for each advance of 6d. per ton in the price of coal, and ½ per cent. for each advance of 1s. per week, or fraction of 1s., granted to workmen.

Loan Sanction.—The City Council has received the sanction of the L.G.B. to the borrowing of £6,000 and £958 for electricity purposes.

Weston-super-Mare.—Price Increase.—The E.S. Co. has advanced the price of energy on the flat and maximum demand rates by 1d. per unit, the latter to apply to the low-rate units, and by ½d. per unit for heating and power.

Weybridge and Walton-on-Thames.—Price Increase. The Urban E.S. Co. announces that from the quarter ending September the price of energy for power and heating will be advanced by 10 per cent.

Wolverhampton.—Price Increase.—The E.S. Committee recommends that after the June readings the charge for the supply of electricity to all ordinary consumers not under contract be further increased by 10 per cent., making a total of 60 per cent. over pre-war charges.

TRAMWAY AND RAILWAY NOTES.

America.—State Railway Control.—The U.S. Congress has passed a Bill authorising the President to assume control of urban and interurban electric lines conveying workpeople to and from shipyards engaged on Government work. The Bill specifically excludes "any street or interurban electric railway which has as its principal source of operating revenue urban, suburban, or interurban passenger traffic or sale of power, heat, and light, or both."

Burnley.—Year's Working.—The Corporation tramway department has made a profit for the past year of £6,389. This has been placed to the reserve fund, which now amounts to £34,196.

Ilford.—Sandberg Process.—The Tramways Committee has decided to have 50 joints in its tramway track treated with the Sandberg oxy-acetylene rail-hardening process, at a cost of £2 per joint.

Liverpool.—Strike.—According to the *Evening News*, a large number of tramway workers struck work on Tuesday, dislocating the service.

In the early morning the conductresses on strike held up munition workers' cars, pulled conductresses who were at work off their cars, threw mud at the drivers, cut the trolley ropes, and broke some of the windows of the cars. The strikers demand an arbitration board, comprising five representatives of the Tramways Committee and five employés, with a neutral chairman, and also the same pay for a 48 instead of a 60 hours' week.

London.—L. & S.W. Railway.—It is announced that as from July 22nd the L. & S.W. Railway Co. is entirely abolishing its second-class rail bookings. Holders of second-class season tickets expiring after July 21st will be given the option of exchanging to first class by a proportionate payment, or should they elect to travel third class a *pro rata* allowance will be made. It is intended to convert the existing second class stock to third class as soon as possible; meanwhile, second-class carriages after July 21st will be available for third-class passengers.

Pontypridd.—Annual Accounts.—The working of the U.D.C. tramway undertaking for the year ending March 31st, 1917, resulted in a gross profit of £6,843. The income amounted to £23,989, and the working expenses to £17,142.

Walsall.—Year's Working.—The net profits of the Corporation tramways, including motor-buses, for the past year, amounted to £16,515. It has been decided to appropriate £5,000 to the relief of rates, to put £4,895 to a special reserve account for motor-omnibuses, and to carry forward £6,620.

TELEGRAPH AND TELEPHONE NOTES.

Germany.—The Secretary of State of the German Post Office said in the Reichstag, on introducing the Budget:—"The construction of new lines for telephone and telegraph traffic is, unfortunately, not possible owing to the lack of building materials and staff. The heavy snowstorms and hard frosts of this winter have disturbed telegraph and telephone working worse than has been the case for a long time. Only by bringing up all available forces, and by military help, has it been possible to repair the heavy damage. It is apparent that our open wires are insufficient, and that it will be necessary, after the war, to extend the cabling of at least the main trunk lines on a regular plan. After the war, moreover, automatic and semi-automatic working of telephone traffic must be again extended."—*Telegraph and Telephone Journal.*

Largest Wireless Station?—Buenos Aires reports that the wireless station there will be the biggest in the world. It includes three gigantic towers approaching in size the Eiffel Tower. —*Wireless Press.*

Post Office Employés.—The Postal and Telegraph Clerks' Association has decided to affiliate with the Labour Party. —*Evening News.*

Secret Wireless.—A very grave feature of the sinking of the hospital ship *Llandovery Castle* is the strong circumstantial evidence that the U-boat had been advised by wireless of the vessel's sailing. It has always been strongly suspected that the Germans still have secret wireless stations on the Coast of America. —*P.M. Gazette.*

Sweden.—According to the *Economist*, the Swedish Government proposes to acquire the Stockholm Telephone Co. It is said that the deal will be advantageous to the shareholders, but that, on the other hand, the public is likely to suffer, as telephone charges will be considerably enhanced.—*Telegraph and Telephone Journal.*

Telegraph Delays.—Complaints have appeared in the daily Press regarding serious delays that have been experienced in the transmission of inland telegrams, the time occupied in some cases exceeding that taken by train or tramcar to cover the distance. The delays are officially attributed to the influenza epidemic, depletion of staffs, and the shorter hours during which telegraph offices are open.

United States.—A joint appeal of the Secretary of Labour, Mr. Wilson, and Mr. Samuel Gompers, President of the American Federation, has been successful in preventing a nation-wide telegraph strike. Mr. S. J. Konenkamp, President of the Commercial Telegraphists' Union, in postponing indefinitely the "walk-out" voted by an overwhelming majority of the men, after the Western Union had refused to abide by the decision of the Taft Labour Board, relies upon prompt action by Congress to give the President authority to take over the telegraph and telephone systems. The Administration, while desirous of obtaining the specific approval of Congress, holds that the President has already legal authority to take over the lines as a war measure.—*The Times.*

Wireless Operators on Board Ship.—At the meeting of the Marconi International Marine Communication Co., Ltd., last week, the chairman said that the recent threat of the wireless operators to strike was due to the delay of the Ministry of Shipping in agreeing to an application for authority to increase the wages of operators. Although the latter were employed and paid by the company, their remuneration was provided by an agreed subsidy from the shipping companies, and without the concurrence of the shipowners the Marconi Co. could not deal with any question of increased pay, except on its own responsibility. The company had conferred with the representatives of the Association of Wireless Telegraphists, and a complete agreement had been arrived at.

Referring to the heroism of the wireless operators, Mr. Isaacs described, as a typical example, a case in which, after the operator on board a ship attacked by a submarine had obtained a promise of immediate assistance from a land station, he refused to leave his post, because he hoped to get into communication with a ship nearer at hand, although his ship was being shelled, and he was in a very exposed position. He was killed by a shell at the moment when he had attained his object, and the ship, with its crew of 45, was, in fact, rescued by the American cruiser which he had summoned at the cost of his own life.

CONTRACTS OPEN AND CLOSED.

OPEN.

Gillingham.—July 22nd. B.C. One 640-B.H.P. combined Diesel engine and alternator. See "Official Notices" to-day.

London.—L.C.C.—The Highways Committee recommends that tenders be invited for the supply of field coils, machined bronze bearings, armature coils, plough carrier brackets, magnetic brake coils, and accumulators for use in the tramways department.

CLOSED.

Australia.—New South Wales.—P.M.G.'s Department:

4 miles 330 yd. paper-insulated lead-covered conductor cable, 800 pairs £1,572 per mile; 1,540 yd. paper-insulated lead-covered conductor cable, 600 pairs, £1,202 per mile; 2 miles 1,100 yd. paper-insulated lead-covered conductor cable, 500 pairs, £1,004 per mile; 4 miles, 880 yd. paper-insulated lead-covered conductor cable, 400 pairs, £876 per mile; 1 mile submarine telephone cable, 7 pairs, £500 per mile; 880 yd. submarine telephone cable, 14 pairs, £709 per mile.—Western Electric Co., Ltd.

Victoria.—P.M.G.'s Department:—

8 miles 184 yd. paper-insulated lead-covered conductor cable, 400 pairs, £876 per mile.—Western Electric Co., Ltd.

Queensland.—P.M.G.'s Department:—

1 mile 140 yd. paper-insulated lead-covered conductor cable, 800 pairs, £1,572 per mile.—Western Electric Co., Ltd.

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SOUTH AUSTRALIA.—P.M.G.'s Department :—
916 yd. paper-insulated lead-covered conductor cable, 400 pairs, £876 per mile; 880 yd. silk and cotton-insulated switchboard cable, £274 per mile; 3 miles 300 yd. paper-insulated lead-covered conductor cable, 75 pairs, £398 per mile.—Western Electric Co., Ltd.

WESTERN AUSTRALIA.—P.M.G.'s Department :—
1 mile 99 yd. paper-insulated lead-covered conductor cable, 800 pairs, £1,572 per mile; 1,179 yd. paper-insulated lead-covered conductor cable, 600 pairs, £1,202 per mile; 1,290 yd. paper-insulated lead-covered conductor cable, 500 pairs, £1,004 per mile; 2 miles paper-insulated lead-covered conductor cable, 400 pairs, £876 per mile.—Western Electric Co., Ltd.

The above are subject to adjustment for any variation either up or down in the prices of copper, lead, tin, antimony.—*Tenders.*

Bradford.—Electricity Committee. Recommended tenders :
C. A. Parsons & Co., Ltd.—12,000-KW. turbo-generator.
J. Wolstenholme & Son, Ltd.—Circulating water pipes and "specials."
Mirrlees Watson Co., Ltd.—Air pump and water extraction pump for auxiliary condensing plant.
Stewart & Lloyds, Ltd.—Steam pipes for new turbo-generator.
Holden & Brooke, Ltd.—Vertical-spindle motor-driven centrifugal pump.
Hick, Hargreaves & Co., Ltd.—Surface condensing plant for Valley Road works.
Thwaites Bros., Ltd.—Air exhauster in connection with the suction ash plant.

Tramways Committee :—
Hadfields, Ltd.—Point fittings at schedule prices.

Cape Town.—Corporation. Electric light wiring of the extension to the Early Morning Market, Sir Lowry Road, viz :—

C. H. Pead (accepted)	**£192**
Edward A. Shaw & Co.	197
R. G. Jack	228
Cunningham & Gearing	249
Gilmour & Co.	265

Cavan.—Messrs. Ferguson & Co., Dublin, have secured the contract, at £2,172, for the installation of electric lighting in Cavan Workhouse.

London.—The Metropolitan Asylums Board has accepted the following tenders :—Electrical Contracts and Maintenance Co., Ltd., installation telephone switchboard, £248; Keith & Blackman, Ltd., electric fan, £27, (less cost of fixing by the Board's own staff).
The Metropolitan Water Board has accepted the tender of Pope's Electric Lamp Works, Ltd., for electric lamps for 6 months.

Newcastle-under-Lyme.—Accepted tender :—
One 150-KW. converter and necessary high and low-tension switchgear.—British Westinghouse Co., Ltd., £2,107.

New Zealand.—Public Service Stores, Wellington :—
700 extension bells, 1,000 ohms, and 500 6-conductor cords, mounted, £90.—Richardson, McCabe & Co., Ltd., £473; 100 sounders P.O. pattern, £287.—P. R. Baillie & Co.; 2,000 switchboard plugs, £275.—A. D. Riley & Co., Ltd.; 10,000 galvanised telegraph arm combiners, £291.—P. & D. Duncan, Ltd.—*Tenders.*

Sheffield.—Electricity Department :—
Dewshurst's Engineering Co., Ltd.—250 steel boiler tubes; Cole, Marchent and Morley, Ltd.—Eight new valves and spindles.

Health Committee :—
Edison Accumulators, Ltd.—Two British built chassis.

Walsall.—T.C. Electricity Department. Accepted tenders :
Brush Electrical Engineering Co., Ltd.—Two 350-K.V.A. transformers, and one 100-K.V.A. transformer, £929.
British Westinghouse Co., Ltd.—Three switch cubicles for the above transformers, £345.
W. Wistance, Ltd.—Work in connection with use of canal water for condensing purposes at Birchills generating station, £150.
Cross & Cross, Ltd.—Steel carrier for conveying main across canal, £168.
Vacuum Oil Co., Ltd.—700 gallons transformer oil.

Wolverhampton.—Electricity Committee :—
Staveley Coal & Iron Co.—20 tons of flat c.i. plates, £7 15s. per ton.
Gibbons, Bros.—Platform, hand-railway, stairway, and ladder for the second 5,000-KW. turbo set, £230.
Siemens Bros.—Two E.H.T. switch panels, £160 and £165.

FORTHCOMING EVENTS.

Tramways and Light Railways Association.—Friday, July 12th. At 3 p.m. At Caxton Hall, Westminster. Annual Congress.

Junior Institution of Engineers (Midland Section).—Saturday, July 13th. Visit to Ocker Hill Pumping Station. Meet at Snow Hill Station, Birmingham, at 1.50 p.m.

Electrical Power Engineers' Association (Northern Division).—Thursday, July 18th. At 7 p.m. At the Grosvenor Hotel, Deansgate, Manchester. General meeting.

OUR HALF-YEARLY INDEX.

As it is necessary to effect every possible economy in paper consumption, the Index to Vol. 82 of the ELECTRICAL REVIEW, which will be printed in the course of a few weeks, will be supplied only to those who, through the post, specially apply for it. To such it will be supplied for 3d., post free. Any reader or advertiser at Home or Abroad, who requires a copy for binding, or for other purposes, is asked to make application therefor promptly to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

NOTES.

Channel Tunnel Approved.—The International Parliamentary Commercial Conference, representing all the Allied countries, on July 4th unanimously adopted the following resolution, after a paper had been read by Sir Arthur Fell, M.P., on the commercial advantages of the Channel Tunnel :—"Considering the advantages which would accrue from increased facilities for the transport of passengers and goods between France and Great Britain, this conference suggests to the Governments of those countries that the construction of the Channel Tunnel should be proceeded with as soon as possible."—*Evening News.*

Fruit Drying by Electricity.—According to the Bulletin of the Swiss Association of Electricians, the drying or evaporation of fruit and vegetables by electrical means has been successfully accomplished in Switzerland. Trials carried out at the instance of the Government of various apparatus showed that electric evaporation apparatus could compete with those using coal only when the price of energy did not exceed 3 to 4 centimes per KW.-hour. Such a price was only possible with the hydro-electric companies' surplus energy, and fortunately in 1917, in the period of "high water," a considerable surplus was available during the night, which allowed of its supply at the price named. Some companies even, for patriotic motives, agreed to supply current at a lower price, the works of the Canton of Barich offering it during the night only at 1 centime per KW.-hour. Others have gone beyond this even, and decided to supply their customers with energy during the night gratuitously.

Educational.—MANCHESTER MUNICIPAL COLLEGE OF TECHNOLOGY (UNIVERSITY OF MANCHESTER).—The session 1918-19 opens on October 3rd. Matriculation and entrance examinations will be held in July and September. Matriculated students may enrol for 1918-19 from August 1st, 1918, and if under 18 years of age are eligible for membership of the O.T.C. Further particulars are given in our advertisement pages to-day.

The Storage of Coal.—Although the storage of coal has become of unusual importance under war conditions, it should not be considered only as a war expedient, and plans for storage should be made in connection with every industry that uses coal as one of the adjustments necessary to stabilise a fundamental industry of the country. An abstract of an unusually valuable paper, which was read before the Western Society of Engineers, Chicago, on April 15th, by Mr. H. H. Stock, on why coal should be stored; the practicability of storage and effect of storing on the coal; systems of storage employed; cost per ton and precautions to be observed, appears in *Power* (Vol. XLVII, No. 23). A reason often advanced against storage is the increased cost involved, but a suitable readjustment of mining and transportation conditions should mean a lower cost for mining and transportation that would, at least partly, offset the additional necessary cost for storage, and should not increase the cost to the consumer much, if at all.

Electric Welding for Ships.—The electric welding tests being conducted by the Emergency Fleet Corporation at the Federal shipbuilding plant at Newark, New Jersey, are the subject of a report made by Mr. Mason, who is directing the tests, the objects of which are to demonstrate the economy of welding in time and money, and its adequacy to build a staunch ship. Mr. Mason says that electric welding in its various phases has for years been employed in shipyards, and the proposal to extend its use to the major part of ship construction has met with gratifying approval from the shipbuilder. It has been necessary to design a ship to suit the material available, without encroaching on that needed for the regular ship construction at the plant. The hull will have the outline, dimensions, and strength conforming to the ships the Federal company is building.

Briefly, the programme is to assemble a hull rapidly by spot welding. The structure then becomes a house favourable for work in all weather and at night, in which the completion of the ship may go on. After the material is thus assembled, so that it is sufficiently strong to hold its shape, the work is completed by arc welding all seams. Roughly, the spot welds are to be about 10 in. (25·4 cm.) apart.

One quarter of the structure will be riveted, the other three-fourths welded, so that the tests of strength will afford a basis of comparison.

Electric welding offers a great field for lightening a ship. In this design various views of this opportunity will be tried out; ultimately 10 per cent. of the steel may be eliminated.

The manufacture of the spot-welding yoke and appliances is placed in the hands of the Universal Electric Welding Co. of Long Island City. The early stages of the arc welding are to be accomplished by the Wilson Electric Co., which was so successful in the work on the German ships' repairs, but it is the intention to call in all men with ideas and apparatus, and to give them a field to test out in actual work. To this end Prof. Adams's Committee is searching out all available talent.

An adequate system of testing the work when done is under consideration. The primary test will consist of filling the hull with water and shifting the points of support under continual and close scrutiny; as one-quarter of the whole will be riveted in the normal manner, there will always be a gauge of comparison between this portion and the portion which is welded. Likewise, there will be a chance for comparison of the two forms when subjected to abuse by bumping with rams and in various other ways.

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Machine Tools and their Electrical Gear.—One of the questions still to be seriously tackled by machine tool builders is the design of direct-coupled motor-driven machines. At present the motor and switch gear cannot be said to be in any way incorporated in the design of the machine. Indeed, not infrequently they are attached in a way which at first sight suggests that the job has been done by the erectors and not by the drawing office. This is not unnatural with small tools. It applies particularly to control switchgear, and is the case not only with medium-sized machines, where the design is usually standardised for belt-driving, but with the largest machines. Rarely does the motor and switchgear seem part of the general design of the machine. The best direction for the solution of the problem would now seem to be the use of more or less standard motors but with improved attachment between motor and machine tool. The incorporation in the design of control and switchgear generally leaves even more to be desired. Present-day control gears with push-button control afford special means for increasing the handiness of the machines. This is particularly true of large machines. They can be controlled from two or more stations electrically in a much simpler manner than if the control were mechanical. The tendency at present, however, seems to be to use the control levers and shafts which serve for a belt-driven machine, and simply attach the switches thereto. In many cases it would seem possible to install simple switches near the point of application of the movement, and to transmit the power electrically. It is recognised that all controllers should be as close as possible to the working position of the operator. The difficulty, especially in large machines where the working position is movable, is to provide suitable connections between the controller and the motor. As this implies usually multiple-cored cable, and bare conductors are not allowable, provision is necessary for taking up any slack in the cable and avoiding the insulation being frayed against sharp edges or destroyed by trapping between moving parts of the machine. The investigation of the possibilities of electrical apparatus would certainly be quite profitable to machine tool designers, especially those connected with the larger machines.—*American Machinist.*

Sports Meeting.—The London Munitions Workers' sports are to be held on the Herne Hill track on Saturday, July 27th, at 3 p.m. In connection with this sports meeting a very varied programme has been arranged, including four handicap events, eight scratch races, and several novelty items. Of the last named, the ladies' tug-of-war should be well worth seeing. Entries have to be sent in not later than July 15th, and full particulars may be obtained from the Hon. Sports Secretary, 24, Great Russell Street, W.C. 1.

Canadian Water Power.—"Water Resources," Paper No. 20 of the Dominion Water Power Branch of the Canadian Department of the Interior, which has just come to hand, deals with the interests dependent on power derived from the Winnipeg River. The City of Winnipeg, although in the "Middle West," remote from other large centres of population, and from the sources of many raw materials, ranks as the fourth manufacturing city in Canada; between 1900 and 1915 the capital invested increased by 1,480 per cent., the value of its products by 1,770 per cent., and the persons employed by 637 per cent., while the cost of power diminished by 76 per cent., the last being a most important factor in the development of the city and its industries. Cheap hydro-electric power has superseded practically all the private fuel power plants; apart from lighting, heating, and traction, the total hydro-electric power connected is 66,740 H.P., and the fuel plants constitute only 3 per cent. of the total. The city is at the meeting of five railway systems, and is the gateway to one of the greatest markets in the world.

The total capacity of the Winnipeg hydro-electric plant at Point du Bois in 1915 was 47,660 H.P. The total capital expenditure was $7,339,538, the total revenue $976,854, and the gross balance $648,972; after paying interest, sinking fund and depreciation, there remained a net surplus for the year 1914-15 of $79,191, practically wiping out a deficit in the earlier years of the undertaking. The capital outlay was about $150 per H.P. installed; additional plant of about 57,760 H.P. is being installed, which will bring down the capital cost per H.P. very considerably. The peak load in 1914-15 was 25,400 H.P., the number of consumers 32,953, and the KW.-hours generated, 70,743,274.

The report deals in detail with the Winnipeg Electric Railway Co., which has hydro-electric plant of 22,500 H.P. and steam plant of 22,000 H.P., and carries 58 million passengers a year, besides supplying light and power, the total connected load being over 99,000 H.P. A number of smaller undertakings in the district are described in the report, which also gives a quantity of economic information. In 1914 about 136 million KW.-hours were actually sold or used. The capacity of the river with full regulation is equal to a peak load of 836,000 H.P., and the total peak load in 1914 was 64,300 H.P.; allowing for an annual increase of 8 per cent., the whole power of the river will be required in Greater Winnipeg alone in 30 years.

Corrosion of Cast-Iron.—The experimental work done for the purpose of a report upon the corrosion of cast iron water mains laid only two years previously in the soil at Esch, in the Grand Duchy of Luxemburg, is described by P. Medinger in the *Journal für Gasbeleuchtung*, February 16th:—

The pipes had become as soft as hardwood, and could be cut with a clasp knife. An analysis of the original metal showed metallic iron 92·64 per cent., carbon 3·42 per cent., while that of the corroded pipes showed metallic iron varying from 30·5 per cent. to 44·2 per cent. only, and carbon 24 per cent. When the pipes were first taken up little or no rust was visible, but the iron had been changed into a powdery metallic form. The pipes were laid in yellowish-grey heavy loam, in which there was a good deal of gypsum; the loam contained 7 per cent. of calcium bicarbonate and 19 per cent. of water, which held in solution 2·05 gm. of calcium sulphate per litre; there was scarcely any chlorine present.

From elaborate electrical tests the author proved that a difference of potential as low as 0·5 volt produced between the carbon and the iron would cause a flow of 0·8 milliampere through the pipe, and he attributes the rapid deterioration to the electrical action in the presence of the electrolyte formed by the solution of the salts in the soil with rain water. This solution is kept in permanent contact with the pipes owing to the retentive character of the soil.

A New Application of Electrolysis.—A new small industry has just been started in Valencia, Spain. In the Valencia district a large number of small decorative articles are manufactured in clay, wood, glass, and *papier-maché*, and some of these are now being encased in a thin "skin" of metal, which greatly improves the appearance and permanence of the articles.

The method employed is simple. A small compressor supplies air at a pressure of about seven atmospheres to a receptacle filled with metallic powder (generally lead, for cheapness). At the moment the metallic powder emerges from the jet, it is melted by an oxy-hydrogen flame, and a spray of molten metal encases the object to be "metallised," which is placed on a revolving platform. The object then goes to the electrolytic bath, and receives its new skin of copper, silver, or gold. Glass articles are first treated by a sand-blast to ensure the necessary roughness for the adhesion of the lead. A new type of Leyden jar is being manufactured, in which the old silver-foil is replaced by a homogeneous film of silver.

The firm of Arturo Piera, Valencia, is the Spanish pioneer in this class of manufacture, and is already supplying a large number of carvings, lamps, candelabras, and statuettes for interior decoration at Madrid.—*La Energia Eléctrica.*

The Batti-Wallahs.—On Monday, after a lapse of 18 months, 40 members of the Batti-Wallahs' Society attended a lunch meeting at the Holborn Restaurant. Past-President L. M. Waterhouse was in the chair. It was decided that a further lunch be arranged for Monday, September 16th, to be followed by similar functions on the third Monday of each subsequent month.

Charges for Public Services.—Moving the second reading of the Statutory Undertakings (Temporary Increase of Charges) Bill, Mr. Wardle said it had been framed to give effect to the recommendations of Select Committees appointed to consider the case of gas and tramway undertakings whose position had been adversely affected by the war, and its provisions applied also to water and electricity supply undertakings. In the case of companies, intervention was not to take place until the dividend on the ordinary stock or shares had been reduced to half the standard or maximum rate, or half the average dividend for the three years before the war, whichever were the smaller; the sliding scale or maximum charge would then be suspended, and the company could charge such prices as might be held by the Board of Trade sufficient to cover costs of production and to pay a dividend at the rate above mentioned. In the case of municipalities, the prices might only be increased sufficiently to prevent loss, and not in any event more than 50 per cent. The Bill was to have effect for two years after the end of the war.

Strong exception was taken to the proposals in various quarters on the ground that the relief given was almost negligible, capital could not be obtained except on ruinous terms, and that the gas companies were subject to competition. The motion was agreed to, and the Bill referred to a Committee of the whole House.

Writing to the *Financial Times*, Mr. T. W. Cole, secretary to the Provincial Electric Supply Committee of the United Kingdom, points out that:—"Up to the present the statutory rates for electric supply embodied in the various Provisional Orders of the companies can be raised by the Board of Trade every five years on application by the company provided proper grounds are shown for such revision. The arrangement has in general worked satisfactorily to all parties. This Bill, however, curtails the power of the Board of Trade, and allows it to grant such increases (if war losses are the plea—which, of course, includes practically all present day cases) only if the dividends are falling below one-half of the pre-war figure. And then the increase must only be sufficient to bring the dividend up to half the pre-war dividend. In other words, Parliament is taking the position that whatever are the war losses of a company, the shareholders must be content to lose half their income. Further, considering that the electric supply industry is a 'key industry' (in the words of a Board of Trade Committee) and that the money of the shareholders is performing a national service (and especially in view of the fact that munitions works and factories generally which are making big profits are dependent on the supply company for the power) it is most inequitable that such shareholders should have no redress until they are half ruined, so to speak. It is the more deplorable since the electric supply shares are held usually as permanent investments by small holders who depend on the same for their incomes or part incomes. The fact that their money is invested in national and public 'utility works' should itself entitle them to protection, whereas apparently they would be better off if they held investments in one of the much-deprecated 'luxury trades.'"

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Measuring Rapidly Varying Temperatures.—Ordinary thermometers are too sluggish to follow rapid variations of temperature. It has recently been possible to construct apparatus by which variations of temperature with a frequency as great as 10 times a second may be measured. The changes of temperature in the cylinders of steam engines or explosion engines can thus be measured. The temperatures are recorded on a galvanometer connected to platinum-iridium wires of 0·02 mm. diameter consisting of 65 parts of platinum and 35 parts of iridium, the deflection depending on the resistance of the wires, and, therefore, their temperature. These wires can be used up to a temperature of 1,850° C.—*Elektrotechnik und Maschinenbau.*

Extinction of Fires in Transformers.—The firm of Wintrich & Goetz, Bensheim, has designed an automatic apparatus for extinguishing fire, that is particularly adapted for use with transformers, oil switches, &c. The apparatus is in many respects similar in appearance and design to the "Minimax" fire extinguisher, from which it differs in the method of producing the pressure to eject the fluid from the interior and in the nature of the fluid used. Instead of producing the gas pressure by a chemical reaction, a small container containing compressed nitrogen is screwed into the top of the apparatus. This gas is released by striking a knob, which in turn hits a sharp pin that punctures a disk that closes the gas container.

The fire-extinguishing liquid seems to be a volatile incombustible carbon compound, which by its volatilisation withdraws heat so rapidly from the conflagration that further combustion is impossible. The liquid is perfectly non-conducting to electric currents, as has been shown by tests at 40,000 volts, in which the jet was projected against an arcing horn discharger.

In order to render the apparatus automatic in its action, it is set up so as to feed a pipe-line running through the various transformer and switch chambers to be protected. In each chamber two outlets from the pipe are provided, one near the ceiling over the apparatus, and one near the floor. Both these openings are closed by fusible plugs. Connected to the upper opening by a fusible wire is a weight. If the temperature at the top of the chamber rises owing to a conflagration, the fusible plug and the fusible wire melt; the first opens the passage for the extinguishing fluid, and the second releases the weight. This releases a cam holding a weight suspended above the fire extinguisher. This weight falls on to the knob that punctures the gas container, and the fluid is forced through the pipe-line and is poured over the centre of the fire. If burning oil overflows on to the floor in any of the chambers, the lower fusible plug opens, and the liquid issues from this outlet as well as from the one in the ceiling.—*E.T.Z.*

Lignite as Fuel.—Previously to the outbreak of war, Germans were experimenting in Devon on the utilisation of lignite for generating power. The lignite deposit is in the Bovey Tracey basin. In March, 1914, Dr. Lambrecht, the leading mineralogical adviser to the German Government, submitted a report to the Deutsche Bohrgesellschaft, on the property and works, in which he referred in the highest terms to the results and prospects of generating electrical energy at very low cost. This view is confirmed by an experienced English mineralogist, and though the lignite has the great disadvantage as fuel of being high in sulphur, valuable by-products could be obtained from it.

The Controller of Coal Mines has issued a circular in which he directs attention to the importance of developing the resources of any alternative kinds of fuel, in view of the drastic economy in the use of coal which is necessitated by the release of miners for service in the Army, and the increasing demand of our Allies. Peat which is not cut by the end of July is not likely to be in fit condition for use during the winter. In the circular directions are given as to the method of cutting, drying, and preparing peat for fuel.—*The Times.*

Possibilities of the Electrochemical Load.—At a recent meeting of the new-business men of the Ohio Electric Light Association, C. A. Winder, of Niagara Falls, discussed the possibilities of this load from the standpoint of the average company. In considering the power consumption, Mr. Winder pointed out that aluminium consumes the largest amount of power per lb. of finished product, approximately 12·5 KW.-hour, and is extremely dependent upon the low cost of power. Aluminium manufactories may exist a thousand miles from the centre of gravity of distribution, provided that energy can be obtained at $20 to $25 per KW.-year. Artificial abrasives are next, with an energy consumption per lb. of product of about half that for aluminium. The weight of finished material, however, is high, so that if the haul of the finished material were 2,000 miles (3,218 km.), it is doubtful if an artificial abrasive plant could exist if power were free. Under the prevailing price of water power a 500-mile haul is given as a maximum. Calcium carbide, ferro alloys, sodium, chlorates, and phosphorus are stated to be in practically the same position as artificial abrasives—namely, all require power at the prevailing water-power rates and within close proximity to the centre of gravity of their consumption.

Ferro-silicon, from an engineering standpoint, can be made economically under normal circumstances in furnaces of about 10,000-H.P. input, and the author states that apparently those companies now entering this field are planning on small furnaces. Such engineering, however, it is pointed out, cannot withstand the rigours of competition that will follow the war, the product now being very high in price. Low frequency is a prime requisite to the successful operation of ferro-alloy, calcium carbide, and similar furnaces.

It is stated that if we consider off-peak power for such loads as artificial abrasives, ferro-alloys, and calcium carbides, it is found that an 80 per cent. load factor will so greatly increase the overhead costs that the power will have to be obtained without any cost at all to be attractive. Daily off-peak power for a carborundum furnace is absolutely out of the question, as the carborundum furnace operates for 36 hours. Neither, for the same reason, can the graphite furnace be considered. Valley power coming in periods of eight months is of economic possibilities that are not attractive to the average electrochemical industry.

The smallest user of power per ton output is, perhaps, the caustic and chlorine industry, and it is, consequently, the most affected by long freight hauls. Therefore these materials are manufactured near the market, and are two of the few electrochemical industries that the central station, perhaps, may hope to attract. The only difficulty is primarily one of rates.

The only classes of power users that the modern central station in large cities should solicit are japanning ovens, brass-melting and steel-melting furnaces where good scrap is available and other conditions correct, as well as industrial power-consuming devices. —*Electrical World.*

British Patents for German Inventors.—In the House of Commons Sir Albert Stanley, in answer to Sir E. Carson, who asked whether patent agents were allowed to enter into communication with and receive communications from inventors in Germany who desired to protect their inventions in this country by filing specifications in the Patent Office, said that patent agents were permitted to enter into and receive the communications referred to by general licence of the Board of Trade. Such communications were made through agents in neutral countries, and were subject to censorship in the ordinary way by the Postal Censor. Whether they should be allowed to continue was being carefully considered by the Government.

On a later occasion he stated that 1,310 applications for the grant of patents had been received from enemy subjects since the outbreak of war, of which 944 had been accepted.

Reconstruction in Industry: Whitley Councils.—The formation of Joint Industrial Councils on the lines of the Whitley Report is steadily progressing. Councils in the pottery and building industries are already at work, and during the present month the following newly-formed Councils will hold their first meetings:—The Heavy Chemical Trade, Gold, Silver and Allied Trades, the Rubber Industry, Match Manufacture, the Silk Industry.

In the following industries Provisional Committees have already drafted constitutions of proposed Industrial Councils, which have been sent out to the various Associations concerned for their approval:—Baking, Cable-Making, Commercial Road Transport, Electrical Contracting, Furniture Making, Leather Goods and Belting, Vehicle Building.

A constitution for the printing industry has been drafted, and will shortly be sent out for approval to the Associations concerned. When these constitutions have been approved, the first meetings of the newly-formed Councils will be arranged with as little delay as possible.

In the following industries preliminary conferences as to the formation of Industrial Councils have taken place, and proposals to proceed with the drafting of constitutions have been approved:—Bobbin Manufacture, Boot and Shoe Manufacture, Electric Power and Supply, Roller Engraving, Woollen and Worsted Industry.

In some 20 other industries the question of the formation of Joint Industrial Councils is being given careful consideration, and in a number of cases proposals to summon joint conferences of Employers' Association representatives and Trade Union representatives have been approved. There are many of the nation's industries, of course, in which the organisation on the side either of the employers or of the workers is not sufficiently representative as yet to admit of the formation of Joint Industrial Councils at once. In these industries the "Whitley idea" is being carried out by the formation of temporary bodies which are termed Interim Industrial Reconstruction Committees. They will deal with the many urgent problems attached to the re-establishment of their representative industries on a peace basis, and, in addition, will improve the organisation of their trades where it is at present unrepresentative. Later it is hoped they will be in a position to pass from their temporary nature, and become full Joint Industrial Councils. Towards the formation of these temporary bodies the Ministry of Reconstruction has already made considerable progress, and Committees have already been established in some 20 trades and industries. Fuller details of progress in this matter will be available shortly.

Fuel and Light Ration.—Commenting on the new Household Fuel Order, the *Times* points out that in converting from coal to gas or electricity some curious discrepancies arise. For instance, in the case of a householder having seven occupied rooms, who takes 5½ tons of coal, he can have either 18,750 cb. ft. of gas and 200 units of electricity, or 15,000 cb. ft. and 120 units, the latter being evidently much the worse alternative. The reason is to be found in the fact that in the lighting allowance 15,000 cb. ft. of gas is taken as the equivalent of only 240 units of electricity, whereas, when the coal allowance is converted into gas or electricity, 1 ton equals only 15,000 cb. ft. of gas but 800 units of electricity. Hence, if a man taking 6 tons of coal decides to convert ½ ton of it into gas and takes his lighting allowance half as gas and half as electricity, he gets 15,000 cb. ft. of gas and 120 units of electricity; but if he converts a ¼ ton of his coal into electricity he gets 200 units, and the remaining ¼ ton, together with all his lighting allowance taken as gas, gives him 18,750 cb. ft.

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Operating a Turbine with Stripped Blading.—Mr. H. S. Reeder, writing to *Power*, relates an experience due to losing six rows of the low-stage blading on a 500-KW. unit. The accident occurred with about 40 per cent. load on the turbine just after the generator had been synchronised with another unit, and at the time the attendant was building up the vacuum on the condenser. The stripping of the blading was caused by water being forced up into the low-pressure end of the turbine by the priming pump after the circulating pump had stopped owing to a blown fuse on the motor drive, a jet condenser being used. After removing the stripped and distorted blading from the cylinder and spindle, the turbine was put back in service and operated for several months before renewing the low-stage blading, it being capable of pulling the full rated capacity of the generator, although at a considerable increase in steam consumption.

Wages in Electricity Undertakings.—A mass meeting of the Electrical Trades Union, the National Union of Enginemen and Mechanics, the General Workers' Union, and the Workers' Union will be held at Holborn Hall on Tuesday, July 16th, at 7.30 p.m., to consider the report of the Conference on Wages in Generating Stations, Sub-stations, and Mains Departments in the London district.

Rules for Lightning Conductors.—The latest Swiss rules concerning lightning conductors deal in detail with the materials to be used, the principles and methods to be followed during erection, and the policy to be adopted as regards inspection and testing.

Spiral and other "fancy" finials reduce the efficiency of a lightning conductor. Large metal parts outside the building, *e.g.*, ridge plates, metallic roofing, gutters, and rain-water pipes, should be connected to the conductor system, and used as far as possible, instead of special conductor wires. The large surface of such parts makes them more effective in dealing with lightning discharges than the heaviest practicable wires. Large masses of metal inside buildings should be connected to the conductor system at their highest and lowest points. All the higher points of a building should be provided with conductors, since the area protected by one conductor is much smaller than commonly supposed. Chimneys should always be safeguarded, a high chimney being fitted with a metal crown ring, from which conductors run to earth on opposite sides of the shaft.

Solid wires, stranded ropes, or rolled strips of copper or galvanised iron may be used as conductors. Copper conductors and earth wires may be zinc- or lead-sheathed, if desirable. A lead earth wire may be used where there is special risk of corrosion, but it should be not less than 75 sq. mm. in section, and mechanical protection should be provided by a pipe or other means. The dimensions of conductors should be not less than the following values:—

	Copper.	*Galvanised iron.*
Solid wires, minimum diam. ...	6 mm.	8mm.
Stranded rope, minimum section	34 sq. mm.	65 sq. mm.
Stranded rope, minimum diam. of wires.	2·5 mm.	3 mm.
Strip, minimum section... ...	40 sq. mm.	75 sq. mm.
Strip, minimum thickness ...	2 mm.	3 mm.

Accessibility for inspection and repair is an important consideration. Connections should be effective and durable; bends should be avoided; mechanical protection should be afforded where desirable. The connection between conductor and earth wire should be easily accessible to authorised persons only.

Two conductors should be provided on buildings covering areas up to 300 sq. m., with an extra conductor for each additional 200 sq. m. A water-pipe system forms an excellent earth connection. Various suggestions are made for other earth electrodes; these include the use of 10 or 15 m. of strip or wire laid zig-zag or of metal rope splayed out, the minimum cross-sections for iron and copper being as above. Plates 50 × 100 cm. in area and 1 mm. (copper) or 2 mm. (iron) in thickness may be used. Not less than 1 sq. m. of netting may be used with meshes not less than 500 sq. cm. in area, and conductors of the same minimum section as above. Lead wire or strip 75 sq. mm. in section, or lead plates 3 mm. in thickness, may be used where there is much risk of corrosion. A ring earth wire round the building at a depth of 40 or 50 cm., and with radiating branches, is useful where earthing conditions are unfavourable. If the soil is not permanently moist, the earth electrodes should be placed in a layer of moist clay or charcoal, but not in coke or ashes. Service tests, particularly of earth resistance, should be made at intervals not exceeding five years, and much oftener in the case of important buildings.—*Schweizer Elektrotechnischer Verein, Bulletin.*

Fatalities.—On Thursday, last week, after two hearings, a Coroner's jury returned a verdict of "Accidental death due to electrocution" in the case of W. H. Kershaw (42), a station attendant in the employment of Thwaites Bros., Ltd., engineers, Bradford. Evidence was given that Kershaw was working in the transformer sub-station at the engineering works. He knew all the appliances, and the warnings in the room had been drawn up by him. On Sunday he and a labourer were repairing a high-tension cubicle adjoining the station, and the work appeared to have been completed early in the afternoon. In the evening the two men overhauled the mechanism to see that all was in order. Kershaw went to test the high-tension cubicle on which he had been working, first switching on at the main. On then switching off, the indicator on the cubicle showed that the current was partially on. To investigate further, Kershaw went to open the cubicle door, but it would not move. He went to the back and unscrewed a steel plate to gain an entrance. The labourer looked inside, and remarked to Kershaw that the indicating lamp was not showing. Kershaw then entered to try to find the fault, and immediately after there was a flash, and every electric lamp went out. The cubicle was a mass of flame. Kershaw was quite dead when, with assistance, he was extricated. The body was badly burned. Mr. Andrew Ryan, electrical engineer at the works, said it was not Kershaw's duty to remove the back plate, and he should not have done so. It was stated in evidence that Kershaw received a shock at from 3,000 to 6,000 volts, and that it was "practically suicide" for him to be doing what he did.

Idwal Davies (8), of Mardy, was recently killed by an electric shock. He was playing ball near the Lockett-Merthyr Collieries, when the ball alighted on the roof of the electric power station. Davies climbed up to fetch it, but caught hold of a live wire. His right hand and arm were burnt almost away.

Non-Ferrous Metals Act.—The *London Gazette* for July 9th contains a further list of companies, firms, and individuals to whom licences have been granted under this Act.

Plant for Disposal.—Hampstead B.C. invites tenders for the following steam plant:—Two 350-KW. Willans steam alternators, one 350-KW. and one 300-KW. Ferranti steam alternator, three feed-water heaters, &c. For particulars see our advertising pages to-day.

Institution Notes.—Association of Mining Electrical Engineers.—The annual meeting of the North of England branch of the Association was held in Newcastle-on-Tyne. The report of the hon. secretary and treasurer (Mr. T. H. Day), which showed an increase of members and an enhanced cash balance in hand, was adopted. The officers for the ensuing year were elected as follows:—President, Mr. C. A. Nelson, Wallsend and Hebburn Collieries; vice-presidents, Messrs. J. P. Foster (Leeholme), and S. A. Simon (Blackhill); secretary and treasurer, Mr. Thos. H. Day (Benton).

Mr. F. Church, of Tibshelf, has been elected president, and Mr. A. R. Davies, of Bolsover, and Mr. W. Wynes, of Mansfield, vice-presidents of the Midland Branch of the Association.

The I.E.E. Benevolent Fund.—Mr. W. Lang and Sir W. Slingo have been appointed by the Council to be members of the Committee of Management of the Benevolent Fund, in succession to Dr. Alex. Russell and Sir John Snell.

Appointments Vacant.—Assistant engineer and fitter, for the Royal Burgh of Sterling Electricity Works; switchboard attendant, 25s. + 20s. + 12½ per cent., for the Ipswich Corporation Electricity Department; two junior shift engineers (63s)., for the Burnley Corporation Electricity Department; switchboard attendant, 35s. + 15s. 6d. + 12½ per cent., for the Redditch U.D.C. Electricity Works; switchboard attendant, 25s. for the Loughborough Corporation Electricity Works. See our advertisement pages to-day.

Volunteer Notes.—LONDON ARMY TROOPS COMPANIES, VOLUNTEER ENGINEERS.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Corps Orders No. 27 by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Captain of the Week.—Capt. W. Hynam.
Next for Duty.—Capt. W. Darley Bentley.
Monday, July 15th.—Adjutant's Technical Lecture ("Earthworks"), 6.30—7.30.
Tuesday, July 16th, to Thursday, July 18th.—Drills as usual.
Friday, July 19th.—Adjutant's Technical Lecture ("Earthworks"), 6.30—7.30.
Sunday, July 21st.—Commandant's Parade at Waterloo Station, 8.45 a.m. for work at Esher. Dress: Drill order, with haversacks and waterbottles. Mid-day and tea rations to be carried.

C. HIGGINS, *Capt.* R.E., *Adjutant.*

Electric Lamps in Collieries.—During an inspection which was made last week by members of the Midland branch of the Colliery Managers' Association of the Kirkby and Lowmoor pits of the Batterley Co., some interesting information was forthcoming as to the success which had attended the introduction of electric lamps into the workings, the first installation of which was made two years ago. Mr. H. E. Mitton, the manager, forwarded a communication stating that the result had been a large decrease in the number of nystagmus cases. Success depended upon having a very competent man in charge to see that the lamps burned full time, so as to prevent overcharging when they were returned. The electric power plant in the pits includes a 1,250-KW. Curtis mixed-pressure turbo-alternator, the total capacity of the plant at 75 per cent. power factor being 2,240 KW., and the present average output per day 11,500 B.O.T. units.

Static Frequency Doublers.—The static frequency doubler is based upon the superposition of a steady field upon an alternating field. In the form discussed two magnetic circuits are juxtaposed, so that a coil carrying direct current is interlinked with both magnetic circuits. Each of the magnetic circuits contains two coils that are connected in pairs consisting of one coil from each circuit. One of these pairs is connected in series with respect to the alternating current fluxes, and is connected to the supply circuit. The other pair is connected in opposition, and supplies alternating currents of twice the supply frequency. For a given sum of the alternating and direct-current ampere-turns the secondary flux has its greatest value if the ratio of the maximum value of the A.C. ampere-turns to the D.C. ampere-turns is equal to 2. The sum of the alternating and direct-current ampere-turns should be chosen, so as to give a minimum magnetising current.—M. OSNOS, in the *E.T.Z.*

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REVIEWS.

Liquid Fuel for Internal-combustion Engines. By HAROLD MOORE, M.Sc.Tech., F.C.S. London: Crosby Lockwood and Son. Pp. xv + 200; figs. 49. Price 12s. 6d. net.

Anything which will spray and is combustible has been defined as a fuel for liquid-fuel furnaces. Provided that it contains no solids bigger than a reasonably fine mesh of brass gauze, the definition is not far out of reality. But with the internal-combustion engine it is different, for a fuel may burn readily, and be easily capable of being sprayed into a Diesel cylinder, yet it may be so loaded with fine particles of free carbon that it cannot be used, for the carbon will deposit and spoil the working of the engine.

The internal-combustion engine is, in short, by no means the simple thing in respect of fuels that a casual thinker might imagine. In this book, which appears to say almost the last word that can be said of so multifarious a subject, the engineer who has to deal with this class of engine will surely find all he is likely to want so far as the choice of fuel is concerned. Involved chemical research into liquid fuels is not attempted. The author takes the liquids as he finds them, and deals with them on their physical and mechanical sides, and, so far as necessary, with the more simple chemical facts, and with the thermal or thermo properties.

The type of engine has, of course, much to do with the choice of a suitable liquid fuel, and the author takes three classifications, viz.: (1) Engines fitted with carburettors, such as the petrol engine; (2) engines fitted with simple vaporisers, such as the paraffin motor; (3) engines fitted with fuel pumps and atomisers, such as the Diesel and the semi-Diesel type. He might, perhaps, have added a fourth class, or the engine with the selective vaporiser of the Griffin type, wherein an asphaltic oil is vaporised as regards its best constituents, and the asphaltic portion is run liquid out of the vaporiser instead of being allowed to go hard and cold in a standing engine, gluing the parts fast. This class is certainly only a variant of class 3, but merits special mention because of the difficulties which it overcomes. Indeed, it should overcome the free carbon difficulty, and so render some of the impossible tars capable of use in the vaporiser engine.

The author remarks that coal cannot be burned in the internal-combustion engine. Yet Diesel, in his book on the rational heat motor, by which he meant the first form of Diesel engine, did actually describe it as a powdered-coal engine, though it is not easy to understand how he expected to avoid dust and grit troubles.

In dealing with liquids of a combustible nature, petroleum is clearly entitled to the first mention. The world's output in 1915 was nearly 427 million barrels, or, say, 60 to 70 million tons—a small fraction of the world's coal production to be kept in mind in all dealings with the subject, for this small fraction of about 5 per cent. tells us that however used, liquid fuel can only serve the special, and not the general, purposes.

Wisely, very little space is devoted to the origin of petroleum—why stir up sleeping dogs? A few pages are allotted to the definitive chemistry of the olefines and paraffins, and of the chain and the ring formation of the carbon atoms. Shale oil receives two pages, and coal tars follow with 10. Wood, peat, and lignite are briefly treated, the animal and vegetable oils, valuable as they are, being more fitted usually for other industrial or edible uses.

The alcohols close the list with an interesting three pages, for the author has the gift of putting useful matter into small bulk, and does not waste words. Thus at page 38 appears a chapter on fuels for carburettor engines, at present certainly the most important class because of their use in aircraft work. This chapter is full of interest, and the remarks on explosive range should be familiar to all users of such engines.

Specific gravity, spontaneous ignition in its relation to compression, calorific value, and boiling point are all given, and one sees why alcohol, with its lower calorific capacity, will give a higher thermal efficiency than more easily ignited petrol.

The next chapter deals with the fuels for vaporiser engines, or those in which the fuel enters the cylinder before compression, and Chapter X deals with atomiser engines, or the Diesel and semi-Diesel classes.

Though all classes of oils may be used, there are some which contain so much extraneous matter as to unfit them for use; and it is very difficult to filter out free carbon.

Asphaltum trouble is referred to, but the author dismisses asphaltic oils as impracticable for Diesels, and says nothing about their use in engines with selective vaporisers. Part II closes with a number of analyses and much other valuable information.

Part III deals with the examination of fuels physically and chemically. Perhaps its most valuable portion is that dealing with mixed fuels and the temperature of spontaneous ignition with combined temperature and pressure, as in the Diesel and similar types of engines. This is, of course, the crucial factor in such engines, and fixes the lower limit of compression. In Chapters XI and XII valuable physical constants may be found, the latter chapter dealing with the subject of calorimetry.

An appendix closes the volume, and in it are given many tabulated fuel statistics additional to those found through the body of the book. One table in particular is new, giving the weight of air and of oxygen, and the volume of air and oxygen necessary to burn weights or volumes of five fuels from 1 to 9 units, the fuels ranging from CH_4 and CO, H and C, to C_2H_4. Carbon, of course, is excluded from the volume list. The Admiralty fuel-oil specification is given, also that of the German Tar Distillers' Federation and others. A glossary of trade names for petroleum products precedes an excellent index.

Practical Electricity. By TERRELL CROFT. London: Hill Publishing Co. Pp. 646; figs. 582. Price 10s. 6d. net.

In the sense in which we understand the term in this country, the title of this book is misleading. It does not, for instance, deal with the subject which is dealt with in Ayrton and Mather's book of the same name; in other words, it does not deal primarily with the laboratory aspect of electricity. Rather must it be classed as a text-book of applied electricity. The scope and method of the book, however, render it extremely difficult to compare with any contemporary English texts, and in order to define its exact *raison d'être* we cannot do better than quote from the author's preface:—

"'Practical Electricity' was written for certain definite purposes. Primarily, its object is to present the fundamental facts and theories relating to electricity and its present-day applications in a straightforward, easily understood way for study by any man, of little mathematical training, who desires to acquire a working knowledge of the subject. If a man understands arithmetic, he should be able to get the meat out of this book. Secondarily, the book was designed for university graduates who desire a medium whereby they can, with minimum effort, review, refresh, and reconstruct in line with modern theory and practice their concepts of electric and magnetic phenomena."

Owing to the rapid and "intense" courses which are now being provided in many industries for the instruction of war workers, methods of teaching based on analogies and illustrations are becoming more and more popular, and the book under review is a remarkable example of the efficacy of such methods in the teaching of electricity. That this subject is susceptible of "analogical" treatment has been proved by the mechanical contrivances devised by Drysdale, and improved upon by Perren Maycock and others, but we do not remember having seen more complete and satisfactory use made of the hydraulic analogy than in this book. Potential, current, resistance, inductance, capacity are all accurately paralleled in hydraulic circuits, and two- and three-phase distribution and the three-wire system are also illustrated in the same way.

The book commences by devoting an unusual amount of space to the theories of electricity, and the fundamental notions concerning matter, electrons, and the ether are developed in considerable detail. Magnetism is then dealt with, and special chapters on this subject are given to industrial uses of magnetism, such as lifting magnets, and to the magnetic properties of iron and various kinds of steel.

The section entitled "Fundamental ideas concerning electricity" is a suitable introduction to the succeeding sections on current, electromotive force, work and power, and to the study of electromagnetism up to and including hysteresis. Two important sections are then taken up by the study of primary and storage batteries, with a short section on electrolysis. Following are chapters on the different forms of electromagnetic induction and inductance. Having thus prepared the ground with exceptional thoroughness, the author commences to deal with electric generators, first treating of the principles, and proceeding step by step to build up the theory and practice of armature and field constructions, armature reaction, and commutation in both bipolar and multipolar machines. The D.C. motor is then dealt with in a similar manner, and here, as elsewhere, the author spares no pains to elucidate his subject by means of analogies and illustrations.

Finally come the sections relating to A.C. generation, equipment, and characteristics, both single-phase and polyphase. The chapter in this part dealing with transformers is worthy of special praise, both on account of its method of treatment and the well-prepared diagrams used to illustrate it.

Throughout the text numerical examples have been used to illustrate the use of formulæ, &c., but higher mathematics have not been used in any part of the book. Whatever of theory the book contains is described by the author as "practical theory," and its inclusion is amply justified on the ground that the effective application of practical information depends upon the understanding of certain vital principles which must, with or without the knowledge of the practician, underlie such information. Perhaps it is worth while suggesting to the author that the inclusion of higher mathematics could have been defended on equally logical grounds.

The book is well produced and admirably illustrated; nor are its merits merely superficial, for in method of treatment, clearness, and accuracy it leaves little to be desired. Mr. Croft will no doubt find that the seven years spent in the making of his book will have an appropriate reward.—P. H. S. K.

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OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—The Hackney Electricity Committee has reported as follows respecting Mr. Robinson's request recently mentioned here:—

The borough electrical engineer has placed before us further information as to the nature of the work and the scope of the department in which his services would be utilised if the requisite permission is granted, and after thoroughly going into the matter it does not appear to us that the proposed work to be undertaken can be considered to be of greater national importance than what is now being carried out by the officer in connection with the Council's electricity undertaking, and the maintenance of a supply of electrical energy to the many important premises in the borough which are primarily engaged upon work essentially necessary for the successful prosecution of the war, and where a temporary failure of supply would be of serious moment. As we have come to the conclusion that the national service will not be benefited by an exchange of duties, we do not think it expedient that the permission asked for in the borough electrical engineer's communication should be granted, and therefore recommend that, for the reasons above stated, the Council are unable to grant the borough electrical engineer permission to accept a commission in His Majesty's Forces.

Mr. Robinson's services are asked for by Sir John Hunter, Administrator of Works and Buildings, Air Ministry.

At the Newcastle-on-Tyne City Council on July 3rd, Mr. R. Mayne (chairman of the Tramways Committee) moved a recommendation that the salary of the tramway engineer and general manager, Mr. ERNEST HATTON, be increased from £1,000 to £1,500 per annum, at the rate of £100 per annum for five years. The report was adopted with one dissentient. In connection with the proposal, the committee had issued a statement of salaries paid to similar officials in other towns. This included the following:—

Bexley, 5 miles measured as single track, engineer and manager, £700.
Birmingham, 123 miles, engineer £1,600, manager £1,500.
Bradford, 108 miles, engineer £900, manager £1,000.
Cardiff, 18 miles, engineer and manager, £1,000, and pupils.
Darlington, 9 miles, engineer and manager, £700, rising to £800.
Glasgow, 198 miles, engineer £1,250, manager £1,500.
Leicester, 21 miles, engineer £900, manager £600.
Liverpool, 124 miles, engineer £1,600, manager £1,500 (deputy £800).
Manchester, 184 miles, engineer £1,500, manager £1,500 (deputy £750).
Newcastle, 72 miles, engineer and manager, £1,000.
Reading, 13 miles, engineer and manager, £800.
Salford, 75 miles, engineer £1,250, manager £750.
Sheffield, 79 miles, engineer £1,200, manager £1,200.
Sunderland, engineer £1,000, manager £600.

The salary of Mr. A. W. CLEGG, electrical engineer to the Accrington Corporation, has been increased from £400 to £500 a year.

Chesterfield Corporation Electricity Committee has recommended that Mr. W. A. TOPPING, assistant electrical engineer, be paid a war bonus of 10 per cent. on his salary of £230.

Mr. E. J. H. BLUETT, electrical engineer to the Ascot District Gas & Electricity Co. since the opening of the electrical department in 1907, has tendered his resignation upon being granted a temporary commission in the R.A.F.

General.—The Albert Medal of the Royal Society of Arts for 1918 has been awarded to Sir RICHARD TETLEY GLAZEBROOK, C.B., Sc.D., F.R.S., "for his services in the application of science to the industries of peace and war, by his work as Director of the National Physical Laboratory since 1899, and as Chairman of the Advisory Committee for Aeronautics."

Mr. HOPKIN MORGAN, electrical engineer to the Port Talbot Railway & Docks Co., has been appointed by the Coal Mines Department of the Board of Trade to be district engineer.

According to the *Times*, Dr. HORACE LAMB, Professor of Mathematics in the University of Manchester, and Sir E. RUTHERFORD, F.R.S., Langworthy Professor and Director of Physical Laboratories in the University of Manchester, have been elected foreign members of the Royal Academy "dei Lincei," Rome.

Mr. OLIVER HEAVISIDE has been elected an honorary Fellow of the American Institute of Electrical Engineers.

According to the *Review of the River Plate*, Mr. F. H. JONES has resigned from the position of engineer and manager of the power plants of the Compania Alemana Transatlantica de Electricidad.

The Franklin Institute has presented the Franklin Medal to Signor GUGLIELMO MARCONI in recognition of "his brilliant inception and successful development of the application of magneto-electric waves to the transmission of signals and telegrams, without the use of metallic conductors."

Roll of Honour.—Sergeant HUGH MAGEEHAN, R.E., who has been awarded the Military Medal for good work in laying lines and keeping up communication during the German offensive, was employed in the Manchester Corporation tramways department.

Sapper R. JACKSON, R.E., who is in hospital suffering from trench fever, was an electrical engineer in New York before the war.

The Military Medal, for devotion to duty, has been awarded to Gunner F. YATES, R.F.A., who was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Pioneer A. GREGORY, R.E., reported missing, was employed by the St. Helens Cable & Rubber Works.

Private F. QUINN, Labour Battalion, accidentally killed, was employed as an electrician in Oldham before the war.

Private W. H. JONES, Lancashire Fusiliers, who has died of wounds, after being previously reported missing, was employed by the Bury Corporation as an armature attendant at the tramway depôt.

The Meritorious Service Medal for services rendered with the Forces in France has been awarded to Sergeant W. C. COLLIER, R.E., formerly on the staff at the Whitby U.D.C. electricity works.

Lieutenant THOMAS HAMILTON, fourth son of Mr. J. B. Hamilton, the general manager of the Leeds Corporation tramways, has been made a Member of the Order of the British Empire in recognition of an act of gallantry performed during instruction in bomb-throwing in February, 1917. Lieutenant Hamilton was posted missing on May 12th, 1917, and has not since been heard of, death now being presumed.

Obituary.—MR. W. T. PRESSLAND.—The death is announced of Mr. W. T. Pressland, of Ryde, consulting engineer to the Isle of Wight Electric Light & Power Co., Ltd., and one of the first directors of the concern. He was 57 years of age.

MR. G. W. WILLCOCKS, C.B.—We regret to record the death, which occurred somewhat suddenly on July 7th, at the age of 70 years, of Mr. George Waller Willcocks, C.B., M.Inst.C.E., formerly Chief Engineering Inspector to the Local Government Board.

MR. W. PERREN MAYCOCK.—Writing to inform us of the death of their much-esteemed colleague, Mr. W. Perren Maycock, M.I.E.E., Messrs. A. P. Lundberg & Sons say:—"After some six years' close working together, we have been enabled to fully appreciate his many good qualities and valuable assistance. He was a genuine friend to the wiring fraternity, and lost no opportunity of furthering its interests. He possessed an abundant optimism, and always argued that if a proper system of instruction could be initiated, electrical installation work would quickly occupy a respected position, instead of, as at present, being considered the Cinderella of the profession. His books and articles in the technical Press were written in such an easy style, and with an absence of bewildering mathematics, that readers had absorbed his meaning before they were aware of it. The knowledge so obtained must have been of great value to many workers, who, without his books and teaching would have remained in the dark. It was partly through his optimism that we decided to continue our switching competitions after the outbreak of war, as he held the opinion that it gave the younger ones a chance to show what they could do during their big brothers' absence on the country's work. The knowledge obtained and its application have been to many the steppingstone to recognition in the Army, Navy, and Air Services, as letters received testify. There are many examination competitors (as well as students in his own classes in electrical installation work) who will find that they have lost a staunch friend who had their interests always uppermost in his mind."

NEW COMPANIES REGISTERED.

Coal Traction Co. (Bloxwich), Ltd. (150,798).—Private company. Registered June 24th. Capital, £3,500 in £1 shares. To construct and work tramways and other forms of traction, and to carry on the business indicated by the title. The subscribers (each with one share) are:—J. White, Jun., 8, Holyhead Road, Handsworth, Birmingham; J. Ward, 8, Park Road West, Wolverhampton, builder. The first directors are to be appointed by the subscribers. Solicitor: T. H. Cleaver, 36, Cannon Street, Birmingham.

Cliffords, Ltd. (150,828).—Private company. Registered June 27th. Capital, £2,000 in £1 shares. Merchants and factors of aircraft, wireless installations, materials, tools, machines, engines and accessories, motor cars, motor boats, electrical generators, switchboards, steam turbines, boilers, pumps, cotton, textile, and hosiery machinery, metals, metal castings, timber, hardware, &c. The subscribers are:—Clifford W. Edwards, Station Chambers, Peterborough, engineer, 50 shares; Ellen L. Taylor, Colwyn House, Peterborough, secretary, 20 shares; W. Wilson, Killarney, Leicester Road, Loughborough, 10 shares; Mrs. S. Edwards, White House, Kegworth, 10 shares. Permanent managing director: Clifford W. Edwards.

Henley's Tire & Rubber Co., Ltd. (150,905).—Private company. Registered July 5th. Capital, £200,000 in £1 shares. To take over the tire department of the business of W. T. Henley's Telegraph Works Co., Ltd., with the premises where the same is carried on, and to carry on the business of manufacturers of and dealers in wheels, rims, tires, rubber, golf, and other balls, &c. The subscribers (each with one share) are:—G. Sutton, 74, Blomfield Street, E.C., manufacturer; M. Roberts, 137, Victoria Street, S.W., civil engineer. The first directors are: G. Sutton, M. Roberts, and A. E. Salmon. A director need not be a shareholder. Remuneration, £200 each per annum (£350 for the chairman). Registered office: 18, New Union Street, E.C.

R. F. Hamilton & Co., Ltd. (150,000).—Private company. Registered July 4th. Capital, £3,000 in £1 shares. To take over the business of a scientific instrument maker and gear cutter carried on by R. F. Hamilton at 172-4, Firth Park Road, Sheffield, as R. F. Hamilton and Co.; also manufacturers of and dealers in electrical and other instruments for laboratory and works use, micro-photographic accessories, chemical balances and weights, &c. The subscribers (each with one share) are:—R. F. Hamilton, 172, Firth Park Road, Sheffield, scientific instrument maker and gear cutter; F. Atkinson, 186, Attercliffe Road, Sheffield, metallurgist. The first directors are: R. F. Hamilton, F. Atkinson, and H. Chatty. Solicitor: W. Tottle, 18, Norfolk Road, Sheffield.

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Expert Metal Workers, Ltd. (150,865).—Private company. Registered July 1st. Capital, £1,000 in £1 shares. Manufacturers, treaters, depositors, and producers of metals, mechanical and electrical engineers, founders, &c. The subscribers (each with one share) are:—Miss C. H. Watts, 32, Thames Street, Sunbury-on-Thames; T. S. Ball, The Castle, Sunbury-on-Thames, company secretary. The first directors are; Sherard Cowper-Coles (permanent managing director) and T. S. Ball. Sherard Cowper-Coles has the right to nominate two directors. Registered office: 1, French Street, Sunbury-on-Thames.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Adelaide Electric Supply Co., Ltd.—Trust deed dated June 11th, 1918, constituting a floating charge on the company's undertaking in Australia to secure an issue of debenture stock, subject to trust deed of May 25th, 1911. The amount secured in the first instance is **£25,000, but** the company may issue further debenture stock (exclusive of premiums on redemption) up to £600,000 on the nominal amount of the issued capital, whichever is greater. In the event of the whole of the company's undertaking being purchased under the powers in the Act authorising the undertaking before June 1st, 1923, or in the event of a compulsory winding up, a premium of 10 per cent. is payable. In the event of the security being enforced against the company, a premium of 5 per cent. is payable. Trustees: Electric & General Investment Co., Ltd.

African Direct Telegraph Co., Ltd. (21,895).—Capital, £300,000 in £10 shares. Return dated June 19th, 1918. 23,600 shares taken up; £236,000 paid. Mortgages and charges: Nil.

Anglo-American Telegraph Co., Ltd. (2,891c).—Capital, £7,000,000 in £394,400 ord., £3,302,800 pref. ord., and £3,302,800 def. ord. stock. Return dated May 24th, 1918. All stock issued. £600,000 paid; £6,400,000 considered as paid. Mortgages and charges: Nil.

Morris & Lister, Ltd.—Memorandum of satisfaction in full on December 22nd, 1917, of debentures dated 1910-12, securing £6,950, has been filed.

Foster Construction Co., Ltd.—Mortgage on freehold premises at Plaistow, dated May 16th, 1918, to secure all moneys due or to become due from company to London & South-Western Bank.

Runbaken Magneto Co., Ltd.—Satisfaction in full on June 18th, 1918, of debentures dated February 29th, 1916, securing £1,000. Also filed: Particulars of £2,000 debentures, created April 19th, 1918, whole amount being issued June 20th. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

The French Cable Co.

The reasons which have induced the Compagnie Française des Cables Télégraphiques to acquire a large financial interest in a new French undertaking for wireless telegraphy, of which mention was made in this journal some time ago, were set forth in a report presented at an extraordinary general meeting which was held recently in Paris, when the ordinary share capital was increased from £537,000 to £640,000 for the purpose of this participation. It appears that the directors have been preoccupied for some years past with the progress of wireless telegraphy, and had even prepared agreements with wireless companies. The object of these agreements had been the establishment and working of stations by the company, but the arrangements failed to secure the approval of the French Postal and Telegraphic Administration in this form. Nevertheless, stations of large power had been erected in different foreign countries prior to the war, and it had been quite certain that France also would embark upon the same path within a brief period. Without prejudging the organisation which would ultimately be adopted by the French Government for the operation of French radiotelegraphic systems, and although no wireless station was yet open in France for commercial service with the United States, the directors considered that they ought not to cease to take an interest in everything which referred directly or indirectly to this question, having regard to the relations which the two systems must eventually maintain abroad, and perhaps also in France. Under these circumstances, and as soon as it was known that a French company was in process of formation—the Compagnie Générale de Télégraphie sans Fil—under first-class financial auspices, and with a large programme, the directors thought advantage should be taken of the occasion to intervene in wireless questions and obtain a sufficiently important share in the undertaking to provide the company with the means usefully to interpose in discussions which the working of wireless telegraphy might eventually raise. Owing to the control exercised by the Government over the company according to the Convention of 1901, the directors had to seek the sanction of the Ministry of Commerce, Posts and Telegraphs, and the amount required for the participation had been provisionally derived from the company's contingency fund, subject to repayment out of the capital augmentation above-mentioned. The Compagnie Générale de Télégraphie sans Fil has been formed with a share capital of £500,000, of which one-fifth has been subscribed by the Cable Co. Addressing the shareholders at the meeting, M. Ernest May mentioned that until last year the company was indebted to the State, which had made advances on the basis of the revenue guaranteed by the Convention of 1901. These payments constituted a debt bearing interest, but the company no longer owed anything to the State, and another clause of the Convention has consequently come into operation. This provides that the net profits shall be distributed first by allocating 4 per cent. to the shareholders, and then by a sub-division into thirds, namely, one-third is to be placed to the contingency fund and one-third is to be devoted to the redemption by purchase of the 3½ per cent. obligations, whilst the remainder can be disposed of according as the company's statutes permit.

Callender's Cable and Construction Co., Ltd.

The directors' report, which we were able to mention only briefly last week, showed that for the year ended December, 1917, there is a balance at the credit of profit and loss of £121,784, from which are deducted interest on debenture stock, £13,500; dividend on preference shares, £10,000; appropriation for depreciation of buildings, plant and machinery, &c., £17,232, leaving £81,051 plus £249,207 brought forward, less amount transferred to reserve account, £150,000, leaving an available balance of £180,259. Out of this it is proposed to pay a dividend on the ordinary shares at the rate of 20 per cent. per annum, less income-tax, being 20s. per share, requiring £35,000, and a bonus of 5s. per share, less tax, requiring £8,750, and making a total return for the year of 25 per cent. There is carried to reserve £25,000, and carried forward, subject to excess profits duty, if any, £111,509. The ever-rising cost of raw materials and labour have rendered the carrying out of the company's operations difficult and expensive. Transport restrictions have been considerable, and in other ways the course of manufacture has been rendered difficult; but in spite of all, the company has produced an increased amount of cables and warlike stores, and is continuing to do so. Under these circumstances the results shown are satisfactory. All plant and appliances have been maintained as usual in thorough order, the expense of so doing having again increased, due not only to the high cost of labour and materials, but to the greater difficulty in keeping the machinery in running order when working under existing conditions. The operations of the Anchor Cable Co., Ltd., have again been closely bound up with those of the parent company. The workshops at Leigh have been continuously employed, day and night. The directors have had under consideration for some time past the advisability of reorganising the capital of the company, so as to bring the nominal capital more into accord with the sum actually engaged in the business. They therefore propose to increase the capital by an issue to existing ordinary shareholders, as a bonus, one new fully paid-up share of the nominal value of £5 for each £5 ordinary share now held. The necessary authorisation from the Treasury has been obtained to this issue. They have transferred to the reserve £150,000 from the amount carried over from previous years, and this, with the £100,000 previously in reserve, gives an available sum of £250,000, out of which it is proposed that £175,000 shall be capitalised against the new issue of ordinary shares. They also recommend the transfer to reserve from the profits of the present year the sum of £25,000, so as to restore the reserve to £100,000. The annual meeting was held yesterday, and an extraordinary general meeting followed for the purpose of giving effect to these recommendations. It is intended that the £5 ordinary shares shall in due course be sub-divided into £1 shares. A further number of skilled men have been called to serve with His Majesty's Forces, afloat or ashore. Twenty-six of the company's men have fallen.

Marconi International Marine Communication Co., Ltd.

At the annual meeting, on July 2nd, Mr. Godfrey C. Isaacs, who presided, said that the balance sheet showed increase in capital of £250,000, making £600,000 at the end of 1917. Debentures had been reduced from £114,360 to £112,280 by purchases during the year. General reserve account had been increased by £210,356 to £258,009. Cash at bankers and investments in war loan and in short loans against securities amounted to £410,000, as against £75,000 in 1916. Receipts from ships' telegrams, subsidies, &c., increased by £200,000 to £470,000, and profit carried to balance-sheet amounted to £192,000, as compared with £96,000, the increase in profit being due entirely to the increase in the volume of business. The 5 per cent. interim dividend paid on February 1st figures in the appropriation account, and it was proposed to declare a further dividend of 10 per cent. which would absorb £60,000. A sum of £50,000 had been placed to reserve for obsolescence of plant—this being necessary in view of the replacement of many ship stations by stations of newer design which would have to be made at the end of the war. There was reason to believe that due consideration would be given this question when excess profits were dealt with. A sum of £105,418 was carried forward, this sum being subject to excess profits duty for the years 1916 and 1917. Dividend was being paid on the increased amount of capital, although it was towards the end of the year, in order to meet the obligations which the company had entered into with the Board of Trade. By the end of the year the total number of public telegraph stations owned and worked by the company on the high seas had increased by 793 to a total of 2,265. But these figures did not give precise indication of the number of ships fitted during the period. Making similar deductions for vessels lost at sea this year, there was a further substantial increase for the first six months of this year. The total renewals increased by £218,000 to the rate of £570,000 per annum, and for the

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first six months of this year they amounted to £703,374 per annum. At an extraordinary general meeting subsequently held a resolution was passed altering the articles of association to comply with the rules and regulations of the Stock Exchange in order that the company's shares may be quoted in the official list. New articles were introduced giving the company power, by an ordinary resolution in general meeting, to capitalise and distribute the whole or any part of its undivided profits.

Anglo-Argentine Tramways Co., Ltd.

At the annual meeting on July 2nd the chairman said that for the year under review the traffic receipts were £2,700,244, an increase of £47,776, in spite of serious labour troubles in the latter part of the year. The subway line had become a favourite means of transport, and in the last five months of the year traffic receipts showed an increase. Careful attention had been paid to the upkeep of overhead lines, permanent way and rolling stock, £248,754 was spent during the year on maintenance, and important economies have been made, especially in the construction of track. The board decided not to add more to the renewals reserve, as large sums were spent annually out of revenue for this purpose. A balance of £17,021, together with £50,969 brought forward from 1916, making a total of £67,990 was carried forward, and it was decided not to pay the balance dividend on the first preference shares. For the year 5s. 6d. in the £, or a sum of £216,404 was paid for income-tax. A saving of £18,000 had been made by substituting, under section 13 of the Finance Act. 1914, for the three years on which the average is calculated 1915-1917, instead of 1914-1916. The view was expressed that the preference shareholders could not hope for a dividend so long as the company was working under the existing contract with a German concern for the supply of electricity. The chairman said that the matter had not escaped the attention of the board. He did not agree that there was no chance of dividends while the contract continued, for they had been working under it for many years during which good dividends were paid. The company had a licence from the British Government to continue to receive electricity from the concern in question although it was on the black list.

General Electric Co., Ltd.

Mr. H. HIRST presided at the annual meeting held on Monday last. He said that the gratifying results of the year were not in the main due to any special war work outside their own industry. With very few exceptions, they manufactured in all their shops the same products that went through in pre-war times, with the addition of those that necessity, invention or experience had created during the war. The latter would form a basis for much fruitful development after the war. They owed their progressive results mainly to two reasons; first, their conservative policy in the past. Their generous allocations to depreciation and reserve had lowered their book values to an extreme minimum, so that, at the present moment profits need no longer be applied to the same radical degree for these purposes. Secondly, all their works had had the advantage of full employment throughout the year, with a great deal of repetition work. The advantages of this full employment and repetition work showed themselves both in higher wages to the workpeople and staff and in better returns to the shareholders. At many a general meeting in pre-war days they had dwelt on these conditions as the two essentials to cheap and efficient manufacture. It had required a world's upheaval to convince the majority of their countrymen of these first principles of production, and he hoped that this lesson might be ever present in the minds of their future legislators. In addition to the dividend of 6 per cent. on the preference shares and of 10 per cent. on the ordinary shares—the latter free of income-tax—they were suggesting a bonus to the ordinary shareholders of one ordinary share of £10 for each two ordinary shares held. This operation would be carried out by transferring from the undivided profits (reserve account) £287,500 to capital account. A resolution to this effect would be submitted to the extraordinary general meeting on July 23rd, to confirm the adoption of the new Articles of Association. This action was desirable because the ambitious programme before them demonstrated that, if the resolutions were passed, the last vestige of a private company character would, as far as the G.E.C. was concerned, have disappeared. £1,600,000 of new capital would be created, and the present shareholders were justly entitled to some of the pre-war profits accumulated at their expense before the new shareholders came in. Considering there was still a reserve left of £175,000 and a carry-forward of £145,000, whilst goodwill, patents, fixtures and installations, loose plant, tools, &c., figured in the balance-sheet at a nominal sum of one pound, the distribution to the ordinary shareholders was both just and modest. Owing to the action of the Treasury in refusing to sanction the division of the ordinary shares into denominations of £1, a difficulty arose in the distribution of the bonus shares, where a shareholder held an odd number of shares. They were making arrangements so that it would be possible to buy and sell the fractional shares which would be created. Their relations with their employés throughout their history had been excellent. In the strenuous years before the war, however, when the electrical industry had to compete against the cheapest labour markets of the world, it was not always possible to pay such wages that workers could put aside something for the proverbial rainy day. They had therefore come to the conclusion that this was the time when they could show their gratitude to those who had loyally worked in their service. They proposed that £37,500 provided from the reserve fund should be vested in trustees, who would at once invest this sum in new ordinary shares of the company at par. The trusts of this fund were for the purpose of application for the superannuation, pensioning off and benefit of employés of the company or their families or dependents, in such a manner as the directors of the company might determine. They proposed to ask an advisory committee selected from the staff to assist them in the administration. It was their hope to add materially to the fund in the future. At that meeting he was reminded that he had spent 37 years in the service of the electrical industry. Thirty-two years ago they laid the foundation of what was now the G.E.C. It looked to him as if they had spent the whole thirty-two years in preparation for that day. Slowly but surely they had undertaken to develop nearly every branch of electrical work. They had sat too long and looked admiringly at the progress of their foreign rivals. He saw no reason why there should not be two, three or four great electrical concerns in this country, grouping themselves into big units out of the mass of electrical material at their disposal in order to play a better and more important part in the world's work. He could not speak for others, but, on behalf of the General Electric Co. he believed he could say that they meant to try. They thought they were ready for it. They had an unrivalled selling organisation throughout the United Kingdom. They had established affiliated companies in all the principal parts of the British Empire, and in many neutral and allied countries as well, every one of them led by men educated in their counting house or their works. They had established modern works in various parts of the country covering nearly every branch of electrical engineering. Their Witton engineering works produced every kind of dynamo and motor for power or lighting from a 20,000-H.P. turbo-generator down to the smallest electric fan. Their carbon works were unique in the country, and they had been compensated for the losses, which had been referred to at their meetings in pre-war days, by the inestimable value which these works had proved to the country during the war. Their telephone works were the first of their kind in the country that produced a complete telephone exchange equipment by British labour and materials; since their inception in 1907 others had followed in their wake. Their lamp works were the first metal filament lamp works in the country, and had as a result formed to-day the nucleus of a healthy and growing British industry, possessed of great possibilities. Their switchgear, tube, fixtures and brass works were amongst the most important of their kind in the country. The cable works in which they were interested were now in full swing, and their magneto works had just commenced a useful and much-wanted output. Would they pardon him for enumerating this impressive list of enterprises with some sense of personal pride? His colleagues, eight of whom commenced their careers in subordinate positions in their business, would bear him out that so convinced was he that his vision would lead him right that he frequently incurred in the eyes of others considerable risks. Nearly every one of these works at the time of their inception meant the planting of a new industry, or the introduction of new methods or designs into the country, and every one required the training of unskilled labour or education of skilled labour to new processes. The fascination of this picture lay not only in the creation of hives of industry on what was not many years ago virgin soil—and the gratifying financial results—but it was the independence of each of these works of foreign assistance. It had not always been appreciated that all works required, besides raw material, certain basic materials which had to be manufactured and which most works used to import. The telephone factory required, for instance, ebonite. They put down an ebonite plant before the war and had been able, not only to supply themselves, but competitors and other trades. The carbon works required soot as a basic raw material. Some time before the outbreak of the war they acquired the process of making soot in which their foreign competitors managed to establish a monopoly. The use of this product in other industries had extended so rapidly during the war that, at the request of a Government department, they had increased that factory fourfold during the last two years, and, whenever circumstances permitted of their starting the laboratories for which they had put aside a credit some years ago, and when they could instal in them the brains which at present were employed in evolving processes of destruction, they anticipated a still larger development in this industry for a variety of purposes. Their engineering works had also developed the production of mica and other insulating materials which were essential for the production of good electrical machines. Their lamp works were able to produce their own tungsten wire, manufacture their own lamp-caps, and had their own glass-blowing works. The latter enjoyed for many years the jealous attention of their foreign competitors, and tempting offers of purchase were made by them, presumably for the purpose of shutting them down. They determined to keep them going at a loss rather than lose their independence, and here again their tenacity had been more than compensated. No works had been more useful since the outbreak of the war. When some day D.O.R.A.'s seal was removed from their lips they would have many an interesting story to tell. Conditions

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of labour had prevented them from getting the increased output that was required of these works in spite of a considerable capital expenditure on new furnaces and new buildings. They, however, were aware of some labour-saving automatic bulb-blowing machines invented in America, for the rights of which Germany negotiated before America joined the Allies. With the co-operation of Mr. Dudley Docker, of the Metropolitan Carriage, Wagon & Finance Co., ever in the vanguard of British industrial progress, they secured the rights for these machines for this country by paying £50,000 for the patents and purchasing a number of machines which would be installed under the direct supervision of experienced American erectors. Thanks to the assistance of the Board of Trade and other Government departments, these machines were expected to arrive shortly, and they hoped they would be the means of firmly settling the glass bulb industry in this country once and for all. They had an option of acquiring, together with the Metropolitan Carriage, Wagon and Finance Co., machines for other branches of the glass industry. It would depend on the working of the present machines whether they exercised that option or not. He could enumerate a good many more of these essential though subsidiary enterprises, but he had said enough to give shareholders an idea as to how their money was being invested. If the electrical industry was to rise to the level expected of it, and not to drift back again into a state of industrial dependence, it must make itself independent of foreign importation and develop all its requirements from raw materials and resources which the Empire placed at its disposal. In that direction great opportunities would be afforded for science; furthermore, in co-operation with labour, and prudent finance, research, and invention, they would be able to take their full share in securing improvement in the social and economic conditions of the country. The electrical industry in the future would not be content to be a mere adjunct to other industries—it would have to be a "key" industry by itself. Industrial penetration, of which they had heard so much of late, had been carried out by Germany, who had used the electrical industry as a key. If electrical concerns were to open the door for British enterprise abroad they must in future be enabled to carry out complete contracts. It was little realised that average electrical contracts brought as a rule only 10 per cent. or 15 per cent. of work into purely electrical shops. The work connected with it automatically brought 85 per cent. or 90 per cent. of work into engineering and other industries. Firms that had carried out the lighting and power installations of Berlin or Chicago had a better opportunity of securing foreign contracts than British firms, which, although their complete range of products might be equally good or better, could only show that they had carried out a section of an installation at Manchester, Glasgow, or Birmingham. He wished some attention to this necessity had been visible in the recent report on the organisation of super-stations contemplated in this country. Firmly convinced that these changes would take place they had had to change their policy somewhat. All the works they owned or controlled had been built, started and developed by their own initiative, and therefore they took much pride in them. The war having of necessity prevented their realising the ideal of being efficient in every branch of electrical engineering by the means they had originally planned, they had decided on another *modus operandi* in order to be ready when the great work of reconstruction began. What therefore was denied to them both by time and restrictions to build for themselves, they must acquire by purchase. In accordance with this policy they had acquired the ordinary shares in Messrs. Chamberlain & Hookham, Ltd., one of the most prominent electricity meter manufacturers in the country. This was also the reason why they had acquired the works of Messrs. Fraser & Chalmers, Ltd., at Erith. That firm had gained a splendid engineering reputation, and without a doubt would have greater chances of development in conjunction with an electrical firm such as the General Electric Co. The acquisition brought to them certain departments which in the light of the above programme were a necessity, but it brought also other departments which opened up to them fresh fields of enterprise. The beauty of this programme was that, from a national point of view it was efficient; it overlapped very little, if at all, the schemes and projects of other big electrical concerns. They would not be surprised that, to carry out these different schemes they required additional capital. They would therefore hold an extraordinary general meeting immediately after this meeting, when they would submit for their approval a resolution increasing the capital of the company to £3,000,000 by the creation of 100,000 additional preference shares of £10 each, and 60,000 additional ordinary shares of £10 each. The directors proposed to issue to the public 80,000 of these preference shares and 16,000 of the ordinary shares on the terms of a prospectus which would shortly be issued. A further 4,000 ordinary shares of £10 each would be reserved for issue to directors and employés, at the same price as it was proposed to issue them to the public. The remainder would be required for certain essential transactions already under contemplation, but upon which it would be premature to dwell that day. As explained in the original notice calling the extraordinary general meeting, the directors would submit for their approval a consolidated and revised edition of the Articles of Association which were better adapted to a company of this size. The ordinary shareholders had always shown their consideration for the preference shareholders, first by voluntarily raising the dividend from 5 per cent. to 6 per cent.—last year by refunding the income-tax—and now they proposed further to raise the preference dividend from 6 per cent. to 6½ per cent. He had endeavoured to lay before them the main outlines of their programme. It would be obvious that some of the projects they had in view would have to wait until the return of their 2,000 men who were at the Front, but it was also clear that the opportunity for quickly reinstating them was available. If his address spelt optimism, it was due to the feeling that the big task in front of them was made easy by local colleagues and devoted and enthusiastic staff. They were doing work of great national importance, and were helping to lay the foundation of an industrial realm within the borders of which untold thousands after them would find elevating and ennobling activities and ideals.

Mr. E. G. BYNG seconded the adoption of the report, and it was adopted. Resolutions were subsequently passed appointing Major-Gen. Sir Newton Moore and Mr. A. Chamberlain directors. Sir Newton Moore, in the course of a speech, said that the directors had, in his opinion, laid down a sound progressive policy.

British Thomson-Houston Co., Ltd.

The report of directors for 1917 shows as follows:—The buildings and machinery of the company have been maintained in good condition throughout the year. The works at Coventry which have heretofore been held on lease have now been purchased by the company under the terms of an option contained in the lease. The large canteen at the Rugby works, mentioned in the last annual report, has been completed. For the year 1916, as stated in the last annual report, it was not possible to take an inventory at the Rugby main factory and the Willesden factory, and in the accounts for that year the book figures were used. A complete inventory was taken in the usual way at all the factories and branch offices at the end of the year under review, and the book figures for 1916 were found to be fully justified. The profits for the year, after deducting all expenses and charges other than interest on debentures and loans, and after making provision for estimated war taxation for the year, are £329,664, plus £163,923 brought forward, less estimated provision to end of 1916 for munitions levy and excess profits duty £150,000. Interest on debentures and loans absorbs £95,745, leaving £247,842 out of which the directors recommend that there be appropriated for depreciations and reserves £194,098, leaving to carry forward £53,744. In the balance-sheet for 1916 the remainder of the cost of "goodwill, patents and licences," after taking into consideration the amounts previously written off, was £100,636. There was written off in that balance-sheet £40,636, leaving a net amount of £60,000. It has now been decided to restore the items comprising this account to their original cost, namely, £219,844. Also in the case of "office furniture and equipment of storerooms," which had been written down to £1, it has been decided to reinstate part of the amounts heretofore written off, and, pending a valuation, this account now stands at £20,000. On the other side of the balance-sheet there has been created a capital reserve account, consisting of the amounts reinstated in the two accounts above mentioned, viz., £157,959, to which has been added from this year's profits £80,000, the total capital reserve account thus standing at £237,959. The book value of the factories and their equipment is under consideration. Under the terms of the trust deed securing the issue of the company's debentures, the company since the beginning of this year has paid to the trustees the sum of £5,565, which was applied by them in redeeming at 105 by drawings £5,300 debentures. The total par value of debentures redeemed to date is £43,805, and leaves a net amount outstanding at the date of this report of £168,195. The amount outstanding at December 31st, 1917, was £173,495. The directors have followed their usual practice in making reserves to cover risks in connection with bad debts and other contingencies. The Rt. Hon. Lord Carmichael, G.C.S.I., G.C.I.E., K.C.M.G., has joined the board.

Meeting: London, July 17th.

Swiss Companies.

The Société Franco-Suisse pour l'Industrie Electrique, of Geneva, records net profits of £139,000 for 1917 on ordinary share capital of £1,000,000, as contrasted with £74,000 in the preceding year. A dividend at the rate of 4 per cent. is recommended, being the same as in 1916.

The "Motor," A. G. fur Angewandte Elektrizitat, of Baden, which is an investment company belonging to the Brown-Boveri group, states that all the supply works experienced a pressing demand for energy in 1917, and the cost of production increased, without, however, its being possible to obtain adequate compensation in higher prices for supply. As net profits the accounts indicate the sum of £91,000, as in the previous year, and the dividend on the ordinary share capital of £1,200,000 remains at 7 per cent., as in each of the years since 1911.

The report of the *Schweizerische Gesellschaft fur Elektrische Industrie, of Basle*, states that the directors were able to make arrangements in 1917 for the covering of the depreciation in the currency in the case of a considerable portion of the company's long-term investments in foreign currency. After making provision for depreciation, the accounts show gross profits of £124,000, as contrasted with £125,000 in 1916, the whole of which in each year has been absorbed by the payment of interest on the loan capital of £2,400,000, and the

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defraying of general expenses and of taxes. The ordinary capital of £800,000 thus receives no dividend for the past two years.

Some Spanish Companies.

Our Spanish correspondent reports as follows:—

The Electro-Industrial Corunesa.—The accounts of this company for the year 1917 show receipts £22,120, expenses £5,188, net profits £16,932. A dividend of 11 per cent. has been declared, as against 10 per cent. for several preceding years. £6,160 was placed to the amortisation fund, and £1,360 carried forward. The capital of the company is £86,000. The year 1917 was the twelfth and most successful in the history of the company. The hydro plant at Capela furnished all the power necessary without having to make use of the reserve steam station. Nearly all the energy developed is sold in bulk to two subsidiary companies which supply electricity to the towns of Vigo, Coruna, and Ferrol. There is a growing demand for current in the dockyards of Ferrol.

Sociedad General Gallega de Electricidad.—A dividend of 7 per cent. is proposed. The directors report that many new consumers were connected during 1917, but this increased business was balanced by the increased cost of fuel and other materials, and higher wages to staff. Also, the severe drought of last autumn had an adverse effect on the running of water-driven plant, and the reserve steam station was employed for a longer period last year, thus increasing the fuel bill by £2,500 over the previous year. The company have obtained permission to utilise an additional 1,500 litres per second (at 151 metres head) at the Fervenza waterfall, and for this purpose have just bought a 1,750-H.P. Escher-Wyss Brown-Boveri unit. The overhead network is being extended to supply a further 400 H.P. to the naval workshops at Grana.

Saragosa United.—A dividend of 6 per cent. has been declared. Owing to the drought of last autumn and the severe frosts last December it was not possible to give a continuous supply to all consumers, and for the same reasons the calcium carbide factory owned by the company produced 145 tons less than the preceding year, and through railway deficiencies disposed of 359 tons less. The demand for electricity is increasing, 53 new power consumers having been added, and 650 lighting consumers. The public lighting scheme is completed. Energy for this is being supplied at 5 centimes (one halfpenny) per unit. The company is considering the question of developing fresh water powers in the district.

Eléctrica Irurak-Bat.—The directors propose a dividend of 4 per cent. They report increased sales of electricity, and also increased running and repair costs.

Unión Eléctrica de Cartagena.—The total receipts for 1917 were £61,616, and expenses £44,324. A dividend of 4 per cent. was declared, making with the 3½ per cent. already paid 7½ per cent. for the year.

French Companies.

The Société Francaise des Electrodes reports profits of £32,000 for 1917. After allocating £17,000 to depreciation, the directors recommend the payment of a dividend of £1 8s. per share.

The Société pour l'Industrie Electrique states that the profits realised in 1917 amounted to £35,000, as against £33,000 in 1916. Including the balance brought forward, the sum at disposal is £39,000, which has been transferred to the profit reserve fund, which now totals £107,000.

The directors of the *Société Electro-Chimique du Giffre* report profits of £56,000 for 1917, as contrasted with £27,000 in the previous year. It is proposed to distribute £2 16s. per share, as against £2 8s. in 1916, and to apply a portion of the reserve fund of £74,000 to the part payment of a new issue of shares in contemplation.

The receipts of the *Chemin de Fer Nord-Sud, of Paris*, amounted to £601,000 in 1917, or £110,000 more than in the preceding year. On the other hand, the working expenses increased almost in the same proportion owing to the high cost of raw materials and wages, whilst the financial charges were greater than in 1916. The net profits total £22,000, which sum has been carried forward, and no distribution is proposed, as in the previous year.

The Société d'Electro-Chimie reports gross profits of £93,000 for 1917, as compared with £151,000 in the preceding year, war taxation having been first deducted from the former total. After having made provision for depreciation, the accounts show an available balance of £50,000, as against £55,000 in 1916, and the directors propose a dividend at the rate of £2 per share for 1917.

The Compagnie du Chemin de Fer Métropolitain de Paris reports a further expansion in the traffic in 1917, but the working expenses also increased very largely owing to the dearness of coal and other raw materials, and of labour. The net profits and balance forward are £219,000. After placing 5 per cent. of the net profits to the legal reserve fund, and setting aside £39,000 for the redemption of shares, a dividend at the rate of 5.6 per cent. has been declared on the ordinary share capital, leaving £48,000 to be carried forward

The Compagnie Continentale Edison, of Paris, reports gross profits of £40,000 for 1917, as contrasted with £62,000 in the previous year, and net profits of £22,000, as against £18,000, the total balance available for last year with the amount brought forward being £28,000. A year ago a dividend at the rate of 16s. per share was declared, but as it is necessary to strengthen the financial position it is yet uncertain whether any distribution will be made for 1917.

German Companies.

The Deutsch-Sudamerikanische Telegraphen Gesellschaft, of Cologne, proposes to pay a dividend of 5 per cent. for 1917, being the same rate as in the preceding year.

The directors of the *Deutsch-Atlantische Telegraphen Gesellschaft, of Cologne*, recommend a dividend of 3½ per cent. for 1917, this comparing with a rate of 4 per cent. in the previous 12 months.

The report of the *Julius Pintsch A.G., of Berlin*, states that the manufacturing profits continued the declining tendency in 1917, and the gross proceeds approximated to those realised in the preceding year solely as a result of the larger turnover. As it was only necessary to appropriate £51,000 for depreciation, as against £126,000 in 1916, the net profits total £134,000, as compared with £93,000, and the directors recommend a dividend of 14 per cent., this rate contrasting with 10 per cent. in 1916.

The Concordia Elektrizitats A.G., of Dusseldorf, reports that a portion of the works extensions at Dortmund was brought into use in 1917. As net profits the accounts indicate the sum of £9,100, as compared with £8,800 in 1916, and the directors recommend the payment of a dividend at the rate of 12½ per cent. on share capital of £50,000, this contrasting with 7½ per cent. in the previous year. It is now proposed to increase the share capital to £100,000 to provide for the extension of business.

The Treuhand Bank fur die Elektrische Industrie A.G., of Berlin, which was originally constituted by the former Felten and Guilleaume-Lahmeyer Werke, and which is now a trust company of the A.E.G., reports gross profits of £46,000 on investments in 1917, as compared with £45,000 in the previous 12 months. After meeting interest charges the net profits and balance forward are returned at £37,000, as against £40,000 in 1916. It is proposed to pay a dividend of 4½ per cent. on the paid-up capital of £500,000, the rate in the preceding year having been 4 per cent.

The A.E.G. Schnell Bahn A.G., of Berlin, whose railway is said to be still in course of construction at Berlin, reports the intention to pay interest at the rate of 4½ per cent. on the £1,000,000 ordinary shares for 1917, as in the previous year, whilst the A.E.G. is again to pay 5 per cent. on the £1,125,000 preference shares. It is now intended to increase the latter class of capital by £300,000, and to seek authority to continue the payment of interest during construction on the ordinary shares also for the years 1918 and 1919.

The report of *Hartmann & Braun A.G., of Frankfort-on-Main*, states that the turnover in 1917 largely exceeded that of previous years, and was almost exclusively composed of articles for the national defence. The gross profits, which amounted to £142,000 in 1916, rose to £178,000 last year, and the net profits advanced from £49,000 to £51,000 in the two years respectively. The directors recommend a dividend at the rate of 15 per cent., as compared with 14 per cent. in 1916, and with the further issue of new gratis shares the rate becomes increased to 29½ per cent., as against 34 per cent. in 1916, when similar shares were also presented to the proprietors.

The report of the *Gesellschaft fur Elektrische Unternehmungen, of Berlin*, which owns supply works, and is also interested in others, refers to the difficulties experienced in securing alterations in contracts so as to obtain higher prices which would equalise the dearness of fuel and other raw materials, and of labour, and suggests that the Imperial authorities should intervene and legally regulate the rates charged for energy. On the other hand, the tramways yielded more favourable results in 1917, and the company was also able to dispose at a profit of certain investments in the Bologna supply works and the Electric and Traffic Undertakings Co., of Buda Pesth. After meeting interest charges on the loans of £1,940,000, and defraying general expenses, taxes, &c., the accounts show net profits of £185,000, or the same amount as in 1916, and the dividend is at the rate of 5 per cent. on the share capital of £3,000,000. This compares with 5 per cent. in 1916 and 6 per cent. each in 1915 and 1914. It is stated that the company has again got in touch with its Russian undertakings, but it is uncertain whether possession will be resumed or claims lodged for compensation.

Siemens Bros. & Co., Ltd.—At an extraordinary general meeting on July 9th, it was resolved that each of the existing shares of £5 each be subdivided into five fully-paid shares of £1 each, and that the share capital of the company be increased to £1,500,000 by the creation of 900,000 shares of £1 each. Treasury consent is to be applied for.

Anglo-American Telegraph Co., Ltd.—Interim dividend for the quarter ended June 30th of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less tax.

Direct U.S. Cable Co., Ltd.—Interim dividend of 2s. per share, less income-tax, being at the rate of 4 per cent. per annum, for the quarter.

Dublin United Tramways (1896), Ltd.—Interim dividend 4 per cent. per annum, less tax, on ordinary stock for half-year.

Fraser & Chalmers, Ltd.—Dividend of 7½ per cent. less tax, on the preference shares.

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Chile Telephone Co., Ltd.—During the year ended March, 1918, the aggregate number of subscribers at all centres increased by 1,177 to 15,420. The gross revenue was £213,140, an increase of £60,958. The total expenditure (exclusive of income-tax) was £129,187, an increase of £36,590. The net revenue was £83,953, an increase of £24,368. £7,000 is placed to general reserve, £20,000 to reserve for renewal of plant, and after dividends of 3s. (interim) and 5s. (final) per share, free of tax, on the shares are paid, £24,289 remains to carry forward, subject to excess profits tax. The exchange adjustment account shows a credit balance of £12,375, the rate of exchange at March, 1918, being 15¼d., as compared with 10¾d. at March, 1917. In order that the nominal capital may approximate more closely to the actual capital expended, the directors propose to transfer from the general reserve to capital account £110,000, and distribute the equivalent to the shareholders in 22,000 fully-paid £5 ordinary shares in the proportion of one share to every three shares held. Treasury sanction has been obtained.

Rangoon Electric Tramway and Supply Co., Ltd.—Sir Frederic W. Fryer presided at the annual meeting on June 27th. He said that after providing for interest on debenture issues, dividend on preference capital, and the several allocations enumerated in the report, there remained £9,568 from which the directors recommended payment on the ordinary share capital of 3 per cent. (free of income-tax); carrying forward £4,258, an increase of nearly £1,300 compared with last year. While some economy had been effected in other branches of expenditure, the increase in power house expenses of £6,515 was attributable to the higher price of coal. The increase in tramway receipts was £4,500, and the cars travelled 119,801 more miles, carrying nearly 50 per cent. more passengers than in 1916. The private lighting and power department showed a small though steady increase, and alterations were being carried out which would greatly improve public lighting in the city of Rangoon.

Crompton & Co., Ltd.—A dividend of 7 per cent. on the ordinary shares for the year ended March, 1918, is to be paid, as against 5 per cent. last year.

Edmundsons' Electricity Corporation, Ltd.—After providing for income-tax and mortgage and debenture stock charges, the net profit for 1917 is £12,209, against £12,294 for 1916. After paying the dividend on the cumulative preference shares, £5,128 is to be carried forward.

Lima Light, Power & Tramways Co.—Dividend of 1½ per cent.

STOCKS AND SHARES.

Tuesday Evening.

There is a noticeable continuance of the good tone in most markets, and the inactivity on the part of the Germans in starting their new offensive is held to be all to the good of the Allies. It has had the effect of quickening interest in industrials, where the greater part of Stock Exchange business is being transacted. Manufacturing shares stand out with particular prominence for their strength, General Electrics, for instance, having risen to 26½. Another feature is a fresh advance in the Underground Railway stocks. In the telegraph section, prices hold their ground, and further gains have been secured by Callenders, Telegraph Constructions, and one or two others.

Districts have risen to 19, and Metropolitans have been a remarkably good market, with a rise of 2 points to 24¼. Underground Electric Income bonds followed up their rise of 3 points last week with a further gain of 2½ this week. The "A" shares are also better. Central London stocks are quiet, but a little demand for them found there was hardly any floating supply in the market. Other home railway stocks are strong, the attention of the investor being turned to this market by the imminence of the dividend announcements, and the fact that at current prices good returns are still obtainable. The prospect of what is likely to happen after the end of the war is so obscure that people have given up attempting to prophesy, and are content to buy stocks, taking what chance there may be of Labour troubles in the future.

The Callender's Cable & Construction Co. has raised its dividend from 20 per cent. to 25 per cent. for the year, and details are now issued as to the bonus in shares which was announced earlier in the year. One new share is to be given for every old share at present held. As in the case of the General Electric Co., the Callender board intended to split the £5 shares into new ones of £1 denomination, but the Treasury came down on this scheme also, and refused permission for the shares to be split. For 1917, the company made just over £91,000 net, an increase of £4,200 over the 1916 figure. The reserve is raised to £100,000, and £111,000 goes forward to the new accounts. From all of which it is obvious that the Callender's Co. has done remarkably well, and occupies an extremely strong financial position. General Electrics, as already noted, have risen to 26½, after a momentary spasm of indecision upon the refusal of the Treasury to allow of the splitting scheme. The Preference shares advanced 10s. to 11; the meeting was regarded as very satisfactory. Telegraph Constructions have gone up 30s. to 44, and all things considered, it is natural enough that there should be some expectation as to the company falling into line with others, and distributing some kind of a share bonus. Edison Swans have hardened to 40s. British Westinghouse Preference and others of this group maintain their improvements, and the optimists talk hopefully on the probability of further rises which they consider are likely to take place in the prices.

The rise in Mexicans has halted, and so far as the railway stocks are concerned, a disposition has developed to allow prices to droop a little after their recent big advance. The Utilities are maintaining their ground pretty well, though it is found easier to buy bonds to-day that it was a week ago. Monterey Fives are 2 points higher at 40½, but Pachucas went back to 42½. Brazil Tractions are down a point. The British Columbia Electric group is somewhat heavy.

Scarcely a ripple has disturbed the course of the market in home electricity shares. If anything, prices lean slightly to the easier side, there being a little talk of the possibility of dividend reductions. Gas stocks have given way lately, and this has affected the electric light list sympathetically, although, as mentioned here before, those companies which are doing a good power business are not likely to be greatly affected by the rationing order, which links together coal, electricity, and gas. Telegraphs and telephones are good, with a rise to 3½ in Marconis as a prominent feature. Other members of the Marconi group are rather harder.

Babcock & Wilcox spurted to 3 9/16, a rise of 3/16, and British Aluminium at 35s. are 1/16 higher. Rubber shares have taken a turn for the better, partly on an advance in the price of the raw material to 2s. 3d. per lb. Amongst armament shares there is not much doing, and the base-metal groups are equally quiet.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price July 9, 1918.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6⅜	—	£7 13 10
Charing Cross Ordinary	5	4	3½	—	6 8 1
do. do. do. 4½ Pref.	4½	4½	3¾	—	6 18 6
Chelsea	3	5	3⅜	—	8 0 0
City of London	8	8	11	— ¼	7 5 6
do. do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
County of London	7	7	10½	—	6 16 7
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	6	7	5¼	—	6 13 4
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3¼	—	7 13 10
Metropolitan	3	4	3⅜	—	6 8 0
do. 4½ per cent. Pref.	4½	4½	3⅜xd	—	7 4 0
St. James' and Pall Mall	8	9	6⅞	—	6 11 0
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 18 4
Westminster Ordinary	7	9	6⅛	—	7 7 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	95	+ ½	6 6 4
do. Def.	1½	1½	22	—	6 14 10
Chile Telephone	8	8	9¼	—	4 6 6
Cuba Sub. Ord.	7	7	9⅜	—	*7 3 7
Eastern Extension	8	8	153/4	—	5 1 7
Eastern Tel. Ord.	8	8	159¼	—	*5 0 4
Globe Tel. and T. Ord.	7	—	14¾	—	*4 15 0
do. do. Pref.	6	6	10	—	6 0 0
Great Northern Tel.	24	22	38	+ 1/-	5 15 9
Indo-European	13	—	49½	—	6 5 1
Marconi	15	—	3½	+ ⅛	4 5 10
Oriental Telephone Ord.	10	—	4 13/16	— 1/16	2 1 9
United R. Plate Tel.	8	8	7¼	—	*5 10 5
West India and Panama	6d.	9d.	1⅝	—	*3 6 8
Western Telegraph	8	8	15¼	—	*5 0 10
Home Rails.					
Central London Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	1	1	24¼	+2	4 2 6
do. District	Nil	Nil	19	+ ½	Nil
Underground Electric Ordinary	Nil	Nil	2¼	—	Nil
do. do. "A"	Nil	Nil	6/8	+9d.	Nil
do. do. Income	6	4	83	+2½	*4 16 5
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅔	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3	—	—
do. do. 2nd Pref.	5½	—	2⅛	—	—
do. do. 5 Deb.	5	5	64	+1	7 14 10
Brazil Tractions	—	—	42	—1	—
Bombay Electric Pref.	6	6	9¼	—	6 6 4
British Columbia Elec. Rly. Pfee.	5	5	62½	—	8 0 0
do. do. Preferred	Nil	Nil	46⅜	—1	Nil
do. do. Deferred	Nil	Nil	40	—	Nil
do. do. Deb.	4½	4½	61½	—1½	6 18 0
Mexico Trams 5 per cent. Bonds	Nil	Nil	45⅜	—	Nil
do. 6 per cent. Bonds	Nil	Nil	36½	—	Nil
Mexican Light Common	Nil	Nil	21	—1	Nil
do. Pref.	Nil	Nil	32⅛	—	—
do. 1st Bonds	Nil	Nil	48	+1	
Manufacturing Companies.					
Babcock & Wilcox	15	15	3 9/16	+ 3/16	4 4 0
British Aluminium Ord.	10	10	1¼	+ 1/16	5 14 3
British Insulated Ord.	20	20	1¼xd	—	5 6 8
British Westinghouse Pref.	7½	7½	28	—	5 14 3
Callenders	20	25	19½	+1	6 11 7
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	3 7/8	—	5 16 0
Edison-Swan, fully paid	—	—	38	—	Nil
do. do. 4 per cent. Deb.	4	4	74⅜	—	5 7 5
Electric Construction	7½	10	1 7/16	—	7 12 4
Gen. Elec. Pref.	6	6	11	+ ½	5 9 1
do. Ord.	10	10	26¼	+1	*3 15 6
Henley	25	25	21½	—	5 17 8
do. 4½ Pref.	4½	4½	3⅜	—	5 12 2
India-Rubber	10	10	16⅜	—	*6 4 0
Telegraph Con.	20	20	44	+1½	*5 8 8

*Dividends paid free of Income Tax.

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NEW ELECTRIC PASSENGER LOCOMOTIVES.

(*Continued from Vol. 82, page 598.*)

The gearless locomotive now under construction in the General Electric shops for the Chicago, Milwaukee & St. Paul Co.'s extension to Settle is equipped with 14 axles, 12 of which are drivers, and two guiding axles. The armature is mounted directly upon the axle and, with the wheels, constitutes the only dead or non-spring borne weight of the locomotive. This weight is approximately 9,500 lb., as compared with 17,000 lb. deadweight on the driving axles of the present geared locomotives now in operation on that road. The two fields are carried upon the truck springs with full freedom for vertical plan of the armature between them.

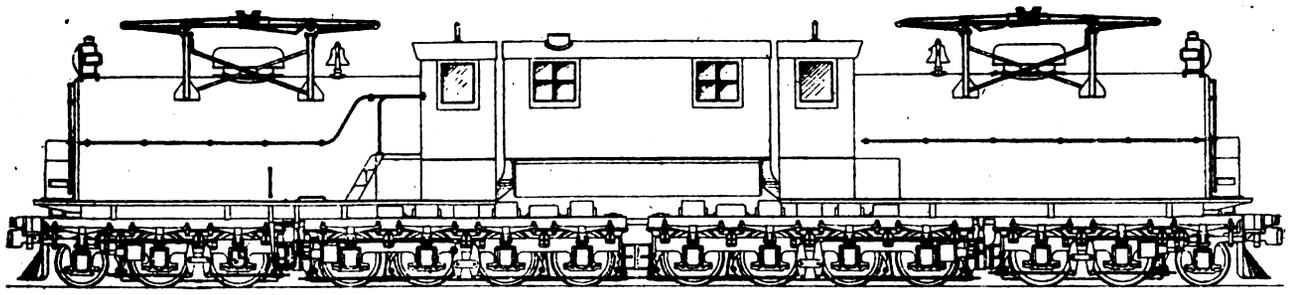

FIG. 4.—ELEVATION OF GEARLESS LOCOMOTIVE FOR THE CHICAGO, MILWAUKEE & ST. PAUL RAILWAY.

The construction of the motors throughout is practically identical with that employed upon the New York Central gearless locomotives, but the capacity of the locomotive is much increased, and the wheel arrangement somewhat different. The following are the general physical characteristics of the locomotives now under construction :—

Length inside knuckles	76 ft. 0 in.
Length over cab	68 ft. 0 in.
Total wheel base	67 ft. 0 in.
Rigid wheel base	13 ft. 11 in.
Diameter driving wheels	44 in.
Diameter guiding wheels	36 in.
Approximate height centre of gravity	57 in.
Weight of electrical equipment	235,000 lb.
Weight of mechanical equipment	295,000 lb.
Weight of complete locomotive	530,000 lb.
Weight on drivers	458,000 lb.
Weight on guiding axle	36,000 lb.
Weight on each driving axle	38,000 lb.
Dead or non-springborne weight per axle	9,500 lb.

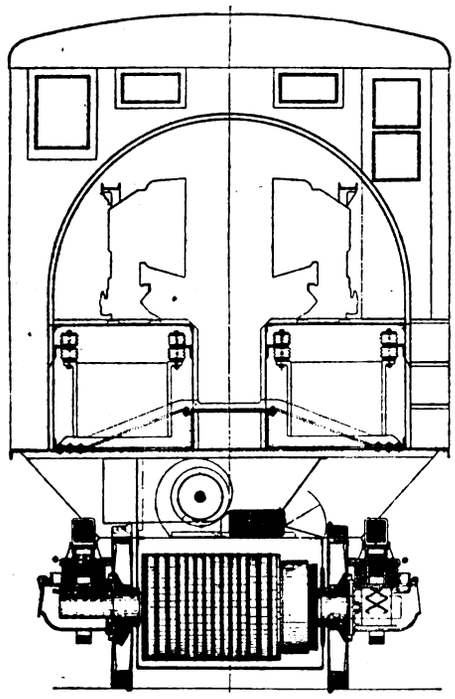

FIG. 5.—CROSS-SECTION OF NEW GEARLESS ST. PAUL LOCOMOTIVE.

With 12 motors per locomotive available for different control combinations, there is a possibility of securing a wide range of speeds to meet the varying conditions of passenger train operation. Motors are connected three in series, giving 1,000 volts per commutator for full-speed operation, but the control also permits a connection of four, six, and 12 motors in series for fractional speed operation. Further provision for variable speed is made by shunting the motor fields in all combinations of motors, but it is probable that the greatest value of field shunt will be obtained with the full-speed connection of three motors in series.

It is especially desirable that a passenger locomotive shall have sufficient weight on the drivers and reserve motor power to haul additional train weight on occasion, and in this respect the gearless locomotive under construction presents some attractive possibilities. The manufacturer's guarantees cover the operation of a 12-car train weighing 960 tons against an adverse grade of 2 per cent. at a speed of 25 M.P.H. Under these conditions there is a demand for 55,200 lb. tractive effort at the rim of the drivers, and equivalent to 12 per cent. coefficient of adhesion of the weight upon the drivers. There is, therefore, ample margin both in weight upon drivers and capacity of the motors to haul not only 12 cars, but on occasion 13 or 14 cars, with practically no sacrifice in schedule speed, and without overloading the motors or exceeding known and conservative practice as regards loading of driving wheels. For example, the gearless locomotive being built will permit the starting of a 12-car train on a 2 per cent. grade with a coefficient of adhesion of only 20 per cent., and accelerates the train at 0.3 M.P.H. per second.

While the manufacturing guarantees are limited to 42,000 lb. tractive effort as a continuous output of this locomotive, preliminary tests upon a sample motor built indicate that a complete locomotive when finished may show values materially higher than the guarantees made. This fact is of the greatest importance, and holds out wide visions of radical changes in the operation of trans-continental trains, both passenger and freight.

The total weight upon drivers of 458,000 lb. is practically the same as the driver weight of the freight locomotive now

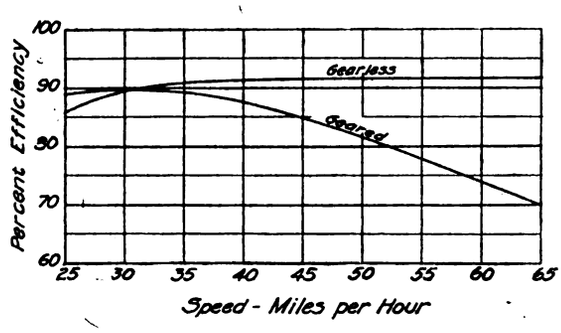

FIG. 6.—EFFICIENCY CURVES OF PRESENT GEARED AND FUTURE GEARLESS ST. PAUL LOCOMOTIVES.

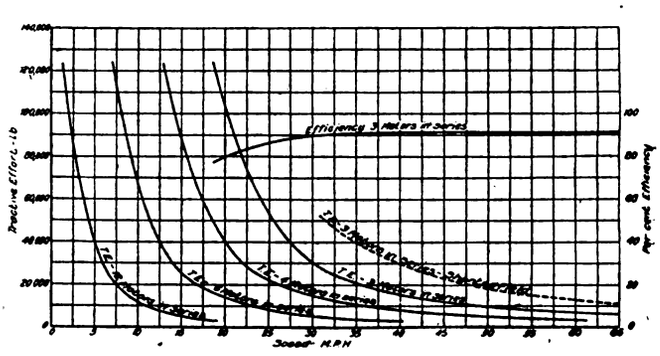

FIG. 7.—CURVES OF TRACTIVE EFFORT AND EFFICIENCY PLOTTED AGAINST SPEED, ST. PAUL GEARLESS LOCOMOTIVES.

in operation on the Chicago, Milwaukee & St. Paul Railway. If, therefore, the completed locomotive meets the expectations of the builder, it offers the possibility of using the same locomotive interchangeably for both passenger and freight service.

The considerable speed variation permitted with four motor combinations ensures a means of operating the locomotive at

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any speed demanded by the character of service to which it is assigned. Furthermore, when operating a freight train at lower speeds it can reasonably be expected that the tractive effort rating of the locomotive will be increased, due to the lower core loss at the lower armature speeds. While not primarily designed as an interchangeable locomotive, it is quite possible that the flexibility of this new gearless locomotive will become apparent when it is put into operation, and its fitness for freight service will be fully recognised.

The control of the gearless locomotive will in many respects be a duplicate of that now in successful operation on the geared motor locomotive previously installed. Provision will be made for regenerative electric braking on down grades, as the success and operating value of this method of holding trains on down grades has been fully established during the past two years of electrical operation on the Chicago, Milwaukee & St. Paul Railway. The geared locomotives now operating utilise a motor-generator set for the purpose of motor field excitation while regenerating, and the results with this combination have been excellent. Careful experiments made during the past two years have demonstrated that motor-generator field excitation is not essential, and the control for the new gearless locomotive will dispense with this feature. This simplification of the control and reduction in weight and cost constitutes a marked improvement.

One of the greatest arguments for electrification is the saving of fuel effected, and therefore it is very essential that the efficiency of electric locomotives be raised as high as possible, in order to fulfil one of the claims for their introduction.

The geared locomotive operates at a high efficiency in heavy freight service where pushers are used on up grades, but accumulative gear losses result in a low all-day efficiency of a geared locomotive in passenger service, when the profile is broken and contains long stretches of practically level track. On the other hand, the gearless motor operates at highest efficiency on level track or lesser grades, and it is this class of service that constitutes the bulk of the all-day duty of a passenger locomotive.

A comparison of the efficiencies of the present geared locomotive of the St. Paul road and the gearless locomotive under construction is presented in the curves shown in fig. 6, which are plotted with speed as abscissæ. The average operating speed at about 50 M.P.H. shows a gain of 10 per cent. in efficiency of the gearless locomotive as compared with the geared type, and throughout the entire range of speed from 30 M.P.H. up, the gearless locomotive will operate at over 90 per cent. efficiency, as compared with drooping characteristic of the geared-motor locomotive

It is proper to note that the considerable gain in efficiency resulting from the adoption of the gearless motor is due almost entirely to the elimination of the mechanical losses inherent with geared motor drive. The exclusion of mechanical parts is followed by an attractive increase in reliability and a marked reduction in maintenance expense. It is felt, therefore, that the introduction of the gearless locomotive upon the Chicago, Milwaukee & St. Paul marks a distinct advance in electric railroading, and this type of construction, now for the first time made possible for mountain service, will result in a marked improvement in the method of handling both passenger and freight trains in this most difficult class of railroad service.

(To be concluded.)

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

ANNUAL CONVENTION.

(Concluded from page 8.)

Annual Report.

The annual report of the Council stated that the membership of the Association stood at 385, an increase of 10.

With regard to electric power supply, the Board of Trade Committee invited the I.M.E.A. to give evidence on this subject, and the Hon. Secretary, Mr. Faraday Proctor, was delegated by the Council for this purpose. A committee was also appointed to deal with the subject, and a statement agreed upon by the Association of Municipal Corporations and the Council of the I.M.E.A. was issued stating, *inter alia*, that in order to ensure that there should be an adequate and economical supply of electric power it was necessary that the areas of supply, instead of being local government areas, should be areas specially delimited as areas suitable for electric supply, having regard to demand and facilities for obtaining suitable sites for generating stations. Generation and distribution need not in all cases be in the same hands. Generation should be on a large scale, and extend over a considerable area. Distribution might conveniently be organised in smaller areas. The new areas, both for generation and distribution, should be continuous, and would in many cases include within their limits places which at present were without a supply, either because no powers existed there or because existing powers had not been exercised. The best use possible should be made of existing systems of generation, transmission, and distribution, and also of the local knowledge obtained by established undertakings. When the whole or a portion of an existing undertaking was transferred to a larger authority, suitable provision would be made in regard to the rights and obligations of existing undertakings, the capital commitments and the responsibilities towards any officers whose status or remuneration would be affected. Undertakings of this description, which involved a monopoly, and upon which the prosperity of the people depended so largely, should be entirely in the hands of the public authorities. The questions of London and the North-East Coast required special consideration, and the foregoing observations were not intended to apply to them.

The sum of £106 had been contributed towards the research on buried cables carried on by the Institution of Electrical Engineers.

The Council was strongly of opinion that the time had arrived when the Association should have branches in different localities throughout the kingdom for the more particular consideration of local questions. It was felt that there was great need for a combination of local authorities in different districts to deal with the many problems that would arise necessitating prompt action in connection with the future organisation of electricity supply. It had become imperative that in various localities arrangements should be made that would provide for meeting at more frequent intervals.

With regard to model general conditions of contract, the Council had adopted a recommendation made by the President and the Hon. Secretary as a result of a joint meeting between representatives of B.E.A.M.A., I.E.E., and I.M.E.A. Councils, that on future contracts the amount to be paid at the expiration of one month after the plant was taken over should be 15 per cent. instead of 10 per cent., and that the remaining 5 per cent. instead of 10 per cent. should be retained until the end of the period of maintenance. The B.E.A.M.A. had also raised the question of making payments on account prior to delivery, but as they formulated no proposals safeguarding the purchasers' interests the matter had not proceeded further.

At the annual conference of the National Association of Local Government Officers in May the important question of superannuation was reported upon. There was reason to look forward with confidence to this measure making favourable progress. The President of the Local Government Board had been approached, and Mr. Hayes Fisher decided to appoint a committee forthwith to inquire into and consider the whole question.

The Council was of the opinion that an increase or bonus should be granted to all salaried officials serving under local authorities on account of the decreasing purchasing power of money.

The Council called the attention of the Board of Trade to the financial burden imposed upon electricity supply authorities as a result of various statutory orders and restrictions, and subsequently the Board, in co-operation with the Ministry of Munitions, received a deputation of the I.M.E.A. As a result of the interview the Government Department concerned agreed that there should be an increase in the charges to controlled establishments, and that they would support undertakings in seeking a revision of the charges under all other long-term contracts.

As it was considered desirable to take united action on various matters relating to conditions of employment, remuneration of staff and employés, and emergency matters, the Council passed a resolution that a joint standing conference be constituted representative of the electricity supply industry generally. It was decided to communicate with the Incorporated Association of Electric Power Companies, the Provincial Electricity Supply Association of Great Britain, and the Conference of Staff Officials of Electric Supply Companies in London with a view to the formation of such a conference.

As a result a standing conference had been duly formed with Mr. C. P. Sparks as chairman and Mr. H. Faraday Proctor as hon. secretary, and several meetings had been held with beneficial results to the interests concerned.

It was further agreed that an executive committee of the Council should be appointed, with power to act in all emergency matters.

Information was received from the I.E.E. regarding the formation of a British Electrical Engineers' Association, to include chief engineers and assistants in electricity supply undertakings, and it was resolved: "That the Council approves the formation of the British Electrical Engineers' Association, and recommends the members of the I.M.E.A. to support it."

Owing to increased expenditure for printing and postage there was a deficit of £20 on the year's working.

Mr. J. E. Edgecombe had served the Association as hon. treasurer for 14 years, and the Council placed on record its appreciation of the services which he had rendered to the Association.

The question of training and employing disabled soldiers and sailors for sub-station attendants was discussed between representatives of the electricity supply industry and repre-

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sentatives of the Electrical Trades Union. Agreement was arrived at as to the general basis of wages which should be paid and conditions under which employment of such men might be deemed to be acceptable to the employers and the Trade Unions.

There was throughout the year a fairly brisk demand for trained men; upon many occasions the demand exceeded the supply, and, generally speaking, satisfaction was expressed by the employers regarding the results obtained.

A Trade Advisory Committee (Disabled Soldiers and Sailors) Electricity (Power and Supply) had been formed, upon which the Association was represented by the President.

Electricity in Agriculture Committee.—The following were members of this Committee:—

Representing the Incorporated Municipal Electrical Association.—S. T. Allen, borough electrical engineer, Wolverhampton; F. Ayton, Ipswich Corporation Electric Supply and Tramways; S. E. Britton, city electrical engineer, Chester; J. Christie, engineer and manager, Brighton Corporation Electric Supply; W. T. Kerr, city electrical engineer, Hereford; F. M. Long, city electrical engineer, Norwich; H. Faraday Proctor, city electrical engineer, Bristol.

Representing the Incorporated Association of Electric Power Companies.—C. T. Allen.

Representing the National Farmers' Union.—E. W. Langford.

Representing other interests.—Lord Tollemache and F. R. S. Bircham.

The efforts of the Committee had not produced much practical result, and it was feared that little progress would be made until the emergencies of the war had been disposed of.

The Committee had attempted to make some progress with electroculture, and the use of electrical energy on farms, particularly with regard to electric ploughing and cheap methods of overhead transmission lines. Applications had been made to the Treasury for a grant from the Development Fund and the Ministry of Munitions for a permit for small quantities of materials. These applications were submitted to the Board of Agriculture, and, as the applications did not receive the support of the Board, were refused.

The thanks of the whole Association were specially due to Mr. H. Faraday Proctor, hon. secretary, for his valuable services. His duties and responsibilities during the past year had been exceptionally arduous.

The accounts showed an income of £563, and an expenditure of £583. The balance sheet showed a net surplus of assets over liabilities of £916.

CONSTANT-PRESSURE GENERATORS FOR WIRELESS TELEGRAPHY.*

BY L. BOUTHILLON.

NUMEROUS experimenters have used constant electromotive forces for charging the condensers used in wireless telegraphy. The author shows the reasons why, when faced with the task of developing a type of station for wireless telegraphy for the Postal and Telegraph Department of France, he has also chosen the system employing constant electromotive forces for charging the condensers and by selecting the best features of the system of Marconi and Blondel has formed a combination that is an advance on each of them. The paper is divided into four parts.

The first discusses the mode of operation of a charging circuit connected to a source of constant electromotive force and to a discharging circuit containing a gap. The second discusses the relative value of various types of generators and indicates the criteria for their suitability in wireless telegraphy. The third shows the particular characteristics of the system selected. The fourth consists of a comparison of the characteristics of this system with those of the usual alternating-current system.

The first part includes a mathematical examination of the theory of charging a condenser by a constant-pressure generator. It is shown that for the production of musical tones the successive condenser discharges must be regularly spaced at equal intervals, and that consequently successive charges must take place in the same constant time. Furthermore, the voltage across the condenser and the current flowing in it should be the same at the beginning of each charge. If the discharge is supposed to be complete at the time when the spark ceases and the voltage is zero across the condenser, then it follows that the current at the end of the discharge must be equal to the initial current if the current in the charging circuit remains constant during the entire discharge. The maximum efficiency is obtained at a spark frequency double that of the oscillations of the charge, *i.e.*, for one spark per half period. Curves are drawn showing the variations of potential across the condenser and of the efficiency as a function of the frequency of the musical tone for several values of the logarithmic decrement. It appears that the spark frequency may be multiplied by 3 in the case where $\delta = 0.4$ (a value rarely exceeded in practice) and by 7 in the case where $\delta = 0.1$ without diminishing the efficiency by more than 10 per cent. This is pointed out as an interesting characteristic of methods of charging condensers by sources of direct current. After a general consideration of the values of the initial current and of the potential difference at the terminals of the condenser, the inductance and the resistance during the charge, the energy expended in the charging circuit is calculated. The stability of the tone phenomena is considered. It is shown that if a rotary gap is employed, the tone phenomena are stable and occur automatically, regardless of the value of the current at the beginning of the first charge. In case a stationary gap is used, the spark always jumps when the potential difference reaches a certain definite value depending on the bridge distance. On this assumption the equations show that the musical phenomena are stable.

Part 2 contains a number of oscillograms showing repeated charging and discharging of the condenser. Regarding the best type of constant potential generator, it is pointed out that storage batteries have been found to be unsuitable owing to the trouble involved in their maintenance. The author has received tenders from several sources for the construction of direct-current machines for voltages of the order of 20,000 volts, and he is of opinion that no serious difficulty stands in the way of using such machines. The conditions that such machines should fulfil are set out in some detail. In discussing the relative advantages of stationary and rotary gaps it is concluded that it is more difficult to obtain a pure musical note with a constant pitch and intensity with a stationary gap than with a rotary gap. The second disadvantage of stationary gaps lies in the fact that variations in the sparking voltage prevent the attaining of tone phenomena with the maximum efficiency. In coming to this conclusion it is supposed that the spark frequency is not far from that corresponding to the maximum efficiency. If the spark frequency is much higher than this value, the contrary is true, and the stationary gap is preferable to the rotary gap.

In Part 3 the general characteristics of the system selected by the author are set out. The condensers are charged by direct-current high-voltage machines, with or without additional induction, and the discharge circuit includes a rotary gap.

Transmission cannot be accomplished by controlling the field circuit of the machine because of its large time constant. It is done by opening and closing the high-voltage current where it leaves the generator. Because of the high voltage, the switch or break is subdivided into several smaller portions, and the arc which tends to be formed is extinguished in the smaller stations by the air current from the rotary gap and in the larger stations by a seperate blower.

Experiments have been made with systems with powers reaching and exceeding 100 KW. and charging voltages between 10,000 and 110,000 volts. These tests have demonstrated that between these limits the use of the system presents no particular difficulty, and there is no reason why the same should not be the case for larger powers and still higher voltages.

Part 4, dealing with the comparison of the characteristics of direct-current and alternating-current systems, shows that the advantages of the direct-current system lie in the fact that the speed of rotation of the machines does not interfere with the regularity of the circuits, and the rigorous constancy of speed required with an alternator is not necessary, the efficiency obtainable is greater, the system is not so sensitive to changes in the speed of the rotary gap, the musical tone attained is purer, and lastly, the raising of the voltage by placing several generators in series is simple, and provides an easy means of regulating the available power, whereas in the case of alternators spark production in parallel is quite a delicate task.

* *Proceedings* of the INSTITUTE OF RADIO ENGINEERS. Abstract.

ELECTRICITY SUPPLY IN SHANGHAI.

WE have received from Mr. A. H. BLAGDEN, A.M.I.E.E., acting engineer-in-chief and manager of the electricity department of the Shanghai Municipal Council, a copy of his report for 1917, which states that the year under review was the most difficult one with which the department ever had to deal. Owing to the serious breakdowns in November it was necessary to restrict the supply of power between 4 and 10 p.m., and all sign and outside lighting was cut off, giving preference to house lighting, until sufficient plant should be installed capable of meeting all demands. All reasonable precautions were taken to obtain the necessary additional plant required, and it was only owing to war conditions that the new plant had not been delivered and put into commission. The department was suffering from the cumulative effects of serious plant shortage for several years. It was, however, gratifying to record the fact that, due to alterations to the boilers at Riverside, it had been possible with the same boilers to meet an increased load of 2,500 KW.

In October the new 10,000-KW. G.E.C. set was put into commission, and had been on continuous load since that time; from October 4th to December 31st it generated 68 per cent. of the total units, which were 24,615,680. An increase in the works costs was shown, due entirely to the higher price paid for coal, the cost per unit sold being 0.636d.

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The plant capacity was 29,600 KW.; the maximum load 20,927 KW., which would have reached over 22,000 KW. had it not been necessary to make certain restrictions to the supply. The load factor of 44.38 was the highest ever recorded, and it will be noticed that it is higher than in any of the five largest municipal undertakings in Great Britain. The total units generated amounted to 96,921,287, and the units sold were distributed as follows:—Private lighting, 15,206,019, an increase of 6.44 per cent.; public lighting, 1,128,896, an increase of 6.62 per cent.; heating and cooking, 1,129,754, an increase of 25.58 per cent.; power, 57,182,340, an increase of 36.01 per cent.; traction, 3,843,433, a decrease of 0.78 per cent. The all-round increase of 26.27 per cent. would seem very satisfactory under the restricted supply conditions, and as soon as conditions again become normal increases on a much larger scale are expected.

During the year 104.57 miles of cable were erected for extending the overhead mains, and 7.44 miles of E.H.T., 1.08 miles of L.T., and 0.12 mile of pilot cable were laid. The changing over of the single-phase districts to three-phase is being carried out as opportunity serves; at the present time it is impossible to obtain some of the switchgear required for the purpose. The sub-stations number 62, with a transformer capacity of 30,767.5 KW., an increase of 10,574.5 KW., while three new sub-stations are in course of construction. Alterations have been carried out to the lighting mains, and additional sectionalising plugs inserted, enabling tests and repairs to be more quickly carried out. The total number of metal-filament street lamps connected at the end of the year was 1,718. The net increase in house service connections was 1,594, or a total of 23,453 at the end of the year. In spite of the restrictions placed on the additional connections of radiators, the units sold for heating and cooking purposes increased by 25.58 per cent. The effects of the war upon working results of the power department were less than anticipated. The total number of motors connected was 1,527, with a total horse-power of 23,535, being increases of 18 per cent. and 16 per cent. respectively on the previous year.

The year's business resulted in a net profit of £58,739 after meeting all capital charges and writing off £48,470 for depreciation. The estimated profit was £38,725, the increase being accounted for by interest charges of £11,197 less than allowed for, and by the additional sale of 7,000,000 units.

The four new trunk mains between Riverside and Fearon Road were completed, and are in use at 6,600 volts. They cannot be used at their designed pressure of 22,000 volts until re-arrangement of plant has been made.

The new switch and transformer house has been completed and most of the switchgear delivered. Two of the new boilers have been erected and are complete; four more boilers can be erected and finished during the year. The new buildings are nearly completed; the overhead coal bunkers in the boiler-house have been erected. The plant most urgently required is the 5,000-KW. Fraser & Chalmers set, and the circulating pumps for condensing purposes, which are being made by Mather & Platt. The turbine set has been finished for several months, but the necessary tests have been delayed at the manufacturers' works owing to the pressure of Government work.

Mr. Aldridge in July reported on certain extensions which were considered very urgent; in view of the present uncertain conditions as to the delivery of materials, he was authorised to proceed to America, and call for tenders for the plant required. Orders have been placed with the General Electric Co. for one 20,000-KW. turbo-generator set, one synchronous condenser, and one 600-KW. motor generator with the Westinghouse Co. As previously reported, very serious defects had developed in the two 5,000-KW. turbo-generators at Riverside, and it is now considered necessary that an additional 5,000-KW. machine should be ordered at once.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

10,374. "Incandescent electric lampholders and switches therefor." J. G. BARBER AND DRAKE & GORHAM. June 24th.

10,380. "Electric time-limit device." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) June 24th.

10,382. "High-frequency signalling." WESTERN ELECTRIC CO. (Western Electric Co., U.S.A.) June 24th.

10,388. "Accumulator-container and material therefor." M. GREENHILL. June 24th.

10,408. "Sparking plug electrodes." E. P. FOREMAN. June 24th.

10,412. "Electromagnetic wave transmission." B. BINYON. June 24th.

10,417. "Electric heating and cooking apparatus." G. W. L. PATTERSON. June 25th.

10,418. "Electric cigar, cigarette, and pipe-lighter." G. W. L. PATTERSON. June 25th.

10,448. "Magneto motor." D. SUCHOSTAWER. June 25th.

10,453. "Charging material to electro-osmotic apparatus for removing liquids from substances." ELEKTRO-OSMOSE AKT. GES. (Graf Schwerin Ges.) June 25th. (Germany, October 20th, 1917.)

10,454. "Electrodes for electro-osmotic processes." ELEKTRO-OSMOSE AKT. GES. (Graf Schwerin Ges.) June 25th. (Germany, October 20th, 1917.)

10,455. "Electro-osmotic process for removing water from materials." ELEKTRO-OSMOSE AKT. GES. (Graf Schwerin Ges.) June 25th. (Germany, October 20th, 1917.)

10,456/9. "Apparatus for electro-osmotically removing water." ELEKTRO-OSMOSE AKT. GES. (Graf Schwerin Ges.) June 25th. (Germany, October 20th, 1917.)

10,457. "Apparatus for electro-osmotically removing liquids from materials." ELEKTRO-OSMOSE AKT. GES. (Graf Schwerin Ges.) June 25th. (Germany, October 20th, 1917.)

10,458. "Apparatus for electro-osmotically removing water from materials." ELEKTRO-OSMOSE AKT. GES. (Graf Schwerin Ges.) June 25th. (Germany, October 20th, 1917.)

10,460. "Electro-osmotically removing water from materials." ELEKTRO-OSMOSE AKT. GES. (Graf Schwerin Ges.) June 25th. (Germany, December 12th, 1917.)

10,462. "System of electrically indicating on board ship the depth of sea-water." Y. KAWAKITA. June 25th.

10,466. "Electric contact-breakers or interrupters." G. F. COOKE. June 25th.

10,467. "Electric ignition devices." F. L. HOLLISTER. June 25th.

10,477. WIRELESS TELEGRAPHY AND TELEPHONY. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. June 25th. (Germany, July 12th, 1917.)

10,480. "Sparking plugs for internal-combustion engines." G. H. AVELINE AND F. SOCAILLE. June 25th.

10,488. "Electrical resistances." QUEAD, LTD., & J. C. C. MACDONOGH. June 25th.

10,491. "Electro-deposition of zinc and nickel." H. LOWENTHAL. June 26th.

10,500. "Devices for locking incandescent electric lamps in their holders." G. F. COLSON. June 26th.

10,526. "Telephonically transmitting speech." P. L. JENSEN & E. S. PRIDHAM. June 26th.

10,535. "Ignition plugs." W. F. M. EDWARDS. June 26th.

10,548. "Electric generator for motor vehicles." J. GAMBS. June 26th. (France, July 2nd, 1917.)

10,550. "Device for ensuring liquid-tight passage for connections of accumulators with containers made of celluloid." A. DISIN. June 26th. (France, July 25th, 1917.)

10,577. "Single-phase commutator-type electric motors." S. H. FIELDEN AND RHODES MOTORS, LTD. June 27th.

10,601. "Appliance for removing, replacing, or cleaning electric, &c., lamp globes, &c." R. TAYLOR. June 27th.

10,626. "Dynamo-electric machines." VICKERS, LTD., & S. F. BARCLAY. June 27th.

10,630. "Means for production of high-tension electrical discharges." R. E. H. CARPENTER AND CREED & CO. June 27th.

10,640. "Electric pencils for retouching photograph negatives." W. H. FRANKLIN. June 28th.

10,644. "Three-phase action for centrifugal flour-dressers, centrifugal scalpers, &c." E. L. COE & M. RANKIN. June 28th.

10,654. "Electromagnets." M. H. GOLDSTONE. June 28th.

10,658. "Electrolytic cells." C. I. SYNDICATE & H. C. JENKINS. June 28th.

10,665. "Devices for suspending electric lamps, &c." J. W. LANCASTER. June 28th.

10,671. "Improvements in telephones, also applicable to wireless receivers and transmitters." G. M. MASTERS. June 28th.

10,673/4. "Sparking plugs for internal-combustion engines." A. M. LODGE, AND LODGE SPARKING CO. & B. HOPPS. June 28th.

10,676. "Electrical apparatus for indicating and repeating movements at a distance." SCHNEIDERET CIE. June 28th. (France, February 13th.)

10,687. "Electric railway systems." E. J. PATELSKI. June 28th.

10,702. "Modulating means for high-frequency oscillations." WESTERN ELECTRIC CO. (Western Electric Co., U.S.A.) June 28th.

10,714. "Direction-finders, &c., for wireless signalling." R. E. VAUGHAN. June 28th.

10,717. "Receivers for wireless telegraphy." MARCONI'S WIRELESS TELEGRAPH CO. & C. S. FRANKLIN. June 28th.

10,728. "Sparking plug for internal-combustion engines." J. H. FENWICK AND F. GOODSON. June 29th.

10,747. "Dynamo-electric machines." A. G. A. KAULBACK. June 29th.

10,760. "Electric ovens, &c." C. R. BELLING. June 29th.

10,769. "Electromagnetic relay for railway signalling, &c." F. W. LEAKE AND TYER & CO. June 29th.

10,771. "Apparatus for obtaining high-tension one-direction currents from three-phase currents." G. C. TRAVACCHI & O. M. CORBINO. June 29th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

5,177. ELECTRICALLY FUSING AND DEPOSITING METAL. E. H. Jones. April 12th, 1917. (116,308.)

8,826. PORTABLE ELECTRICAL DRYER FOR LOCAL DRYING OF DRAWINGS AND THE LIKE. T. Lavender & J. R. Pannell. June 20th, 1917. (116,373.)

9,208. IGNITION PLUGS FOR INTERNAL-COMBUSTION ENGINES. H. G. Longford, W. W. Longford & W. A. Clark. June 27th, 1917. (116,379.)

10,182. BLOW-OUT SPARK DISCHARGERS FOR IMPULSE EXCITATION AND FOR A HIGH-SPARK FREQUENCY. June 2nd, 1917. (116,391.) (Addition to 108,309.)

10,363. IGNITION PLUGS AND THE MANUFACTURE OF THE SAME. H. G. Longford, W. W. Longford & W. A. Clark. July 8th, 1917. (116,392.)

10,615. MAGNETO-ELECTRIC MACHINES FOR IGNITION IN INTERNAL-COMBUSTION ENGINES. M. S. Conner & C. C. Puckette. July 24th, 1917. (115,399.)

10,766. PRISMATIC GLASSWARE FOR ILLUMINATING PURPOSES. Holophane, Ltd. (Holophane Glass Co., U.S.A.) July 26th, 1917. (116,399.)

12,727. ELECTRO-PNEUMATIC BRAKING SYSTEMS. W. V. Turner. April 17th, 1917. (115,016.)

13,260. ELECTRIC SIGNALLING SYSTEMS, MORE PARTICULARLY FOR USE IN MINES. Automatic Telephone Manufacturing Co. & C. Remington. September 15th, 1917. (116,426.)

16,264. RAILWAY SIGNALLING SYSTEMS AND RELAYS ADAPTED FOR USE THEREIN. McKenzie, Holland & Westinghouse Power Signal Co. (Union Switch and Signal Co., U.S.A.) November 7th, 1917. (116,454.)

16,268. OVENS OR FURNACES FOR USE IN BAKING CARBON ELECTRODES AND FOR OTHER PURPOSES. R. K. Wehner. November 7th, 1917. (116,455.)

16,726. PORTABLE ELECTRIC LAMPS. F. Westwood. November 14th, 1917. (116,457.)

17,801. JOINTS FOR ELECTRIC WELDING ON THIN MATERIAL. F. Blomley. December 1st, 1917. (116,461.)

1918.

3,107. ROTARY ELECTRIC SWITCHES. T. Ammann. February 21st, 1917. (113,621.)

3,575. DYNAMO-ELECTRIC MACHINES. J. W. Burleigh. June 29th, 1917. (Divided application on 9,350/17.) (116,481.)

3,788. CONSTRUCTION OF DIAPHRAGM FOR USE IN SOUND-RECORDING AND SOUND-REPRODUCING MACHINES, TELEPHONES, AND OTHER INSTRUMENTS IN WHICH VIBRATING DIAPHRAGMS ARE EMPLOYED. H. A. McInnes. March 4th, 1918. (116,482.)

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THE

ELECTRICAL REVIEW.

VOL. LXXXIII. JULY 19, 1918. No. 2,121.

ELECTRICAL REVIEW.

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NOTICE TO READERS.

In view of the Order recently issued by the Paper Controller, readers are urged to place a definite order with their newsagents for regular supply of the ELECTRICAL REVIEW weekly. In the event of difficulty arising in so doing, a subscription rate order should be forwarded direct to these offices, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C 4

INDUSTRIAL PREPARATION.

Two months ago, in reviewing some of the measures which had been adopted by certain important British electrical manufacturers to prepare for the reconstruction period, we stated our conviction that it was to industry itself, even more than to statesmen and social reformers, that the nation must look for levelling out some of the rough places of the post-war period. The necessity for better organisation of electrical and engineering industries has been recognised for several years, and, compared with pre-war days, very substantial efforts and progress have been made. Nobody who has watched from the inner circle the course of practical operations would dream of suggesting that to-day, either in organisation or in productive efficiency, we stand where we did. Progress may have been slow at particular periods during the past four years, and to some it may have appeared slower than it actually was, because much has had to be concealed from their view by the necessary supervision imposed by D.O.R.A. The development of new manufactures to avoid renewed importation, the extension of old and the erection of new factories for specialised production, though not as much can be said about them as would be possible under normal conditions, are pretty well known among engineers, though even these occasionally learn of some new advance achieved on a large scale somewhere or other in these islands which it is not policy to reveal to certain watchful eyes. Organisation schemes involving delicate negotiations and leading to transactions of considerable proportions between manufacturing leaders, are of necessity somewhat more protracted, and do not come to maturity with the same order and expedition with which one proceeds with a new manufacturing operation, or builds a new power house or factory. They may be begun and suspended, and then promoted again in some new form or on different lines, and much may be proceeding *sub rosa*. All such matters naturally give rise to rumour, but it is only when schemes reach the stage of actual maturity or achievement that they can be safely considered as contributions to the work of practical reorganisation or extension in preparation for reconstruction of industry after the war.

Mr. Hughes, the Prime Minister of Australia, in referring to the subject of organisation in readiness for Peace, has been covering very much the same ground as he did a couple of years ago. No doubt there is great need of platform appeal to the nation as a whole in respect of such matters, though possibly such appeals do not carry great weight with the people under the prevailing war conditions. Mr. Hughes, of course, approaches the subject broadly, calling for a declaration of national policy which the Government, with its desire to maintain the party truce while the guns are still roaring, has not, so far, seen fit to make. He is not concerned with particular industries, and with so many subjects to command his attention, he is probably unable to follow in detail what has been taking place in any special department. There is a tone of reluctance about his remark:—"I am glad to believe that *something* is being done by *some* people in *certain* industries." The events in the electrical and engineering industries to which we referred in our article of a couple of months ago represent a substantial contribution toward reconstructional improvement, and probably they are by no means the end of what these industries will do. There are still some substantial electrical businesses of reputation which have not joined in the movement. When rumour plays with the names of some of them it may be that there is a desire to feel their pulse, or it may be only

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the work of brokers holding a few shares. Perhaps, even, they have no disposition to "couple up" too closely. There can be a strong business without immense capital. We have seen that practically exemplified where specialised manufacturing limited in class has been accompanied by modern methods, effective personal management, and sound finance. There will be room for many prosperous businesses run on these lines in the electrical and engineering industries of the future.

We printed in our last issue a fairly full report of the important speech that was delivered at the annual meeting of the General Electric Co., Ltd. To those who wish British electrical manufacturing to be strong and on a larger scale in readiness for really effective trading operations throughout the greater part of the world, the programme of Mr. Hirst cannot fail to be inspiring. There is a strength in millions of capital that cannot be possessed by those with hundreds of thousands (if they spread their efforts over too wide a variety of manufactures) when we come up against the Teutonic many-millions concerns which have had things too much their own way in the past. An examination of Mr. Hirst's programme shows that it is the development of a plan laid by him years ago. In some respects the completion of the entire scheme in all of its parts was interfered with by the war, and businesses have been purchased instead of being initiated under G.E.C. auspices. In other respects, which need no enumeration to those who have studied the speech, the state of war has continued long enough to facilitate or to render possible the perfecting of parts of the plan which would have been far more difficult to carry out under the normal conditions obtaining in pre-war days.

The Government has before it the advice of expert authorities concerning the measures that are essential if our great industries are to be safeguarded against outside action in Peace time, enabling them to be profitably conducted for the good of the Empire and for the benefit of the millions for whom well-paid employment will be so necessary. There is still no actual certainty how far the terms of Peace will affect economic relations between our Allies and ourselves. Mr. Bonar Law's answer to a Parliamentary question on Tuesday indicates the Government's difficulty:—"It is not a question of how much their (the Dominions') minds are made up: you must examine the facts." There is likewise uncertainty regarding what will be the issues of a great election when it comes or the political programmes on which it may be fought. Unfortunately, when there is such a variety of problems looming on the horizon for that coming electoral contest, there is little hope of a clear-cut issue on one great question. But we believe that the heart of the people is sound in its opposition to wholesale dumping and penetration by the enemy, and it is the confidence of manufacturers that the Government and the industrial workers will see where the real interests of the nation lie, that induces our industrial authorities and companies to make these far-reaching developments in their organisations. We cannot but believe that many of the changes which are now taking place will be justified in years to come. The entire attitude of Labour toward Industry, however, is unquestionably a matter which gives occasion for serious thought and even of anxiety; but whatever the future may have in store in this connection, it is our bounden duty to-day to do the utmost that lies within our power to rearrange our industrial businesses, even under war conditions, so that they may be in a position to yield the maximum amount of employment with good wages and satisfactory conditions for the worker, and a financial prosperity which shall render Capital secure and the national revenues sufficient.

British Engineering in Spain.

Following up our several recent references to the need for British manufacturers to make special efforts to secure a hold upon the Spanish market for engineering and electrical equipments and apparatus, we may direct our commercial readers' attention to an interesting pamphlet bearing the title "Spain for British Engineers," which was issued some little time ago by the British Engineers' Association, 32, Victoria Street, S.W. It is written by a British engineer who was in Spain for some years handling British machinery. He makes a number of suggestions, based upon his practical experience gained in touch with the principal buyers, both official and commercial. Our failure to foster electrical and engineering trade in that country need not be further enlarged upon at this date. That our neglect enabled Germany to exploit the possibilities of the situation is, we suppose, commonly recognised. The high reputation of British machinery in comparison with that of our foreign competitors should have secured far better results for us, and it would have done so had we followed up the appreciation of the merits of our manufactures by maintaining an appropriate contact with buyers of such articles. The writer of this pamphlet advocates the adoption of new methods and the establishment of an intimate contact with the people. Suitable selling agencies should be established in the principal cities "where engineering products are in constant demand, fed by sub-agencies in the provinces, so as to cover in course of time the whole country." In the investigation of the engineering features of the situation it is practically futile to send any but practical engineers, and the advantage of possessing a knowledge of Spanish needs no emphasis, though French may be of assistance in the absence of such knowledge. The pamphlet before us contains some useful hints on sale conditions and warning respecting official contracts—the latter is worthy of study in relation to municipal orders, a department of activity where credit is "notoriously bad." We commend the publication, which we believe is one of a series, to the notice of any electrical engineering firms who have not already studied it.

Statutory Charges.

The Bill providing facilities for revising the statutory charges for public services, which is now before Parliament, has been received with mixed feelings by those responsible for the conduct of such undertakings. We briefly outlined its provisions in our last issue (page 35); it will be seen that in the case of companies, its effect is practically to reduce the dividends to half their average value before the war, and to keep them at that value during the war and for a period of two years longer. The intention of the measure is said to be to divide the burden equitably between the suppliers and consumers.

When we compare this procedure with that followed by the Government in the case of the railways we cannot help wondering where the "equity" comes in. Railway passengers have to pay 50 per cent. more for the same service, while the shareholders are guaranteed substantially the same dividends as before the war; tramway passengers will also pay increased fares, but in this case the shareholders' incomes from their investments, not too large at the best of times, will be cut down by 50 per cent.—which is not by any means equivalent to an increase of 50 per cent. in the charges, either in ratio or in effect. Moreover, the incomes of the passengers in many cases—perhaps most cases—have increased during the war by at least 50 per cent., so that they will be relatively no worse off through an increase of fares, whereas the tramway shareholders have to meet the increased cost of living with reduced incomes.

On the other hand, municipal tramway undertakings will be allowed to increase their fares "sufficiently to prevent loss" (but not more than 50 per cent.), which means that they will be able to pay the normal rate of interest to the mortgagees or loan-holders who provided the capital. Where is the equity in this case?

The same considerations apply in the case of electricity supply undertakings, and it should not be forgotten that privately-owned electricity and tramway undertakings are usually liable to purchase by local authorities, so that they have only a limited period in which to make good the deficiencies imposed upon them by the Bill. When we look around and see the prosperity enjoyed by so many of our industries in private hands, while these great public services are thus to be restricted to half their modest normal profits, we feel that "equity" appears to be a missing quantity in this connection.

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THE EDUCATION AND TRAINING OF ENGINEERING APPRENTICES.

By P. H. S. KEMPTON, A.R.C.Sc., B.Sc.

One of the *good* things that the war has given us is the awakening of the nation to the need of education, especially scientific and technical education. The general trend of public opinion, the finding of the Lewis Committee, and finally the new Education Bill, are all indications that this awakening is to be a real one and not a stretch and a yawn, followed by relapse into a profounder lethargy. The chief sections of the new Education Bill deal with the raising of the school-leaving age and compulsory attendance at continuation classes up to the age of eighteen: both are reforms long overdue, and the latter bids fair to revolutionise technical education in this country. Fortunately the engineering profession has everything to gain and nothing to lose from any proposals that would tend to raise the standard of education, and schemes are already afoot which anticipate the Minister of Education's proposals. Some of these schemes have stood the test of time, and are worthy of consideration as models upon which future developments can be based; others are admittedly experimental, but nevertheless worthy of attention as providing tests of new and untried educational ideas and theories.

It is unnecessary to insist that our survival as a great industrial nation depends largely upon our engineering resources and efficiency, and that the engineering efficiency of the future is dependent upon the training of the youths of to-day. These things have been said so frequently that they have become platitudes. But it is still painfully true that we are in very little better position to tackle after-war problems now than we were two years ago.

So little is generally known concerning the training of engineers that the Board of Education recently issued a pamphlet: "Engineering Training. Circular 999. Some notes on existing facilities. Board of Education, 1917," purporting to give some information to parents and others who might be interested. And that this lack of knowledge has led to numerous square pegs being in round holes and consequent inefficiency is indisputable.

All of which indicates that it is high time for us to review our system of apprentice training with some thoroughness, and by wholesome demolition of stale and unsound practices and judicious reconstruction on well-tried lines to erect an educational structure which will prove adequate to modern and post-war needs.

In the Electrical Review of December 1st, 1916 an account was given of the Admiralty method of training apprentices, which has worked with valuable results for many years in connection with H.M. dockyards. The immediate purpose of the present article is to give an account of some of the systems of apprentice training which are in operation in this and other countries, and to indicate the lines of possible development.

In this connection it is worth while noting that there appears to be an almost universal consensus of opinion that this question of apprentice training is at the very root of success in the engineering industry, a consensus of opinion that is widened by the following almost haphazard choice of quotations from recent speeches and writings on this subject:—

"In fine, it is sound economics for industries to pay the cost of the training of its own boys." Mr. Algernon E. Berriman, O.B.E., chief engineer of the Daimler Co., in a recent article in *Engineering* (February, 1918).

"Only when manufacturers are prepared to take active interest in industrial training will they be able to ensure that the type of training given to workers is the best from an industrial point of view." *British Westinghouse Gazette*, February, 1917.

"The difficulty of obtaining men with the proper training for performing the exacting work demanded by many of our modern industries has led to the institution by some of the larger concerns of special training courses for boys and young men." From the *General Electric Review*, organ of the G.E.C., U.S.A., January, 1918.

"These youths should be liberated for at least two, and if possible three, half-days a week for the purpose of their technical education. . . . Your committee are unanimous in expressing their belief that the extra expense involved in the absence of apprentices during class hours will be returned to the employers in a far higher degree in the broader mental outlook and initiative of the individual." From the report by a special committee to the N.E. Coast Institution of Engineers and Shipbuilders.

Still further evidence that these revolutionary methods of apprentice training are not the ill-advised and unconsidered whims of modern pedagogues, but that they have been very definitely stated by far-seeing engineers and educationists as far back as the seventies is shown by the following significant sentences from a letter written to the Press by Prof. John Perry in December, 1879: "It is high time that a change should be brought about in the apprenticeship system of England. . . . If we consider the great number of apprentices who are to receive instruction, we must, in spite of the well-known experiments on the Continent, come to the conclusion that the practical part can only be given to them in ordinary workshops. . . . What I advocate is the establishment of classes in the neighbourhood of workshops, where, during two hours a day, they may learn how a knowledge of natural science is applied in their particular trades. These classes ought to be day classes." And in 1889: "Every apprentice should devote at least one hour a day, five days a week, during working hours, to study at a technical school."

Every scheme of technical training of apprentices recognises the existence of three classes of apprentices:—

1. Those whose exceptional ability and "staying powers" will enable them to reach very high positions in their professions.
2. Those whose ability is something above the average, and who will become the foremen and draughtsmen of their trades.
3. Those who are unlikely to rise beyond the level of the journeyman artisan.

Therefore every such scheme must provide for the sifting and adequate training and development of these classes. The first must be given a straight road to the completion of a university course without financial anxiety; the second must receive that special training which will result in a broad outlook and an initiative such as is required of those who are in actual charge of workshops and shipyards; the third must be given as sound a training as is possible in view of their restricted abilities, special care being taken to remedy any defects in their early or fundamental instruction.

(To be continued.)

Electrical Development Campaign in the U.S.A.—The activities of the Society for Electrical Development, in its campaign for a broader and better use of electrical household helps, are striking a popular chord and showing fruitful results. We learn that last year there was a sale of more than $10,000,000 worth of washing machines, at the rate of something like 200 washers per day. About $4.000,000 worth of vacuum cleaners and over $7,000,000 worth of other electrical labour-saving appliances were also sold, which goes to show that there is a real and ever growing need for such appliances in the home. Complete details will be sent to practically every electrical concern in the country, and the Society gladly furnishes information upon request.

The progress of electrical development in this country is sadly handicapped by the lack of a similar energetic organisation; we trust that in the new era that is about to open, this deficiency will be remedied.

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THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

The twenty-first annual general meeting of the Tramways and Light Railways Association was held on Friday last at Caxton Hall, Westminster. Mr. R. J. Howley, M.Inst.C.E., vice-chairman of the council, was in the chair, supported by Mr. James Devonshire, Coun. R. Mayne, Mr. A. L. C. Fell, Mr. S. Sellon, Mr. W. E. Hardy, Mr. E. H. Edwardes, Mr. A. L. Barber, Mr. E. Hatton, Mr. H. England, Mr. S. White, Mr. C. D. Stanley, Mr. W. Thom, Mr. Mason, and Mr. A. de Turckheim (secretary).

Sir Arthur Stanley, G.B.E., M.P. (chairman of council), who had been seized with illness, sent his address, which explained that there was a net credit balance of £87 on the year's working, with a total of £608 to carry forward, of which £550 was invested in War Bonds. The feature of the year was the setting up of the Board of Trade Tramways Committee, of which their past vice-chairman, Mr. Devonshire, had been appointed chairman. A better choice could not have been made. Mr. S. Sellon and Mr. Howley had been appointed to represent the association on that Committee. This committee was urgently needed, for a great variety of questions covering the whole field of tramway work had to be dealt with. They might not have got all they wanted, but at least tramway administrators and managers now knew where to go and to whom to apply. There had been a perfect epidemic of demands for increased wages, at first local, afterwards national. Great unrest prevailed, and the Committee on Production made awards week after week till there was hopeless confusion. At last there was a demand for a national award of a 20s. bonus, and a committee was formed to represent the undertakings before the Committee on Production. Since then there had been a further demand for a 12½ per cent. increase or its equivalent. In the result an award was made on July 9th, increasing the 20s. bonus to 25s. per week, and was in full settlement of any claim with respect to the bonus of 12½ per cent. A claim for an equal bonus to women failed. They highly appreciated Mr. Howley's work at both arbitrations. So far back as 1916 steps were taken to obtain relief by pressing for powers to increase fares. Nothing was done till last April, when a House of Commons Committee was appointed. Last June the Committee reported, not in favour of a short measure which would have allowed the situation to be dealt with quickly, enabling some of the hard-hit undertakings to take advantage of the summer season, but submitting a controversial combined Bill dealing with gas, water, electricity and tramways, the provisions of which were inapplicable to tramways generally. This was a severe disappointment. As to Industrial Councils, a draft scheme for setting up a National Council for Tramways was all but completed, and any attempt to bring employers and employés into closer co-operation for their mutual benefit should be encouraged, as likely to lead to a better understanding, harmonious working, and improved results. The council had also dealt with such matters as decimal coinage in its application to tramways, standardisation of overhead line material, national service, deferred repairs and statutory depreciation allowances, women drivers, steel tires, &c. The next matter that the committee would devote attention to was the supply of materials after the war, and the Board of Trade Report on Electric Power Supply, tramway generating stations, and many other kindred matters.

After the adoption of the report and accounts, some discussion took place, at the instance of Mr. E. Hatton and Coun. R. Mayne, of Newcastle, as to the composition of the council as representing the municipal and company sides of the tramway industry. Six members retired, including two municipal men, leaving only three out of eighteen. The council recommended the election of six company men only. Mr. A. L. C. Fell (L.C.C. Tramways), Coun. Mayne, and Mr. Harvey (Ilford) were nominated, and the six vacancies were filled by ballot by the appointment of Messrs. H. England, E. H. Edwardes, Fell, Coutts, Mayne and Baker, two additional municipal representatives being thus added to the council.

The Chairman opened a discussion on the recent national awards, and detailed the action taken by the council. He explained the effect of the award of July 9th, and said that the 5s. advance was the figure expected in view of other decisions. Tramway employés were getting very excellent remuneration as compared with other classes of workers.

Messrs. Barber, Hatton, Cox, White, Mayne, Fell, Stanley and others took part in the discussion, which was followed by a paper by Mr. E. H. Edwardes (S. Lancs Tramways Co.) on "National Industrial Councils," in the course of which he showed how the Whitley scheme was being applied to the tramway industry. He emphasised the far-reaching nature of the schemes now in the process of completion, and said that the employés would have to be divided so far as tramways were concerned into two classes—municipal and company.

Mr. Devonshire reminded the members of what was happening with regard to the efforts of the Ministry of Labour to assist and train disabled soldiers and sailors on their discharge. Large numbers of men, not all physically fit by any means, were coming into the market, and with them sympathy must lie. He had to represent the council at the Ministry of Labour in connection with the employment of disabled sailors and soldiers in electric light and power stations. On the one side were five employers' associations, and on the other five trade unions. They had started in a small way with sub-station switchboard work, and the ten bodies he had indicated had under the constitution power to nominate their own chairman. With due modesty he might mention that the trade unions had proposed him as chairman and he had occupied the position ever since. They were now called the National Advisory Committee for the whole of Great Britain and Ireland in connection with the employment of disabled sailors and soldiers for electrical work. He thought so far as their industry was concerned a good foundation had been laid for the establishment of industrial councils.

Mr. A. L. Barber opened a discussion on "Increased Fares," and traced the efforts to obtain statutory powers to enable tramway undertakers to recoup themselves for increased cost of running, maintenance, &c. He detailed the provisions of the new Board of Trade Bill, and said that the first amendment sought by the Association referred only to company-owned undertakings, and its effect was to suggest that the Board of Trade should have power to modify the fares and charges to such an extent as would enable companies to earn 5 per cent. on the capital properly expended on the undertaking. This would practically put companies on the same footing as municipalities. The second amendment was to ask for the proviso that any modification of fares should not be less than a halfpenny. It was impossible to say what would be the result of their efforts, but members of the association could be satisfied that everything possible was being done on their behalf.

Considerable discussion ensued as to the financial effects of the amendments that were sought, and in reply, Mr. Barber pointed out, to remove misapprehension, that the fixed percentage asked for was upon capital expended.

Mr. W. E. Hardy next opened a discussion on the Coal Restriction Order, pointing out how greatly

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industrial consumers of electric power were affected by the new regulations. Tramways appeared to have been singled out in the call made for economy, perhaps because they were easily accessible to Government departments. With the advent of the new order for rationing coal for householders, the question of the 15 per cent. reduction of consumption of electricity by ordinary consumers was in reality wiped out, and even the favoured North came into the scheme, so that he would not be surprised to learn that considerable modifications might be made in the Coal Restriction Order as applied to tramways. He referred to the different interpretations of the order, and said that a 15 per cent. reduction in coal consumption meant considerably more than a 15 per cent. reduction in service, because the standing losses in a power station would be practically unaffected. Therefore the tramways with their own power stations were harder hit than those which purchased energy. He referred to the use of coke breeze, and particularly invited the opinions of generating station managers in the matter of burning this fuel.

Considerable discussion followed, in which the argument was in favour of the substitute for coal, and the proceedings closed with the customary votes of thanks.

TRADE UNIONISM—PAST AND FUTURE.

(COMMUNICATED.)

MANY are the discussions on trade unionism in its different aspects to-day, and many are the criticisms levelled at the various unions and branches of unions, on their action or inaction, their programme or their status, and particularly is this so in the electrical industry, but throughout all these discussions and criticisms there appears a general impression that some sort of trade unionism is not only desirable, but absolutely essential to modern working conditions. Yet no one union so far seems to satisfy the requirements of all its members, and others who would be members but for the fact that the union, as we have it to-day, is so obviously imperfect, and that is why electrical workers are not all members of one union, and why jealousy, bad feeling, and suspicion, have existed between two such unions as the E.T.U. and the E.P.E.A.

Nor can there be any improvement in this direction until the general principles underlying trade unionism have undergone a great change, and have been explicitly defined. The common formulæ of the present trade unionism are not palatable to all the workers, especially in the electrical industry, and as a result the higher or technical grades of workers have not been attracted to the unions, yet even those who on political grounds, or because of visions of "status" and the loss thereof, have been most antagonistic to the unions in their recognised and usual form, are beginning to feel that the organisation of labour is a vital necessity not only to the workman himself, but to the nation as a whole. Nor can this be wondered at when we consider that many technical men to-day find a difficulty in obtaining more than about £150 per annum, or even less; but they are not prepared to sacrifice their most cherished principles without a struggle, and so their only hope lies in the formation of a new union whose aims and objects, although not entirely dissimilar from the aims and objects of the every-day union, will fit in more with their views on the conduct of theirs and the nation's affairs.

Is it, therefore, possible to form a new union which will be satisfactory to all classes of workmen, and which will efficiently protect both the workman and his industry? To answer the question it would be necessary to go into the whole history of trade unionism from its birth. To do this thoroughly is obviously impracticable in a short article of this description.

But let us have no doubt, no compromise on one point. The miserable portions of our population came in to serve a system, the system underlying our principles of trade, the system of cheapness. They never had a chance to be anything but miserable, and as time went on they conceived the idea of organising in the hope of bettering their conditions. In fact, trade unionism sprang up as a revolt against the system, and was a protective movement for a class of producers, or a reaction against the traditions of trade. But in the first place they made one grave mistake, and it has hindered their progress ever since. They felt that as producers their interests had been little cared for by their employers, and they, in their turn, thought little of the interests of the country. They failed to realise that if the individuals of a nation are to be successful, then that nation as a whole must also be successful. Their only thought, however, was of protecting themselves, and they did nothing to foster production and to maintain efficiency.

It is true that trade unionism did to some extent encourage efficiency, and many of the best workers were enlisted in its cause, but as a whole they did not realise that it was the inferior workman who encouraged cheapness, and that he was the agent of the employer who wished to depress wages.

To the working man the trade unions stand as his last hope of maintaining his position in the social system. It is therefore a good sign that the country generally is beginning to appreciate the importance of production on the large scale and general efficiency in production. No longer do workmen complain of labour-saving machinery, for they have learnt that the machines increase their output and that increased output means better wages. All our attention is now concentrated on increasing the national output, and since the old form of trade unionism did nothing to encourage output, some new form of unionism is clearly desirable.

This new trade unionism cannot long be delayed, although there is no direct evidence that it is in the making. A new national policy is freely talked of, and there is no reason why the new trade unionism should not form an important feature of the national policy, but whenever, and however, it is formed, it must be based on the recognition of the producing character of the people as a whole.

The union which merely forces wages up by continual agitation is a failure because we have learned by now that so surely as wages increase, so surely does the cost of living go up proportionately; but the union whose principles are based on the recognition of producing character will be favourable alike to all classes of workmen and will bring them more in touch with the employers. It will discourage unorganised and casual labour, as well as inefficiency, and it will fight the bad employer. Moreover, it will become compulsory, and although it will regulate wages, conditions of employment, education of the workers, and the standard of work turned out, it will not interfere with management except perhaps to help to control competition.

The present is a splendid opportunity for this great reform, which is the best and only revolution we need in this country. We require a strong leader, and surely in the electrical industry such a man can be found, but he will have a hard office to fill, for in many the class prejudices and the suspicion of employers are very deeply ingrained.

If only such a man can be found, a man of honourable character, who will have the respect and confidence of employers and workers alike, then we can feel justly optimistic. Yet our chief hope can surely be found in that great British Army, which we all hope to see soon returning to civil and industrial life, for its members have learned their lesson by bitter experience.

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AUTOMATIC POWER FACTOR REGULATION.

In any A.C. power installation which includes induction motors subject to fluctuating loads the inevitable question of power factor has to be contended with, particularly so to-day when industrial power loads are developing rapidly in number and size, and it is becoming increasingly difficult for supply undertakings with their existing plants to meet the demands of their customers. Moreover, where the charge for power is on a K.V.A. basis, it is obviously to the consumer's advantage to reduce his power bill by regulating the power factor of his system and keeping it as near unity as possible, and, if this regulation can be carried out *automatically* withuot complication or other operating disadvantages, the additional cost of the automatic gear becomes negligible in comparison with the direct saving of money it brings about.

The three methods by means of which the power factor of an A.C. installation can be improved may be broadly classified as follows:—

1. The application of phase advancers of the commutator type to individual induction motors.
2. The use of static condensers.
3. The use of over-excited synchronous motors and rotary converters.

Each of these methods has its advantages and disadvantages, and has been described and discussed in the technical Press from time to time. The third method, however—the use of over-excited synchronous machinery—is the only one which lends itself readily to automatic control.

An interesting example of this method of power-factor regulation is afforded by a plant rceently installed at the Ledston Luck Colliery of the Micklefield Coal & Lime Co., by the advice and to the specification of Mr. W. B. Woodhouse.

The overall power factor of the existing electrical system was about 0.6 lagging, and to correct this a synchronous motor was installed to drive the ventilating fan for the pit, this being large enough at the same time to furnish sufficient current to raise the power factor of the whole system to a value approaching unity. The equipment included a Brown-Boveri automatic regulator specially adapted for use with this motor in such a way that the field excitation of the latter could be automatically varied to the extent necessary to compensate the whole of the lagging current of the installation.

The motor in question was supplied by Messrs. Mather and Platt, and is rated at 1,000 K.V.A., 2,000 volts, 50 cycles; as it is only requred to give an output of 360 B.H.P. continuously

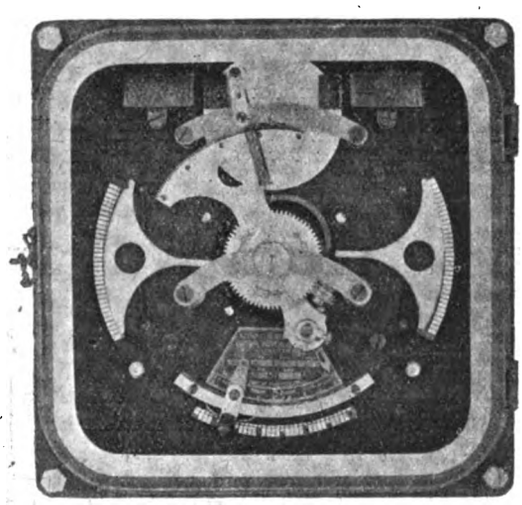

Fig. 1.—Automatic Power-Factor Regulator.

for the fan, the surplus K.V.A. capacity is available for phase compensation. The automatic power-factor regulator (shown in fig. 1) was supplied by Messrs. Brown, Boveri & Co., Ltd., London; it controls the excitation of the motor on the same principle as that of the well-known pressure regulator made by this firm. In this case, however, the series transformer is inserted in the bus-bars, so that the regulator follows every change of power factor on the system, and correspondingly varies the excitation of the fan motor—and hence the K.V.A. output of the latter—in such a manner that the power factor of the whole installation is automatically maintained practically at unity independently of variations in the load and power factor of the individual motors about the pit.

This plant has given very satisfactory results during a long period of commercial operation, and is worthy of special notice by those power suppliers who are troubled with the technical difficulties which a low power factor invariably brings about, and also by those power consumers who have to pay for their power on a K.V.A. basis. In either case the judicious installation of suitably rated synchronous motors, automatically over-excited to compensate the phase displacement of the local system as above described, will invariably bring about advantages and savings that will soon repay the extra cost of the special gear.

Fig. 2 is a general diagram of connections for automatic power-factor regulation. It is important to know that the

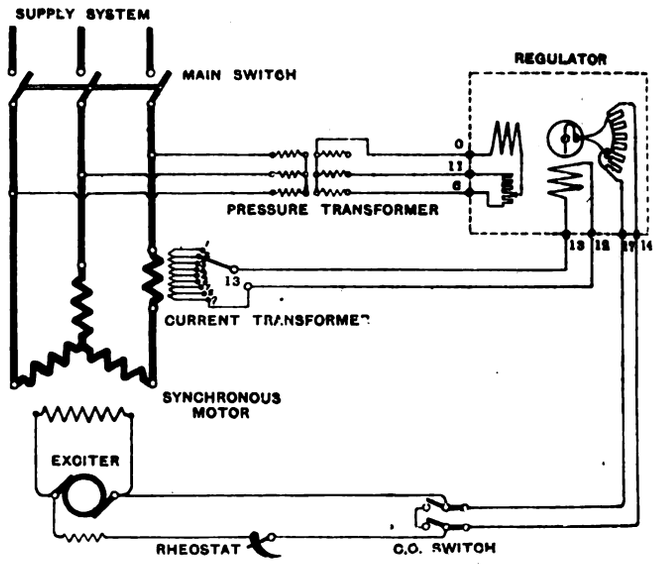

Fig. 2.—Diagram of Connections.

principle involved is not limited to the case of isolated synchronous motors, but is applicable to all synchronous machinery, and in particular to generating stations as a whole. For instance, in the case of a number of power stations operating in parallel, all the generators installed in one or more of them can be provided with equipments for the automatic regulation of the power factor, the pressure regulation of the system as a whole being taken care of by one or more of the other stations feeding the same system. In this way the pressure regulation of large interconnected systems becomes simplified and improved, while the automatic control of the power factor of the system is of great advantage.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Indicator to Call a Deaf Clerk.

A large firm in Edinburgh employs a deaf clerk, and the accompanying sketch shows the method by which he is called to the manager's room when required.

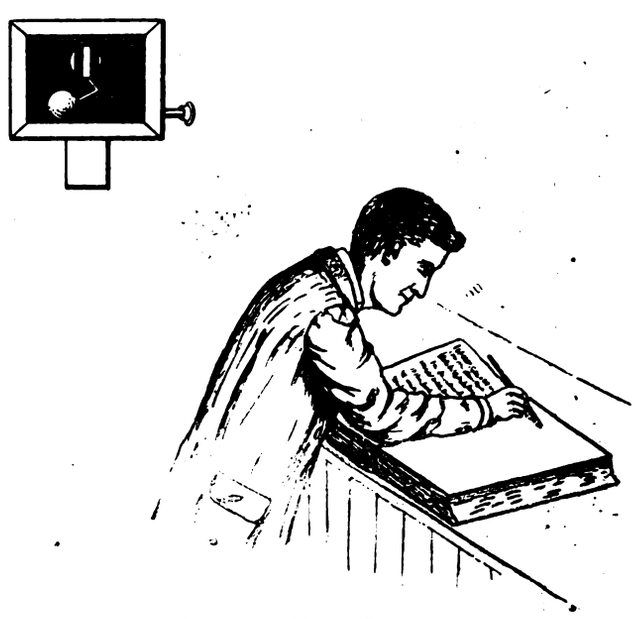

Fig. 1.—A Novel Indicator.

The inventor removed the glass front from an ordinary mechanical-replacement indicator and fitted the indicator so

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that when the flag falls a large white marble drops through a hole made for the purpose in the bottom of the indicator case. The marble falling six feet on to the floor (where it is retained within an enclosure) makes sufficient concussion to ensure attention by the clerk. The marble, of course, has to be replaced by hand each time after use.

This device is in daily use, and has proved entirely successful.

Spring-Mounted Battery Carrier for Motor Vehicles.

The mounting of batteries on petrol motor vehicles has always been a difficult problem, especially in the case of industrial vehicles fitted with solid tires where the vibration set up when negotiating rough roads is great. Some motor manufacturers have mounted the batteries on springs, while others have attached them rigidly, claiming that the use of springs causes the battery to continue to vibrate after the action of the heavier vehicle springs has ceased. The accompanying illustration, fig. 2, shows the battery-mounting arrangement recently adopted by the Grant Motor-car Corporation, of Cleveland, O., U.S.A. As will be seen, the battery is mounted

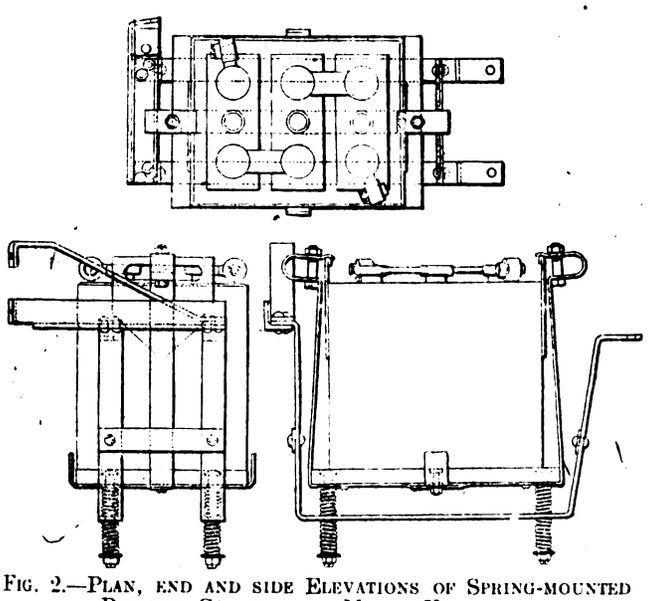

Fig. 2.—Plan, end and side Elevations of Spring-mounted Battery Carrier for Motor Vehicles.

in a cradle on four sets of springs, one half of each set being placed between the cradle and the battery and the other half below the cradle. It is claimed that the lower springs tend to counteract those on which the battery rests, so that the spring action does not continue after the vehicle springs have come to rest. A second spring cradle inside the main supporting one is provided, it having U-shaped tops with small bolts which hold the edges of the battery jar or case in place.

The Austin-Walters Rheostat Units.

Messrs. Austin Walters & Son, of Little Peter Street, Manchester, are now making electric rheostat units, which we illustrate below, for which distinct advantages over the old

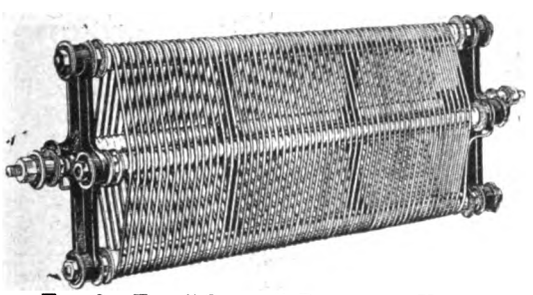

Fig. 3.—The "Ohmic" Resistance Unit.

form of cast grid type are claimed. They are considerably lighter, and have a greater ohmic value in less space; they are unbreakable, rustless, perfectly ventilated, and have practically no temperature coefficient.

They can be used in any position; the illustration, fig. 3, gives a clear idea of the construction. The wire or strip used is a copper-nickel alloy of ample carrying capacity and is wound on a former with metal ends supporting four wrought-iron rods, which are insulated with mica and asbestos tubes, over which a well-spaced wire is wound and bedded. The asbestos sheets before being rolled into tubes are specially treated and impregnated, thus rendering them non-hygroscopic.

The asbestos tubes are used as a means to bed and support the wires in winding, no reliance being placed upon them for insulation. The wrought-iron rods passing through the tubes are substantially insulated with mica bushes and washers, making a sound mechanical and electrical resistance unit. The firm is at present making them in four sizes and various lengths to suit requirements in resistance work, and they are being used in the construction of the welding rheostat shown in the illustration, fig. 4.

These rheostats are built up of a number of units, to carry a current of 200 amperes by a system of paralleling, which the firm employed some years ago in the construction of

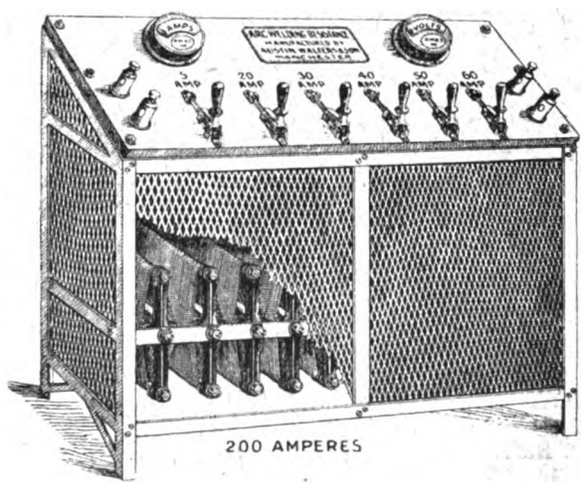

Fig. 4.—Austin-Walters Welding Rheostat.

their bioscope rheostats. The units are wound according to the currents indicated over the switches, and by a combination of the switches the current can be regulated from 20 to 200 amperes in 5-ampere steps. The units can also be used for ordinary series rheostats, and a special connecting clamp can be provided to enable various tappings to be taken as required. On account of their extreme rigidity they are suitable for heavy-current starters and portable rheostats.

In the case of the welding rheostat mentioned above, the units are fitted into a wrought iron frame having a number of slots corresponding to the number of units, so that in the case of renewal or repair the unit need only be disconnected and lifted out of the slot without dismantling the entire frame. A full list of sizes will be available shortly, giving ohmic values, carrying capacity, and weights, &c., of the rheostat units described above.

LEGAL.

Rio Tinto Co., Ltd. v. A. E. G. Electric Co., Ltd., and A. E. G. Electric Co., Ltd. v. Rio Tinto Co., Ltd. (Consolidated).

(*Continued from page* 30.)

On the fifth day of Mr. Clift's cross-examination, Mr. Colefax, K.C., said: Mr. Dufty wrote on his arrival at the mines on September 26th that he found that some ten days previously the Rio Tinto engineers had put the blower set under steam, and that up to 600 or 800 revolutions everything worked in order, but with 1,200 to 1,500 revolutions there was great vibration, and the set had to be shut down. Do you mean to say that that record was the record which a man would have made if he had had the facts before him? —I don't suggest that he had a chart before him. He wrote that he had been informed there had been several runs. The defendant had no account of what had been done with the machine before Mr. Dufty arrived because they never asked for it.

Continuing, the witness said he was cognisant of what was being done in regard to the making of the new shaft. The shaft had been run for two hours on one occasion at 1,200 revolutions. It could not have been run up to the critical speed, because it was not vibrating. When the machine was started they had never been told that there was a critical speed. As to the delay, he said there was no possible doubt that people did not like to work for the A.E.G. Co., and hence the difficulty they experienced in getting the new shaft made, but at that time there was difficulty in getting such work done anywhere owing to the pressure of Government work at the foundries.

Mr. Robert Edward Palmer, mining engineer, formerly employed by the Rio Tinto Co. at their mines, gave evidence as to the changes which were made in the plant and the substitution of the new plant for the old pyritic, and the Bessemer plant and the working of the blowers in relation to them. As to the trials when the shaft bent, he said Mr. Kelton and Mr. Dufty were present for the A.E.G. Co.

Mr. Colefax, K.C., in opening the case for the defence, said that the case had, in part, been dealt with by the arbi-

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trator. It was important to note that the parties, in the agreement, set out their position quite clearly as to how the matter should be dealt with. It was that agreement which constrained the arbitrator to do what he did. The plaintiffs sought to say that in July, 1914, the reason why the tests did not take place was because of the A.E.G.'s failure to deliver plans before February 11th, 1914. That was the issue between them. Upon the facts as presented by the opening and by the evidence, there could have been no loss of output. As to the position in July, 1914, his submission was that the A.E.G. had done everything that formed any part of their obligation—that so far as they were concerned the plant was erected, and all that remained was to carry out the tests. They were prevented from doing that, not through any shortcomings on their part, but entirely because it did not suit the convenience of the plaintiffs that the test should be carried out. It was quite clear that the intention was that the people from Berlin should carry out the tests, which involved the starting up for the first time after the erection of the machine. The defendants suffered great disadvantage, not from any fault of their own. Time went on until October, 1914, when defendants were entitled to be paid the second instalment, which he submitted had been deliberately held back. He contended that the breakdown was due to the Rio Tinto people having injured the machine in attempting to run it.

Counsel then reviewed the evidence at great length, particularly in relation to the visit of Mr. Dufty to the mines and the concealment from him of what had been done in regard to the running of the machine, which he contended clearly showed that there was no defect in the design of the machine.

Mr. Richard Thomas Durran, engineer, of Victoria Street, Westminster, who prior to the outbreak of the war had been for 14 years in Berlin as manager of the foreign department of the A.E.G. (Berlin) Co., and who was a director of the English company, and now managing director pending its dissolution, gave evidence as to the business relations between the A.E.G. and the Rio Tinto Co., and the contract for the plant which was the subject of the action.

Mr. John William Flower, formerly manager of the London branch of the defendant company, and now with Dick, Kerr, Ltd., gave evidence in relation to the transactions with the Rio Tinto Co. as to the supply of turbines. He said that he saw Mr. Clift on several occasions, and he never said anything as to the shortage of steam. There would have been no difficulty in carrying out the tests in this instance if the Rio Tinto people had wished to make them. The defendants repudiated any liability in respect of the second shaft based upon the fact that the plaintiffs had run the machine without anyone else being present. In August, 1914, Mr. Clift then told him he had agreed to postpone the official test. Mr. Clift was then pressing for the starting of the engine without delay, and a proposal was made as to the payment of the second instalment of 25 per cent. in connection with the starting up. The plaintiffs sought to keep the third instalment in hand until the final test had been made. They made a proposal that the defendants should hold themselves liable—that they should be bound by the guarantee—notwithstanding that the plaintiffs had had the use of the machine. This proposal he could not accept. Mr. Clift asked whether the money would go to Germany if it was paid, and witness told him that it certainly would not as it would be paid to the Board of Trade supervisor. The Spanish erector was sent by the Seville office, and he was at the mines for three weeks. In the end they had the statement from him that the plant was in order. In his opinion it was absolutely necessary that the plant should have a detailed overhauling, because even if a small detail were overlooked a serious accident might result. Mr. Clift had never denied that under the terms of the agreement the payment had become due.

Questioned as to the negotiations which had taken place in regard to payments, the Witness said the reason why they preferred using the Spanish company's men was the difficulty which existed, owing to the war, in getting men to go out from this country. In September an agreement was arrived at under which a man should be sent out to start the machine and that an instalment should be paid as soon as the machine was working commercially. He had no idea that the machine had been started prior to that interview. In sending a man out to start up the machine they were not sending him out to repair a bent shaft. Had he known the true facts he would have been strongly opposed to the agreement.

At the conclusion of the evidence for the defence the hearing was adjourned.

(To be continued.)

New Ross (Co. Wexford) Gas Co.

In the Chancery Division of the High Court of Ireland, Mr. Justice O'Connor granted an application by this company confirming an alteration in the company's objects so as to provide for the generation of electricity for lighting, heating and power; changing the company's name to "The New Ross Gas and Electricity Supply Co."; and increasing the capital to £10,000 by the issuing of 1,000 shares of £5 each, ranking for dividend, and in all other respects, equally with the existing ordinary shares. It was stated that from the year ended March, 1909, to the year ended March, 1914, the company paid a dividend at the average rate of 8 per cent. per annum, free of income-tax; that owing to the increased price of coal and the increase in general expenses owing to the war, only 5 per cent. could be paid for the year ended March, 1915; that there was no dividend in 1916, and that 4 per cent. was paid for the year ended March, 1917. This, said counsel, showed that the company was perfectly solvent.

Bruce Peebles & Co., Ltd.

In the First Division of the Court of Session, Edinburgh, on Friday, a petition was presented for the above company for authority to summon and hold meetings of members of the company, of the mortgage debenture holders, and of the unsecured debenture holders, for the purpose of ascertaining their wishes regarding a scheme of arrangement which the company proposed to enter into with both classes of debenture holders with a view to an alteration or modification of their several and respective rights. Both classes of debentures became due on July 1st, 1918. Interest had been paid on the first debentures, but interest amounting to £30,000 upon the unsecured debentures was unpaid, but debited in the annual accounts of the company to profit and loss. The unsecured mortgagees had no right to demand payment of interest until July 1st, 1918. The object of the scheme was to convert the unsecured mortgages into preference shares of the company, with a right to at least 7½ per cent. cumulative dividend as from July 1st, 1918, and, apart from other privileges, to repayment of their capital in a winding up, and to a bonus of 50 per cent. For these rights they were asked to surrender the arrears of interest. In respect that the secured debenture holders agreed to defer for 15 years repayment of their capital, the scheme gave them 1 per cent. of additional interest. The unsecured debenture holders were practically all shareholders of the company, and interested to a much larger extent as members than they were as unsecured creditors. All the meetings were practically unanimous in approving of the scheme, and the respondents were the only parties opposing in court its sanction.

Answers were lodged for Wm. Bain & Co., Ltd., Lochrin Iron Works, Coatbridge, who submitted that the scheme was unfair and inequitable to the dissentient creditors, and that it ought not to be sanctioned. It was proposed, they said, that they and others of the unsecured debenture holders who voted against the new scheme, should be compelled (1) to surrender their accrued debt (to the extent of £27,797), and (2) to become shareholders in the venture, surrendering all the rights of a creditor in enforcing their rights by diligence should the conduct, management or prospects of the company appear to afford ground for doubt as to its future. It was also proposed for no reason whatever to give to the outstanding heritably secured debenture holders (to the extent of £49,850) a right to 6 per cent. interest per annum instead of 5 per cent.

Sir George Paul, D.K.S., to whom the case was remitted, reported that the additional 1 per cent. to the secured debenture holders seemed not to be unreasonable, as they were waiving their right to the repayment as at July 1st, of the capital of their debentures to which they were entitled. Taking into consideration the whole circumstances, the reporter said that, in his judgment, the scheme and the resolutions might be approved of by their Lordships.

Objection was taken by the respondents to the competency of the application in respect that it was presented on the authority of the directorate alone, without any preliminary meeting of the members of the company to consider it. This point of practice was decided by the Court in favour of the company.

The Division, Lord Johnston dissenting, approved of the scheme, and granted the prayer of the petition. The respondents were found entitled to their expenses in the special circumstances of the case.

WAR ITEMS.

To be Wound-up.—The Board of Trade has ordered the following to be wound up under the Trading with the Enemy Amendment Act, 1916:—Metal & Machinery Syndicate, Ltd., 56 and 57, Aldermanbury, London, E.C.2, metal and machinery merchants. Controller—P. H. Green, 60, Watling Street, E.C.4.

Trading with the Enemy.—The *London Gazette* for July 12 contains further lists of bodies and persons in the following countries with whom trading is prohibited:—Argentine, Paraguay and Uruguay; Bolivia; Brazil; Chile; Colombia; Costa Rica; Cuba; Ecuador; Honduras; Guatemala; Mexico; Morocco; Netherlands; Netherlands East Indies; Nicaragua; Peru; Salvador; Spain.

Trade Unionism After the War.—In the course of his presidential address to the General Federation of Trades Unions, Mr. O'Grady congratulated the federation on a rise in membership of 1,033,000. He is reported in the Press

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as saying that after the war there would be greater need for such federations, and they must have a large accumulated reserve to enable them to resist foolish action that would unquestionably be taken by certain individual employers and by certain federations of employers. The fact that there had been very few disputes during the year did not indicate that the workers in various industries were content with the existing condition of things. The Committee on Production had provided machinery which had prevented social revolts arising from the stupidity of employers.

Women-Workers After the War.—The "Times" states that as the result of two informal conferences of leading trade union women, held by the National Alliance of Employers and Employed, it has been decided to place before a large conference of all women's societies in the near future proposals embodying the following points:—

That women, while prepared to give up their present work to returning soldiers, shall not go back to their old jobs on the sweated wages that existed before the war.

That the Government should co-relate the questions of women's labour, the conversion of factories to peace industries, and the distribution of raw material in such a way as to make them inter-dependent.

That the hours of labour of the women and the returning men should be reduced to six, five, and four hours per day, so that all the women and all the men work half-time, and that as the social system resumed its normal course, and as the women went back to the pre-war industries, the hours of the men be increased to a maximum of eight.

That any scheme introduced by the Government to prevent the disabled or pensioned soldier from being exploited by low wages after the war be also made to apply to women.

Having placed these proposals before a conference of women's organisations, and of trade unions that have women members, it is proposed, says the *Times*, to put the results before the men's trade unions, then before the employers, and finally before the Government.

Exemption Applications.—At the West Denbighshire Tribunal temporary exemption until January 1st was granted to Mr. W. B. Tudman, electrician, in the employ of the Colwyn Bay U.D.C. It was mentioned that the engineer to the Council, Mr. A. R. Tudman, had received an appointment in a Government controlled undertaking, and was about to give up his appointment under the Council. The applicant was the only skilled engineer left on the work. Mr. J. Smith, the gas engineer, who will take over the management of the undertaking, supported the appeal.

At Chesterfield, an appeal was made by J. R. Turton (39, Grade 2), electrical fitter, of Saltergate. He said that he had had to close his shop owing to shortage of labour. Six months were granted.

At Mansfield, there was a National Service review of the cases of two motor men engaged with the Tramway Co., D. W. Rowland (42, Class A), and G. T. Faulkner (37, Class A). The manager, Mr. Walker, said that the men were inspectors and drivers, and owing to the shortage of labour they did more driving than inspecting, and could not very well be spared now. Conditional exemption was continued to Faulkner, and Rowland was granted three months on remaining in his present occupation.

At Hastings, Mr. H. T. Elgar appealed for the retention of Henry Southerden (47, Grade 2), electrician, the only man left to do electrical work, and who had been executing wiring for over 20 years. He was responsible for the electrical equipment of the theatre, four churches, and some schools, and if he went that department of the business would have to be closed. Three months were conceded.

At Enfield, exemptions held by E. C. Flint (40), electrical engineer, and J. C. Culliford (37), electrical lamp maker, were withdrawn as they hold protection certificates.

At Bath, in the case of F. Gilham (30, Grade 2), brakesman and car fitter with the Electric Tramways, Ltd., Capt. Little announced that the National Service headquarters had wired that reviews of current exemptions for tramway employés should not be proceeded with at present, and a month's adjournment was granted.

At Middleton, in an appeal for a switchboard attendant at the Oldham Municipal Electricity Works (29, Grade 1), it was contended that he came within the certified occupations list in which there was no age limit. It was stated that he was formerly badged. The Tribunal decided against the contention, and directed the appellant to report for service by August 1st.

At Worksop, an electrical engineer, aged 40 and Grade 2, was given exemption until October 1st.

At Watford, a review was made of the case of E. Burgin (30, Grade 1), electrician, with Messrs. Hopkins & Darley, electrical engineers. Mr. Darley is in the Army, and it was stated that Burgin was the only electrician left in the business. Conditional exemption was cancelled, and the calling up fixed for September 3rd.

Malvern Tribunal has given exemption until December 28th to C. H. Clements (36, Grade 2), electrician, with Messrs. Sparkes & Houlton.

Cranbrook (Kent) Tribunal has given B. A. W. Rowler (48), electrician, a month in which to offer himself for national service.

At Watford, a review was made of the case of R. E. Candell (42, Grade 2), electrician, in charge of the whole of the electrical plant of Messrs. Benskin. The certificate was varied to four months.

At Swinton (Lancs.), an electrician (44, Grade 1), engaged at a local print works, was refused exemption.

At Stratford-on-Avon, an appeal was made by J. Cook (47, Grade 2), electrician, of Edstone Hall, engaged with Mr. Griffiths, and he was granted conditional exemption.

Greenwich Tribunal has refused exemption to J. Wigginton (18, Grade 1), an apprentice with Messrs. Elliott Bros., Lewisham.

At Rickmansworth, on July 10th, an appeal on the ground of work of national importance was made in the case of J. Good (44, Grade 2), electrical fitter, with Messrs. Beeson and Sons, electrical engineers. Six months were granted on the man's remaining in the same occupation. Mr. S. E. Beeson (47, Grade 2), partner in Beeson & Sons, was given a similar period of exemption.

Two months' temporary exemption has been granted by the Oxford Tribunal to F. B. Stone (43, Grade 2), electrician, appealed for by Messrs. J. E. Elliott & Co., electrical engineers. G. A. Bennett (48, Grade 2), electrician at the University electrical laboratory, was granted exemption on taking up approved work of national importance.

At Rochdale, exemption until October 31st was granted to J. E. Kershaw (37, Grade 1), tramway traffic clerk, the only member of the original staff left in the traffic office. A. Worrall (31, Grade 2), and C. Robinson (30, Grade 2), motormen on the Corporation tramways, were directed to report for service by July 31st.

At the Cumberland Appeal Tribunal, an appeal was made for an electrician and motor mechanic, aged 45, married, Grade 2, by Mrs. Lamb, of Hayton House, for whom he was looking after electric lighting and power plant which cost £5,000, as well as the water supply. It was remarked, according to a local newspaper report, that the man was a "pure luxury servant for one single person alone," and he was ordered to join up.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Cable Discounts.

This morning I have no fewer than seven letters from cable-makers advising increases in prices for cables. Seeing that the whole of the seven letters are identical, it appears to be a great waste of money to send them all out.

Could not our cable makers arrange for their Association to send one notice on behalf of the whole of the firms? The much-needed economy of paper that would result from this would be very considerable.

Cable.

Heating and Cooking by Electricity.

In your current issue's leader I am quoted as having distributed to my consumers a leaflet pointing out the saving in fuel effected by the adoption of electric cooking.

This leaflet is attributed to me in error, as I am quite unaware that any consumer of mine has obtained the results stated, and I certainly have not given publicity to any such figures.

As possibly this disclaimer might suggest that I am doubtful of the authenticity of the achievement quoted, permit me to say that this is not the case.

For some time past I have been energetically recommending the use of electric cooking apparatus to my consumers, with altogether gratifying results, and I might say that, when the advisability of opening a National Kitchen in Horsham was under consideration some time ago, there is no doubt that, had the project materialised, the necessary cooking would have been done by electricity.

There is not the slightest doubt that, with current obtainable at anything like a reasonable figure, electric cooking is infinitely preferable to either gas or coal cooking—both from the points of view of economy and efficiency—and I can give instances from my own observation in proof of this.

A certain firm recently placed on the market a small oven suitable for doing the baking, &c., of a small family of from five to six persons. Three-heat regulation is provided, the top loading being 600 watts, the middle loading 400 watts, and the bottom loading 200 watts. After an initial 15 or 20 minutes on the high heat the bulk of the cooking can be carried out on either the medium or the low heat, depending upon the kind of food to be cooked. From this it will be seen that with current at 2d. per unit the cooking costs 1·2d. per hour on the high heat, ·8d. per hour on the middle heat, and ·4d. per hour on the low heat. For general cooking over a continuous period of, say, three hours, the cook can obtain satisfactory results by putting on the high heat for one hour and the low heat for two hours, giving a total current consumption for three hours' cooking of one unit, costing 2d.

This is an example for our gas friends to think about, and it is one I can prove from my own experience, as I have had in daily use for several months in my own household the oven mentioned above.

To my mind, the greatest obstacle in the way of the general use of electric cooking apparatus is the expense of boiling water in

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bulk electrically, and this obstacle is, I am afraid, to a great extent insurmountable. Consumers very frequently shelve the matter of electric cooking when told that it will be advisable to install a coke boiler to obtain reasonable supplies of hot or boiling water, and, to give the Kaiser his due, this is, I am afraid, where our gas friends score.

H. L. Cottam,
Engineer and Manager, Electricity Works.

Horsham, *July 13th*, 1918.

[We regret that the leaflet in question, which was issued by Mr. Napier Prentice, managing director of the Suffolk Electricity Supply Co., Stowmarket, was erroneously attributed to Mr. Cottam. —Eds. Elec. Rev.]

Referring to the leading article in your current issue upon heating and cooking by electricity, as makers of cooking apparatus by coal, steam, gas, and electricity, it may be interesting to both pessimists and pacifists in electric cooking to learn what one firm, amongst many makers of electrical cooking equipment, is turning out for canteen restaurants at the present time. Within the last three years the output of our electrical department in canteen restaurant type apparatus, exclusive of domestic and industrial heating appliances, is, in the aggregate, round about 60,000-H.P. capacity, and the demand is still increasing. In our experience this demand for electrical cooking apparatus is chiefly due to the overall saving in money represented in labour, fuel, food, running and maintenance costs, rent, rates and taxes, floor space, cartage of coal and ashes, decoration, &c., apart from the recognised advantages and superiority of electricity as a heating medium compared to flame methods, in its simplicity and convenience of operation, perfection in cleanliness, and hygienic working conditions.

Given cheap electricity for the million, and hiring powers for apparatus such as are enjoyed by the gas interests, electricity will undoubtedly take first place in our homes and restaurants, &c., for cooking, heating, cleaning, lighting, and other labour-saving devices.

For the **Falkirk Iron Co., Ltd.,**
C. G. Nobbs.

Falkirk, *July 15th*, 1918.

BUSINESS NOTES.

Manufacturers' Council.—The Federation of British Industries, the British Empire Producers' Organisation, and the Imperial Council of Commerce have formed a Joint Council:—

1. To consider and report upon any questions of mutual interest reflecting the common aims of the three bodies—viz., to ensure the conservation and development of the industry, production, and commerce of the United Kingdom and her Overseas Dominions, and submitted by any one of the three constituent bodies.
2. To initiate the consideration of any such subject, and
3. To take any action in relation to such subjects that may be specifically authorised by the constituent bodies.

By means of this Joint Council concerted action will be possible between accredited bodies representative of the business interests—both industrial and commercial—of the United Kingdom and the Overseas Dominions, and its recommendations will naturally carry weight with the Government.

Book Notices.—*Technical Supplement to the Daily Review of the Foreign Press.* London: H.M. Stationery Office. Price 6d. net (fortnightly).—One of the tasks of the General Staff at the War Office during the war has been the issue of a daily review of the foreign Press, the scope of which has been extended from time to time by the preparation of supplements dealing with special subjects. A fortnightly technical supplement, compiled with the co-operation of the Institution of Civil Engineers, was added to the list in January last, and since then has been widely circulated through official channels, for the assistance of naval and military workers. It has been warmly welcomed by those entitled to receive it, but its usefulness has been limited hitherto by the fact that it has been inaccessible to many professional men and firms to whom it would be of interest. This limitation has now been removed by the decision to place the technical supplement on sale, and the issues of May 28th and subsequent numbers may be obtained, at the cost of 6d. each, through any bookseller, or directly from H.M. Stationery Office. Information extracted from the foreign Press is noted as briefly as possible, full summaries being given only in the case of articles of special interest. In addition, a technical information service is available to answer inquiries from Government Departments or engineers desiring information on engineering questions generally, so far as this is obtainable from technical literature, engineering societies' records, or similar sources.

Two pamphlets relating to the testing of scientific glassware have been received from the National Physical Laboratory; one gives instructions as to the method of sending such apparatus to the Laboratory, the other describes the nature and scope of the tests, for which a special building is being erected and equipped.

"Thermal Expansion of Alpha and of Beta Brass Between 0° and 600° C., in Relation to the Mechanical Properties of Heterogeneous Brasses of the Muntz Metal Type." By P. D. Merica and L. W. Schad. (Scientific Papers of the Bureau of Standards, No. 321, May, 1918.) Washington: Government Printing Office. Price 10 cents.

"Science Abstracts." Sections A and B. Vol. XXI. Part 6. June 29th, 1918. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"Dynamo and Motor Attendants and their Machines." Ninth edition. By Frank Broadbent. Pp. xv. + 212; 107 figs. London: S. Rentell & Co., Ltd. Price 3s. 6d. net.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVII, No. 7. July, 1918. New York: The Institute. Price $1.

"The Post Office Electrical Engineers' Journal." Vol. II. Part 2. July, 1918. London: H. Alabaster, Gatehouse & Kempe. Price 1s. net.

"Wireless Telegraphy and Telephony." By W. H. Eccles. Second Edition. Pp. xxiv. + 514; 134 figs. London: Benn Brothers, Ltd. Price 22s. net.

U.S. Exports of Electrical Goods.—The disappearance of German competition has greatly favoured the expansion of the American electrical industry. Owing to the export restrictions in vogue in France and England, the United States is about the only country at present that is in a position to replace Germany in the world's market. The following figures will show the great progress made by the United States in the exportation of electrical goods since the war:—For the years ending June 30th, 1914, 133,000,000 fr.; 1915, 105,000,000 fr.; 1916, 160,000,000 fr.; 1917, 275,000,000 fr. These figures show that the value of exports for 1917 was 70 per cent. above those of 1916 and 105 per cent. above those of 1914.—*American Machinist.*

Trade Announcements.—As from July 24th the address of Mr. Archibald Campbell is altered to 8, Wolseley Road, N. 8. Telephone: "North 2601."

Owing to military service, Mr. E. Craggs, electrician, of Sheerness, has had his stock sold by auction.

Catalogues and Lists.—Stanton Ironworks Co., Ltd., near Nottingham.—Pocket illustrated catalogue of c.i. socket and spigot pipes, flanged specials, manhole covers, surface boxes, &c.

Messrs. Higgs Bros., Summer Hill Street, Birmingham.—Stock list of standard shunt-wound protected motors from ·17 H.P. to 22 H.P.

Fuller Accumulator Co., Ltd., Woodland Works, Chadwell Heath, Essex.—Illustrated leaflet respecting the "Fuller" electric safety lamp.

Automatic and Electric Furnaces, Ltd., 6, Old Queen Street, London, S.W. 1. Pamphlet dealing with the correct normalising of carbon steel.

New State Steel Works in Australia.—The immediate establishment of State steel works in Queensland is recommended by the Royal Commission.—*The Times.*

A National Trade Mark.—We have received a circular of 16 pages, in which Mr. Paul E. Derrick, of Norfolk Street, Strand, sets forth a "statement of the case" for National Trade Marks for the identification of the origin of commercial products.

Non-Ferrous Metal Industry.—The President of the Board of Trade has appointed the following Committee to hear applications under the Non-Ferrous Metal Industry Act: Sir D. Stewart-Smith (chairman), Mr. C. A. Russell, Sir H. Elverston, M.P., Mr. H. J. Mackinder, M.P., Sir E. Hiley (Federation of British Industries), and Mr. E. Manville (Association of Chambers of Commerce). The secretary to the Committee is Mr. C. R. Woods, Board of Trade, Gwydyr House, Whitehall, London, S.W. 1.

A list of further licences granted under the above Act appears in the *London Gazette* for July 12th.

Liquidations.—A. Vernon-Ward (London), Ltd.—Under the compulsory winding-up order made last March, the report of Mr. H. E. Burgess, Official Receiver, has been issued to the creditors and shareholders. The accounts filed under the liquidation show liabilities £22,635, assets valued at £6,981, and a deficiency of £29,581 as regards contributories. The company was incorporated as a private company on May 17th, 1915, for the purpose of carrying on the business of electro-therapeutists &c. The nominal capital was originally £10,000, and was subsequently increased to £20,000. The directors were Messrs. A. Vernon-Ward (who died on December 15th, 1917), A. Lewis, and A. J. Wells. The issued capital was £14,148, of which £3,835 was subscribed for cash. The company in May, 1915, acquired from the Natural Radium Ore, Ltd., certain therapeutic plant and effects for £250 cash and a debenture for £2,000 issued to Mrs. Vernon-Ward. The directors further undertook to pay to Mrs. Vernon-Ward £9,998 in consideration of services rendered and expenses incurred in connection with the formation of the company; also to discharge all trade liabilities of the vendor company. In August, 1916, the company acquired from Mrs. Vernon-Ward the exclusive licence for making, using, and vending an apparatus for applying electric treatment for curative and other purposes. The consideration was £1,000 in cash and certain royalties. The company had no capital at the commencement, the cash subscribed shares not being issued till the end of 1915 and early 1916. In the meantime, assistance was rendered by Mrs. Vernon-Ward, who provided the company with the proceeds of sale of certain other vendor shares. The business of the company was apparently conducted and controlled entirely by Mr. Vernon-Ward, who dominated the board. His remuneration was never fixed, and he drew upon the company's funds without restraint, his drawings amounting to about £5,000 per annum. These drawings were, upon his instructions, debited to the account of Mrs. Vernon-Ward, in all

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probability for the reason that he was an undischarged bankrupt, and Mrs. Vernon-Ward is now returned as a debtor for £13,103, the balance standing to the debit of her account. A. Vernon-Ward (Hove), Ltd., A. Vernon-Ward (Manchester), Ltd., and A. Vernon-Ward (Consolidated), Ltd., were companies formed with similar objects to the London company. The provincial companies appear to have lent considerable sums to the London company, and all the companies accommodated each other from time to time. According to the statement of affairs, the London company is indebted to the provincial companies as follows:—A. Vernon-Ward (Hove), Ltd., £2,281; A. Vernon-Ward (Manchester), Ltd., £4,592; and A. Vernon-Ward (Consolidated), Ltd., £6,546. In October, 1917, the company acquired an invention for the alleviation of deafness. The failure of the company is attributed to Vernon-Ward's extravagance, to insufficient working capital, and to excessive interest paid on money borrowed. Mr. A. F. Dickin, C.A., has been appointed liquidator, with a Committee of Inspection.

GENERAL ENGINEERING ACCESSORIES, LTD.—Meeting, August 14th, at 120, Blackfriars Road, S.E., to hear an account of the winding up from the liquidator, Mr. H. Chapman.

Patents and Alien Enemies.—The B. of T. announces in the *London Gazette* that all licences that have been granted, authorising the payment of fees for the grant, registration, or renewal of patents, designs and trade marks in an enemy country, or for applications on behalf of enemy subjects, payable in this country and the Dominions, are revoked, and that in future all such payments are prohibited.

LIGHTING AND POWER NOTES.

Aberystwyth.—PROPOSED HYDRO-ELECTRIC SCHEME.—Prof. O. T. Jones submitted to the T.C. a report on the proposed hydro-electric scheme, and stated that he had come to the conclusion, with an assumed average rainfall of 60 in., that, without large storage and careful regulation of the discharge, it would not be safe to reckon upon more than 21 H.P. on a 50-ft. fall under the most unfavourable conditions, though for many years it might not fall below 60 or 80 H.P. He had also made calculations assuming the average rainfall to be as high as 80 in., in which case power yielded under unfavourable conditions on a 50-ft. fall would be between 39 and 48 H.P.

Australia.—VICTORIA.—HYDRO-ELECTRIC SCHEME.—The River Latrobe Hydro-Electric Co. has been formed with a capital of £20,000 to install a 250-H.P. hydro-electric plant to supply the towns of Warragul, Neerim, Drouin, and Trafalgar with electricity for light and power purposes. Mr. V. J. Crowley, A.A.I.E.E., is consulting electrical engineer and manager of the company.

MELBOURNE.—The City Council has adopted the recent proposals for the licensing of wiremen, and has appointed a representative to accompany the deputation which is to wait on the Minister for Public Works with the object of seeking legislation on the subject.—*Commonwealth Engineer.*

Barnsley.—The T.C. has decided to appoint an independent expert to advise on the electricity supply in the district.

Bath.—The paragraph entitled "Bristol," in our last issue, should have appeared under the heading of "Bath."

Bootle.—PRICE INCREASE.—The T.C. has increased the charges for electricity, from September 30th next, for lighting, power, and other purposes by 17½ per cent., making a total war advance of 30 per cent. In cases where the charges are made and adjusted to the variation in the price of coal, the price will be increased by 12½ per cent.

Bradford.—YEAR'S WORKING.—The Corporation electricity department accounts for the past financial year show that the energy sold exceeded 55,500,000 units, compared with 46,000,000 in the previous year. The total income was £237,000, against £200,000, and the net income £10,860, or £951 less than in the preceding year. Coal cost £18,300 more than in the previous year, and other causes of increased working cost have been the increases of wages. Capital charges increased by £4,750.

Burton-on-Trent.—PRICE INCREASE.—The T.C. has increased the price of electricity by 35 per cent. for power, and by 15 per cent. for lighting.

Bury St. Edmunds.—MAINS EXTENSION.—The T.C. has decided to extend the electricity mains to the Fornham Road district, at a cost of £625. It was stated at a meeting of the Council that the railway company contemplated using electric power in connection with its wagons.

Canada.—NEW E.S. COMPANY.—The Corporation d'Energie de Montmagny, Ltd., has been formed, with a capital of $400,000, to supply electricity and gas in the counties of Lotbiniere, Levis, Dorchester, Beauce, Bellechase, Montmagny, L'Islet, Kamouraska, and Temiscouata.—*Electrical News.*

WATER POWER.—An Order has been issued by the Ontario Government authorising the production of 130,000 H.P. at Nepigon, New Ontario, with the object of developing the mineral resources of that district. The Ontario Government has also authorised an increase in the electrical equipment at Niagara Falls to the amount of £100,000, and the development of 300,000 H.P. on the Rideau and St. Lawrence rivers. Sir Adam Beck stated that the Commission could supply the American side with 200,000 H.P. by the autumn of 1919, increasing by 30,000 H.P. a month until the maximum of 300,000 H.P. was reached. It is hoped to have available in five years 2,250,000 H.P., equivalent to 50,000,000 tons of anthracite coal a year.—*The Times.*

Carlisle.—ANNUAL ACCOUNTS.—The annual report of the Corporation's electricity undertaking for the past year shows a net profit of £1,295, compared with a loss of £196 in the previous year. The units sold, the income derived, and the output had been in advance of all previous years.

Carshalton, Wallington, and Cheam.—PRICE INCREASE.—The price of electricity to these places has been revised as under, as from the Midsummer quarter, by the South Metropolitan E.T. and L. Co.:—Lighting, 6d. per unit, + 10 per cent.; power and heating, a war charge of ¼d. per unit.

Continental.—SWEDEN.—Among the new electricity undertakings recently formed in Sweden are the Sundals Ryrs Kraft Aktiebolag, formed at Sundals Ryr, with a maximum capital of £11,500, and the Ulf Elektriska Aktiebolag, Ulvekamn. Both will acquire water-power rights, and establish hydro-electric stations in their respective districts.

SWITZERLAND.—It is stated that the United States is to make representations to Switzerland against the "export" to Germany of electric power in large quantities for military workshops, and also against the export of aluminium in quantities exceeding those provided for by agreement.

Dromore (County Down).—PRICE INCREASE.—The U.D.C. has granted permission to the E.L. and P. Co. to increase the charges for electricity for lighting and power by ½d. per unit.

Edinburgh.—ANNUAL ACCOUNTS.—The past year's working of the Corporation electricity department resulted in a loss of £2,956; this has been met from the reserve fund, which now stands at £99,838. During the past four years the deficit on the undertaking has amounted to £21,946.

Farnham.—The 1914 E.L. (Extension) Order has been extended for another year.

Hemsworth.—PROPOSED E.L. POWERS.—The R.D.C. has deferred consideration of a notification from the Electrical Distribution of Yorkshire, Ltd., of the company's intention to make application for electric lighting powers in the Council's area.

India.—OIL FIELD ELECTRIFICATION.—The *Indian Textile Journal* understands that contracts have been invited by Burma oil companies for electrifying their oil-field equipment, at an estimated outlay of £1,500,000.

Lepton.—PROV. ORDER.—The U.D.C. has consented to the application of the Huddersfield Corporation to the B. of T. for a prov. order to supply electricity for public and private purposes within the district.

Newcastle-under-Lyme.—LINKING-UP.—The Electricity Committee has instructed the Stoke-on-Trent Corporation to lay the main connecting the Newcastle-under-Lyme and Stoke-on-Trent electricity works.

Oldham.—ANNUAL ACCOUNTS.—The report of the Corporation electricity department for the last financial year shows a revenue of £79,405. The expenditure was £47,907, and the net profit £7,572, compared with £9,032 in the previous year. The number of units sold for lighting purposes was 1,859,520, against 1,814,635; for power, 9,636,926, against 9,338,100; street lighting, 33,187, against 3,609; and traction, 3,653,455, against 3,349,666, a total of 15,183,088, against 14,506,010, an increase of 4·67 per cent. The revenue showed an increase of 8·04 per cent. The number of lamps, &c., equivalent to 32 watts, was 439,361, an increase of 13,279, and the number of consumers 2,893, an increase of 50. The cost of production increased from 0·69d. to 0·75d. per unit, and increased war wages amounted to £2,546.

Reading.—Mr. G. F. Craven, general manager of the Corporation Tramways Department, has been appointed Local Fuel Overseer for the borough.

Rhodesia.—LOAN.—The Umtali T.C. has borrowed £12,000 for the purpose of installing an E.L. scheme.

Rickmansworth and Chorleywood.—PROV. ORDER.—The B. of T. has extended the prov. order by one year.

Salford.—LINKING-UP.—The T.C. has accepted a tender for cable for the purpose of linking-up the Salford electricity supply with that of Manchester. The Manchester electricity department reports that the first instalment of the new underground mains is now being laid. The voltage is 33,000.

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Salisbury. — Proposed Purchase. — The T.C. has referred to the General Purposes Committee for consideration the question of the option to purchase the undertaking of the E.L. and S. Co.

Silsden.—Proposed E.L. Powers.—The District Council has decided to refuse consent to the application of the Electrical Distribution of Yorkshire, Ltd., for powers to supply electricity in the area.

South Africa.—Loan.—The Wellington (Cape Province) Municipality proposes to borrow £8,000 for an electric lighting scheme.

Stockton-on-Tees.—The electrical engineer having presented a report and estimate (amounting to a total of £10,150) for providing an alternating-current three-phase supply from a sub-station erected in the Stockton area, the matter has been referred to the Lighting Committee for consideration.

Stratford-on-Avon.—Electricity Charges.—The T.C. has decided not to sanction any further increase in the price of energy supplied by the Electricity Co.

U.S.A.—New York.—The big electric lighting companies have arranged for insurance covering bombardment from the air or the sea and other forms of war risk. From $7,000,000 to $10,000,000 has been taken out by the New York Edison Co., and three millions is said to have been taken by the United Electric Light and Power Co.

Walsall.—Loan Application.—Application is to be made to the L.G.B. by the T.C. for sanction to borrow £6,304 for the electricity undertaking.

Wigan.—Price Increase.—The Electricity Committee has increased the price of electricity for lighting purposes by a further 12½ per cent., making 25 per cent. over pre-war rates. The charges are now as follows:—Churches and offices, 6¼d. per unit; shops and dwelling houses, 5d.; theatres, restaurants, &c., 3¾d.

Windsor.—Proposed Bulk Supply.—The T.C. has decided to take no action in the application of the Slough and District E.S. Co. to supply energy in bulk to the Windsor Electrical Installation Co.

TRAMWAY AND RAILWAY NOTES.

Bradford.—Year's Working.—The accounts of the Corporation tramway department for the year ended March 31st last, show an income of £366,495, an increase of £40,090 on the previous year. The average income per car-mile was 15·89d., compared with 13·67d. Traffic expenses amounted to £115,800, as against £99,700, the principal item being £47,000 for wages, an increase of £28,000. The rail-less system showed a deficit of £2,760, though account has to be taken of the feeding value of this system to the remainder of the undertaking. The gross profit was £87,180, and, after payment of interest and sinking fund, the net profit was £31,376, compared with £30,802 in the previous year. The reserve and renewals account now stands at £111,048.

Burnley.—Annual Accounts.—For the year ending March 31st, 1918, the receipts of the Corporation tramway department amounted to £96,967, against £87,039 in the previous year. The total working expenses were £68,203, or 10·64d. per car-mile, compared with £58,604, or 9·08d. per car-mile. Interest and sinking fund absorbed £15,531, rent £1,546, and income-tax £3,818, and £6,389 was carried to the reserve fund, against £5,222 last year.

Continental.—Germany.—The scarcity of means for carrying goods has rendered it highly desirable to be able to adapt ordinary road vehicles so that they may be run on tramcar rails or on ordinary roads.

An article in *Zeitschrift des Vereines Deutscher Ingenieure*, March 16th, describes, with illustrations, an under-carriage enabling a vehicle to run on tramcar rails or on ordinary roads. The arrangement has been put into operation at Düsseldorf.

Each of the main axles of a road vehicle is provided with a pair of auxiliary axles with small running wheels. These auxiliary axles are situated on either side of the main axle to which they are bracketed by swivelling arms. When running on roads all four auxiliary axles are raised from the ground, and the vehicle runs on its road wheels. When it is required to run on rails the auxiliary axles are let down and the load is wholly or partially transferred to the auxiliary wheels. This transfer is effected by operating a crank handle attached to chains by which the auxiliary axles are pulled downwards, thus raising the vehicle off its road wheels.

Electric Vehicle Progress.—A comparison of the cost of doing the same work of refuse collection by electric tipping wagons and by horse haulage, shows how great has been the saving through the use of the former. At Chester we note that, as compared with the cost of doing the same work by horse haulage, the saving during the period in which the electrics have been in service is of the order of £788, or rather more than the amount which has had to be put by in the same period in order to pay for the vehicles in four years. The two vehicles had together travelled 13,688 miles, collected and carried 5,974 tons of house refuse, delivered 217 tons of fuel to the electricity works, and conveyed 167 tons of shell and 256 tons of scrap steel to the railway station. The working expenses for the same period were per mile:—Drivers' wages, 4·50d.; repairs, 0·24d.; materials, 0·60d.; insurance, 0·20d.; electrical energy, 2·65d.; maintenance of tires, 1·06d., a total of £517, or 9·19d. per mile.

The income derived by the cartage of fuel, shell, and scrap steel amounted to £48, making the net cost of carting refuse, excluding interest and depreciation, £469.

The two vehicles are found to do the work of six horses, carts, and men. These, if obtainable, would have cost for hiring £1,517. Drivers employed with the horses and carts also assist in filling the latter, so that, in order to get a fair comparison, their wages should be deducted from the cost of hiring. Each man devotes approximately two-thirds of the day to driving from house to house and collecting, and one-third driving to and from the tip. For the purpose of comparison, the drivers' wages are allocated in equal amounts to collecting and driving, which reduces the hiring figure by £257, making the figures for comparison:—Six horses and carts, £1,260; two electric vehicles, £471, leaving a balance in favour of the "electrics" of £789. The amount set aside in the period for the repayment and interest was £733 6s. 8d. The vehicles were supplied by Messrs. Edison Accumulators, Ltd.

At Pontypridd the figures on the first six months' working of two Edison 2-ton electric tipping wagons make a good showing for electric service, as the saving over the cost of doing the same work by horses was no less than £354, which is at the rate of over £700 a year.

Electricity is charged at 1½d. per unit, and the average consumption is 2·8 units per mile. It should be remembered that the district is a hilly one. The initial cost of each vehicle was £1,020, and for two vehicles the annual charge for interest and repayment of loan (10 years) at 6 per cent. accounts for £280. Insurance at £15, repairs, renewals, and maintenance at £100, and an allowance of £15 per annum for cleaning, bring the total of the fixed annual costs to £410.

The working expenses for the six months, during which the two vehicles handled 4,730 tons of refuse, are given as follow:—Wages (including war bonus and overtime), £389; fixed costs (interest, repairs, &c., half of £410), £205; electricity, 21,695 units at 1½d., £136; tires, 7,744·70 miles at 1d., £32, a total of £762; cost per ton, 3s. 2·69d.; average cost of horse haulage per ton, 4s. 9d.

Glasgow Cleansing Department employs both petrol and electric vehicles, as well as horse haulage. The cost per ton of refuse handled is:—For electric vehicles, 2s. 10·65d.; for petrol vehicles, 3s. 9·52d.; for horse haulage, 3s. 3·15d.—*Electric Vehicle.*

Keighley.—Year's Working.—In his report on the past year's working of the tramway department, the borough electrical engineer states that the adoption of the penny-all-the-way fare has proved a success. The revenue increased by £2,042, and there was a net profit of £1,211. There was a loss on the rail-less system of £457, the car-mileage run being 57,158, against 73,277 in the previous year.

Leeds.—Mr. B. Hamilton, manager of the tramways department, has been appointed Local Fuel Overseer for the City of Leeds, under the Household Fuel and Lighting Order, 1918.

Liverpool.—Strike.—The tramway strikers returned to work on Friday last, pending arbitration.

London.—Underground Railway Accident.—Through the fore part of a City-bound train jumping the metals and tearing up part of the permanent way between Baron's Court and Hammersmith Stations, traffic was interrupted for several hours on Wednesday evening, last week.

Accident.—On July 13th a double-deck tramcar overturned whilst taking the sharp curve at the north end of Blackfriars Bridge. Two persons were injured.

Subsidised 'Buses.—With reference to the subsidy granted by the Government to the L.G.O. Co., the *Daily Chronicle* states that the Metropolitan Municipal Tramways have appointed a Committee to investigate the matter.

Woolwich.—The L.C.C. has applied to the B. of T. for an extension of time to August 7th, 1919, for the construction of the tramways in Eltham Road and High Street.

Northampton.—Wages Dispute.—The Corporation employés, who had given notice to strike on Saturday last unless their war bonus was increased to £1, have decided to accept an advance of 1d. per hour, but request that the question of the 12½ per cent. go to arbitration. Cease work notices have been suspended pending a Town Council meeting.

Sheffield.—Annual Report.—The annual report of the Corporation tramway and motor-'bus undertaking for the year ended March 25th shows total capital expenditure of £1,230,496, and the total sum provided out of revenue for sinking fund amounted to £525,043. For the tramway section, total income was £601,446; total working expenses amounted to £413,730, or an average of 10·17d. per car-mile, being an increase of 1·83d. per car-mile on the previous year. Gross profits were £176,679, and income-tax on profits £27,339, leaving a balance on the year's working of £83,904, a decrease of £4,575 on the previous year. For the motor-omnibus section, total income was £47,641; working expenses, £36,774; gross profits, £7,084, leaving a net balance on the year's working of £4,042.

The amount paid in allowances to dependants of enlisted men was £11,363. Passengers carried numbered 153,506,213, an increase of 10,954,666; car-miles run were 9,761,994; traffic revenue

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was £11,363. Passengers carried numbered 153,506,213, an increase of 10,954,666; car-miles run were 9,761,994; traffic revenue, £595,080, an increase of £76,857; passengers carried per car-mile, 15·73, an increase of 0·97; revenue per car-mile, 14·63d., an increase of 1·74d.

Southport.—The T.C. has applied to the B. of T. for an extension of time until August 15th, 1919, for the completion of the electrification of its tramway system.

Sunderland.—ANNUAL REPORT.—The report of the Corporation tramway undertaking for the year ending March 31st shows a gross capital expenditure of £307,120; total revenue, £98,677; traffic revenue, £97,877, an increase of £12,697; working expenses, £57,653, leaving, after the payment of interest and sinking fund, a net balance of £20,204. The total car-miles run were 1,425,007, a decrease of 38,274 miles; passengers carried numbered 25,041,160, an increase of 3,329,671. Price paid per unit, 1·5d.; total units used, 1,975,539, or 1·38 units per car-mile. Revenue per car-mile, 16·48d.; working expenses per car-mile, including power, 9·7d.; excluding power, 7·6d. The sinking fund amounted to £169,959, while that for reserve was £117,832, and that applied to reduction of rates was £67,027.

Women Drivers.—It is stated that the Ministry of National Service and the Trade Unions concerned are conferring on the subject of employing women as tramcar drivers.

TELEGRAPH AND TELEPHONE NOTES.

Broken Insulators.—At Croston, last week, when two boys were each fined 15s. for attempting to damage telegraph insulators, it was stated that 600 insulators had been broken in that area alone, the damage being £105. During the last two years there had been 25 prosecutions.

Canada.—The telegraph operators of the Great North-Western Railway have threatened to strike, but it is hoped that the strike will be averted.

South America.—According to *The Times*, important developments are in progress in connection with the wireless service. Last year the Pan-American Wireless Telegraph and Telephone Co. was formed, comprising the American and English Marconi Companies and the Federal Holdings Co., which had a concession from the Argentine Government for wireless communication with New York. The last-named company has now been bought out by the U.S. Government, and the Pan-American Co. has secured an amplified concession for world-wide wireless communication with the Argentine. The Marconi Co. has a similar concession, and had begun to erect the plant when war broke out, and the work was suspended.

United States.—The Senate has passed a measure giving the Government authority to take over the telegraphs and telephones of the United States during the war.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—September 4th. Victorian Railway Commissioners. 800 lighting transformers for signal system. A copy of the specification may be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence) in London.

Belfast.—August 16th. Corporation. Two 6,600-KW. turbo-alternators, &c.: one 500-KW. turbo-alternator, &c.; one 30-KW. balancer-booster; four 48,000-lb. per hour water-tube boilers; four fuel economisers, &c.; two steel chimneys, with fans, &c.; two electrically-driven boiler feed pumps, &c.; accumulators: three 500-KW., and five 1,000-KW. rotary converters, with transformers, &c.; two 250-K.V.A., two 350-K.V.A., and six 1,250-K.V.A. transformers. See "Official Notices" to-day.

Gillingham.—July 22nd. B.C. One 640-B.H.P. combined Diesel engine and alternator. See "Official Notices" July 12th.

London.—OFFICE OF WORKS.—July 30th. Carbon-filament tubular lamps. See "Official Notices" to-day.

Spain.—MADRID.—The Dirección de Telégrafos invites tenders for the supply of 70 tons of galvanised steel wire of 4 mm. diameter, and 30 tons of 3 mm., for use in the construction of a telegraph line between Barcelona and Valencia.—*Gaceta de Madrid.*

OUR HALF-YEARLY INDEX.

As it is necessary to effect every possible economy in paper consumption, the Index to Vol. 82 of the ELECTRICAL REVIEW, which has now been printed, will be supplied only to those who, through the post, specially apply for it. To such it will be supplied for 3d., post free. Any reader or advertiser at Home or Abroad, who requires a copy for binding, or for other purposes, is asked to make application therefor promptly to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

NOTES.

Disabled Soldiers.—The April issue of *Recalled to Life*, a journal devoted to "the care, re-education, and return to civil life of disabled sailors and soldiers," contains articles written by men who are seeking for practical solutions of the problems presented by disabled soldiers—problems which are both medical and sociological. Half of the men who are wounded require special treatment for the restoration of movement to damaged limbs. Great military hospitals have been, and are being, established in various centres throughout the country for the treatment of these orthopædic cases. Success in the treatment of orthopædic cases is largely a problem of education—to teach soldiers how to bring back lost movements to damaged joints by voluntary and natural movements of the limbs. The introduction of "curative workshops" to military hospitals is one of the most profitable innovations of the war. Of the men treated in orthopædic hospitals about three-fourths return again to military service; the remaining fourth is discharged as unfit for further service. It is now the business of the Ministry of Pensions to look after the welfare of that discharged fourth. Various writers describe the organisations which are being brought into existence to meet the needs, not only of the men discharged from orthopædic hospitals, but also of the large numbers rejected by the Army on account of a permanent breakdown in health due to exposure in the field. Everywhere the importance of "self-help" is emphasised.—*Nature.*

Air-Raid Signalling Sirens.—In *Engineering*, July 5th, illustrations are given of the Chollet rotating vanes and the series of horns forming the sirens which are mounted on the monuments of numerous French towns to warn the population of the approach of enemy aircraft. The siren consists of a casing, or stator, inside which revolves an aluminium rotor mounted on a shaft provided with ball bearings. The stator has a number of openings, generally rectangular, whilst the rotor has also a number of openings of the same shape. Vanes for canalising the air start from the centre of the rotor and end at the rotor openings. When the rotor revolves, centrifugal force drives the air from the rotor towards the openings and through the openings cut in the stator. The flow of air is thus alternately permitted and interrupted, each opening in the rotor driving air through each opening in the stator in succession. Hence the vibrations of the system vary in number with the number of openings of the rotor. The rotor is actuated by means of an electric motor coupled to the rotor shaft, the system being operated at a distance by means of switches; starting rheostats are used for the large types, which require from 12 to 15 H.P.

In order to amplify the sounds, conical horns of suitable shape and length are connected to each opening in the stator. The Paris sirens have a total weight of 800 kg. (about 1,700 lb.); their aluminium rotor is 0·5 m. (19·5 in.) in diameter, the horns being 2 m. (6 ft. 6 in.) in length and 0·5 m. in diameter at their mouth. In the open, they can be heard at a distance of 8 to 10 kilometres (about 6 miles), but in Paris, owing to the noise in the town, the range does not exceed a radius of 1·5 kilometres (just under 1 mile).

In one type of Chollet siren, all the sound waves are sent in one and the same direction. In this type, the siren is fitted at the bottom of a megaphone horn. There are sirens of this type in which the horn has a length of 3 m. (9 ft. 10 in.) and a diameter of 1·5 m. (4 ft. 11 in.) at the mouth; they weigh each about 1 ton, and the rotor, which is operated by a 10-H.P. electric motor, has a diameter of 0·5 m. (19·5 in.) at the mouth.

Hand-operated sirens have also been built in large numbers, but their range of sound covers a radius of 400 to 500 m. (about 540 yards) only.

Coal by Thermometer.—According to the *Times*, in view of the threatened coal shortage next winter, householders in the United States will be allowed only as much coal as is scientifically necessary to heat the house to a temperature of 68° F. This statement might inspire the imagination to picture an engineer with a squad of assistants and a score of thermometers, carrying out thermal efficiency tests on the grates and chimneys of the houses concerned, or the central heating apparatus of the establishment, in various conditions of weather. We look forward to the compilation of really reliable data on house-warming in the U.S.A.

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Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending July 27th, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Captain of the Week.—Capt. W. Darley Bentley.

Next for Duty.—Capt. E. G. Fleming.

Sunday, July 21st.—Commandant's Parade at Waterloo Station, 8.45 a.m. for work at Esher. Dress: Drill order, with haversacks and waterbottles. Mid-day and tea rations to be carried.

Monday, July 22nd.—Adjutant's Technical Lecture ("Earthworks"), 6.30—7.30 p.m.

Thursday, July 25th.—General Meeting of the whole Corps, 6.30 p.m.

Friday, July 26th.—Adjutant's Technical Lecture ("Earthworks"), 6.30—7.30 p.m.

Saturday, July 27th.—Engineering Reconnaissance Scheme for Officers, at Esher.

The Annual Camp will be held at Esher from August 3rd to August 11th, both days inclusive. During this period Headquarters will be transferred to Sandown Park, Esher.

C. Higgins, *Capt.* R.E., *Adjutant.*

Tariffs for Interconnected Three-Phase Generating Stations.—It is obvious that the conditions governing the reciprocal payments for energy supply between two separate generating stations feeding an interconnected network call for special forms of tariff. Such tariffs should be made to depend greatly on the power factor of the load supplied. The maintenance of high values of the power factor is important. The calculation of certain special cases of distribution systems connected to two separate generating stations shows that under certain circumstances a very small change of the excitation of the machines may alter the direction of the supply of power between the two stations. On this account reverse-current relays may be caused to operate if the excitations of the two stations are not carefully regulated in correspondence. The conditions of such reversals are made clear, and it is shown how in the case of the Rhenisch-Westfälisches Elektrizitätswerk the maintenance of high power factor and accurate control of the direction of flow of the current between its constituent stations are encouraged by the adoption of a special tariff. This tariff is rendered possible by the use of a wattless energy meter.

The difference between the readings of an ordinary watt-hour meter and a wattless energy meter is taken as the basis of a credit and debit in the calculation of the charge to be borne by a particular generating station. Leading and lagging currents have very different effects on the cost of generating power, and the energy supplied under these two conditions may be separated, either by using two wattless energy meters in opposition with stops to prevent them from running backwards, or by using a single meter with two separate counting trains. With stations running in parallel the energy may be delivered in either direction, and the wattless energy meters must be put out of action when the current reverses, special meters being installed to register when this takes place. A diagram shows the installation of two ordinary watt-hour meters, together with four wattless energy meters provided with two reverse-current relays to separate the wattless energy delivered in either direction and with leading or lagging current. If frequent changes in the direction of the supply of power do not take place, the number of meters can be halved.

A special tariff has been drawn up in connection with the reciprocal arrangement between the two generating stations on the system referred to. If A is the number of wattless units to be debited or credited, K the number of actual units, N the number of wattless units delivered at lagging power factor, and V the number of wattless units delivered at leading power factor, then for each station the following relation is taken:—$A = N - V - K$.

If A is negative, the supplier is debited with this number of units at 0·5 pf. per wattless unit, and the consumer is credited with 0·25 pf. for that number of units. On the other hand, if A is positive the supplier is credited with 0·25 pf. per wattless unit, and the consumer debited with 0·5 pf. for that number of units. This tariff is graphically illustrated. The meters are so adjusted that the difference in the readings of the lagging and leading wattless energy meters is equal to the reading of the meter recording the actual energy consumption, if the electrical energy is supplied at an average power factor of 0·7.

Several meters have been constructed for the purpose of this tariff. In one type illustrated the meter contains two armatures, each of which can register on one of two counting trains according as the current is leading or lagging. The two meters are interconnected by differential gearing, which registers amounts to be credited or debited on two separate counting trains. In another form of the meter one armature is used, which records credits and debits on two different counting trains, according to its direction of rotation.—*E.T.Z.*, March 7th and 14th.

London Lectures on Reconstruction.—The Industrial Reconstruction Council has arranged for a series of lectures to be held at the Sadlers' Hall, Cheapside, in October, November, and December next, on Wednesday afternoons, at 4.30 p.m.:—

October 2nd.—Sir Albert Stanley, M.P. (President of the Board of Trade), "Commerce and Industry After the War."
October 16th.—Right Hon. Christopher Addison, M.D., M.P. (Minister of Reconstruction), "Principles of Reconstruction."
October 30th.—Mr. W. L. Hichens (managing director, Cammell, Laird and Co.), "Functions of the Government in Relation to Industry."
November 13th.—Sir Arthur Steel-Maitland, Bart., M.P. (Department of Overseas Trade), "International Trade."
November 27th.—Mr. Ernest J. P. Benn (Chairman, Industrial Reconstruction Council), "Labour and Industrial Development."
December 11th.—Sir William S. McCormick, LL.D. (Department of Industrial and Scientific Research), "Science and Industry."

A full prospectus of the series may be obtained from the Secretary, I.R.C., 2 and 4, Tudor Street, E.C. 4.

Electrical Power Engineers' Association.—As a result of the meeting held in Glasgow, on June 29th, members of the staffs of the electricity supply undertakings of the following Scottish towns have now joined the movement—viz., Glasgow, Greenock, Perth, Dundee, Kilmarnock, and Motherwell.

Eligible members can obtain information from Mr. J. H. Wright, 8, Garland Place, Dundee, Interim Publicity Secretary for Scotland, E.P.E.A.

Electrical Research Committee.—The Electrical Research Committee, which was appointed last autumn under the auspices of the Department of Scientific and Industrial Research, is at present engaged in superintending a research on insulating materials (fibrous materials, porcelain, ebonite, mica, composite materials), and the water-proofing treatment of insulating windings of electrical machines, in respect of which grants have been made to the Committee by the Research Department, the B.E.A.M.A., and the Institution of Electrical Engineers.

The Committee consists of three members nominated by the Institution of Electrical Engineers and three members nominated by the British Electrical and Allied Manufacturers' Association, the nominees of the former being Mr. C. H. Wordingham, C.B.E. (chairman of the Committee), Mr. C. C. Paterson, O.B.E., and Mr. C. P. Sparks; and those of the latter, Mr. F. R. Davenport, Mr. D. N. Dunlop, and Mr. A. R. Everest.

The temporary address of the Committee is No. 1, Albemarle Street, London, W. 1, and its Secretary is Mr. P. F. Rowell.

Charges for Public Services.—A meeting of representatives of public utility undertakings, comprising gas, electricity, tramways, and water supply, was held on Monday last, to consider the proposals of the Statutory Undertakings (Temporary Increase of Charges) Bill. It was agreed that the Bill's proposals were wholly inadequate to meet the case. The companies could not possibly fulfil their obligations to the public unless they were empowered to pay a sufficient rate of interest to attract the necessary capital, and so raise money for the important developments which would be necessary to the country after the war.—*Daily News.*

The Employment of Women at Night in Electricity Works.—We are informed that the Home Secretary has recently had under review the question of the employment of women at night in electrical generating stations and sub-stations. As the work is usually carried on continuously day and night by a system of 8-hour shifts, and as the employment of women at night is illegal under the Factory Act unless it is specially authorised by the Secretary of State, he thinks it desirable to remind authorities of electrical stations that special application must be made to the Home Office (through the District Inspector of Factories) before any women are employed on a day and night shift system. The authorities of some stations appear to be unaware of this, and have employed women at night without authority.

A certain number of orders have been made during the war, under the above-mentioned provisions, to permit the employment of women at night, or for other special hours, in electrical generating stations and sub-stations, but in view of the special suitability of the work for discharged soldiers and sailors, and of the fact that the employment of women at night must in any case cease with the end of the war, the Secretary of State considers it very desirable that so far as possible vacancies should be filled by the employment of discharged men—carefully selected and suitably trained—in preference to women. Disabled men are being trained for electrical sub-station work at several schools and centres in the large towns, but if no trained men should be available the local Employment Exchange, to which all applications should be made, may be able to supply disabled men to be trained at the works. The Secretary of State has accordingly decided, after consultation with the Minister of Labour, not to grant any fresh orders to allow the employment of women, unless he is satisfied that a *bona-fide* attempt has been made to employ disabled men. This decision does not apply to stations or sub-stations at which the employment of women for special hours has already been authorised; in such cases the Secretary of State is prepared, if necessary, to continue the permission during the war.

In connection with the employment of fresh labour new to the work of electrical stations and sub-stations, the Secretary of State desires to call attention to the requirements of No. 28 of the Home Office Regulations under the Factory Act. While such persons, if carefully selected, can be adequately trained within a comparatively short time to do the routine work of an electrical station, they must not, without a longer and more thorough training, be allowed to undertake the class of work indicated in the second part of the first paragraph of the regulation—which includes cleaning of, or near, live apparatus, *e.g.*, switchboards—where technical knowledge or experience is required in order to avoid danger. They may, however, if necessary, be allowed to undertake the cleaning of the fronts (only) of medium-pressure switchboards of a simple character, provided (1) that adequate instruction has first been given; (2) that any necessary safety appliances, *e.g.*, insulating gloves and goloshes, are used; and (3) that such cleaning is not done when the person is unaccompanied.

If copies of this notice are required for distribution to electrical station engineers, or others responsible, they will be supplied on request addressed to the Under Secretary of State, Home Office, S.W. 1, quoting the number 198,802/24,238.

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Engineers' Leaving Notes.—The introduction of leaving notes in controlled shops is being considered this week by shop stewards and engineering and electrical trade unions throughout the country. Mass meetings of protest have been convened in a number of centres to demand the withdrawal of the notes. The question was again considered in Manchester on Monday night at a meeting of delegates of the Manchester district of the Electrical Trades Union, and it was decided to request the Government to cancel the system of issuing leaving notes.—*Manchester Daily Dispatch.*

Sentence for Stealing.—At the Southampton Police Court, last week, T. W. Donald, electrician, was sentenced to six months' hard labour on a charge of stealing a large number of electric globes and other articles, the property of Messrs. Summers and Payne, by whom he was employed as charge electrician.

South Wales and Monmouthshire Linking-up.—With reference to the report of the Committee on linking-up, on page 562 of our issue of June 14th, we wish to point out that the standards quoted cover Group A (Western District) only, and have no bearing on the findings of the Committee with respect to groups B and C.

Training for ex-Officers.—Lord St. Davids, chairman of the London Executive Committee of the Ex-Officers' Employment Bureau, addressed a meeting of leading commercial men at Newcastle, last week, on the aims of the Bureau, which, he said, was not a charity, but a registry run by employers. Sir Henry Hadow, Principal of Armstrong College, supported the scheme, and said that three things were necessary in the interests of ex-officers who required employment—namely, the Bureau, training, and financial assistance. He hoped that employers would give the utmost support to the registry. Regarding the second point, there must be some organised scheme for training and qualifying those who passed through the registry. The ordinary gratitude of the country called for suitable posts to be found for these men. The Ministry of Labour had approached the Universities on a short-course scheme of training officers, and that would be extended to all persons who had served their country in the Navy, the Army, or the air. At Armstrong College there would be a short course for those desirous of becoming teachers under Mr. Fisher's new scheme. If it could be done in one year, well and good; if not, it would be made two years. That course would be available at Armstrong College next term, in September. Financial help might be necessary in some cases, to enable men to profit by these educational facilities, and it was absolutely necessary for the success of the whole scheme that some public financial assistance should be given where it was needed.—*The Times.*

Starting Motors for Petrol Motor-Cars.—A Sub-Committee of the Accessories Committee of the Society of Motor Manufacturers and Traders is considering the question of standardisation as regards electric engine-starting motors for use on petrol motor-cars. At its last meeting it decided to confine itself to motors, and not to take in the question of dynamos for car lighting purposes. Some discussion took place with regard to cable sizes, and it was agreed to recommend that the motor should be fitted on the engine, and not on the chassis.

A Commercial Library.—The new Commercial and Technical Library opened in the Municipal Buildings at Leeds, by the Corporation, will prove of much use to business men. A careful selection has been made of literature likely to prove useful to the electrical and allied trades. Among the volumes on the shelves is an excellent selection of electrical works, as well as a complete collection of reference works and official patent and other publications intended for the use of the commercial community in the district, and on the general reading tables is a selection of the leading trade periodicals. We cannot too strongly commend this excellent example to other public authorities; too many public libraries are crammed with works of fiction, and the sprinkling of technical books shows a want of knowledge of their respective merits. Librarians would do well to seek the advice of experts in the selection of such works, for it is quite impossible for the layman to make a satisfactory choice from the profusion of technical books on the market. We have urged in these columns that business firms and manufacturers should provide well-stocked technical libraries for the use of their employés; to attain successful results it is essential to *lend* the books for home reading, but a set of reference books for use only on the works premises should be provided, and should be at all times readily accessible to the employés. We are sure that technical men in any locality will always be glad to assist in the selection gratuitously, and may add that we are almost daily called upon to give advice in this respect.

The Wages Conference of Electricity Supply Authorities.—At a recent meeting of the Wages Conference of Local Authorities owning electricity undertakings in Greater London, it was reported that the Executive Committee of the Conference had failed to arrive at an agreement with the Electrical Trades Union, and the whole question would be referred to the Committee on Production for arbitration. The Conference empowered the Executive Committee to employ counsel to act on behalf of the Local Authorities, and called upon each Authority represented on the Conference to contribute £10 towards the cost.

Engineering Scholarship.—A Goldsmid Entrance Scholarship tenable in the Faculty of Engineering at University College, value £30 a year for three years, may be awarded in September. Entry forms must be sent in on or before September 10th.

Gas for Traction.—The Gas Traction Committee (the Petroleum Executive, 12, Berkeley Street, W. 1) announces that the Commissioner of Police of the Metropolis has approved the issue of licences for 20 motor-omnibuses equipped to run on compressed coal-gas, and the necessary authority has been obtained to conduct trials with 20 goods-carrying commercial motor-vehicles equipped to run on compressed coal-gas.

Engineering Trade Unions and Amalgamation.—We read in the *Times* that the A.S.E. has adopted a scheme formulated by a Sub-Committee for a basis of amalgamation of the engineering Trade Unions.

Institution and Lecture Notes.—Association of Mining Electrical Engineers.—Negotiations which have been proceeding for some time between the East and West of Scotland Branches of the Association with the view of inaugurating a new branch for the Lothians area of Scotland materialised on Saturday last, when a joint excursion was arranged to Arniston Colliery, near Edinburgh. After inspection of the electrical plant and other apparatus at the colliery, the visitors were entertained by the directors of the Arniston Coal Co., Ltd. The following officials were afterwards appointed:—President, Mr. Peter Milligan, general manager of the Arniston Coal Co.; vice-presidents, Messrs. J. R. Laird, Bathgate, and Bunting, Edinburgh; secretaries, Messrs. D. Landale Frew, 45, Hope Street, Glasgow; Arthur Robinson, 28, North Bridge, Edinburgh. Excursions have been arranged to the Clyde Valley power station and to the engineering works of Messrs. Bruce Peebles & Co., Edinburgh.

Royal Society of Arts.—Mr. Alan A. Campbell Swinton, F.R.S., has been re-elected chairman of the Council for the ensuing year.

Junior Institution of Engineers.—The July issue of the *Journal* contains the Gustave Canet lecture on "The Stokes Gun," by Sir Wilfrid Stokes, and a biographical sketch of the author, who delivered the lecture on June 24th, with lantern and experimental illustrations.

Appointments Vacant.—Assistant railway telegraph engineer (£400) for the Ceylon Government; mains assistant for the Dover Corporation Electricity Works; junior shift engineer for the Rotherham Corporation Electricity Supply; switchboard attendant for the Barnstaple B.C. Electricity Department; senior (£150 + £52 + 12½ per cent.) and junior (£100 + £52 + 12½ per cent.) draughtsmen for the City of Birmingham Electricity Supply Department; shift engineer for the Stretford U.D.C. Electricity Department; switchboard attendant (60s. + 12½ per cent.) for the Derby Corporation Electricity Supply; chief assistant engineer for the Horsham W.D.C. Electricity Department. See our advertisement pages to-day.

The Marconi Libel Case.—On Tuesday the action for libel brought by Mr. Godfrey Isaacs against Sir Chas. Hobhouse was begun before Mr. Justice Darling. The case is proceeding.

Auction Sale.—Messrs. G. N. Dixon & Co. will sell by auction, at Birkenhead, on August 1st, a valuable electric lighting plant, lamps, carbons, fittings, &c. Full particulars are given in our advertisement pages to-day.

British Electrical and Allied Manufacturers' Association.—We are informed that the following firms have been elected members of this Association:—

Accumulators, Ltd.
Arora Co.
Ashdowns.
Associated Battery Co., Ltd.
Barnard, J. W.
Bastian Electric Co., Ltd.
Belling & Co.
Bluemel Bros., Ltd.
Brompton and Kensington Accessories Co., Ltd.
Cable Accessories Co., Ltd.
Croggon & Co., Ltd.
Curtis Manufacturing Co., Ltd.
Elec. & Engineering Specialities Co.
Fuller Accumulator Co., Ltd.
Griffiths Bros. & Co., London, Ltd.
Jackson Electric Stove Co., Ltd.
Jeal & Co., Ltd.
Lithanode, Ltd.
Lucas, Joseph, Ltd.
New Peto & Radford Accumulator Co., Ltd.
Randall Bros.
Richford & Co., Ltd.
Rotax Motor Accessories Co., Ltd.
Rushmores, Ltd.
Sun Electrical Co., Ltd.
Surrey Electrical Co., Ltd.
C. A. Vandervell & Co., Ltd.
Wiggins, F., & Sons.

An Electrically-Welded Ship.—The first steel vessel with the plates welded together, instead of riveted, has just been launched on the South Coast. It is estimated that a saving of 20 or 25 per cent. in both time and material is effected by this system. The shell is continuously welded, both inside and out, up to the bottom seam of the bilge-plate; "tack" welding, in which about one-third of the length is welded at short intervals, is employed for joints that need not be watertight. The deck-plates are butt welded.

Organisation of Industry.—At a meeting of the Industrial Reconstruction Council, to be held in the hall of the Institute of Journalists, 2 and 4, Tudor Street, E.C. 4, on Wednesday next, at 6 p.m., Mr. Arthur Greenwood, Secretary to the Whitley Committee, will open a discussion on "The Organisation of Industry." Delegates from various Trade Unions and Associations will be present.

Canadian Nickel Plant.—On Dominion Day the large plant of the International Nickel Co., which has been for 20 months under construction, began operations at Port Colborne, Ontario. The plant will produce annually from 20,000,000 lb. to 24,000,000 lb. of refined nickel and 12,000,000 lb. of copper. The plant is so constructed that in case of necessity the production could be quadrupled.—*The Times.*

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OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Mr. W. E. PLOWMAN, charge engineer at the Poplar B.C. electricity works, has resigned to take up another appointment.

Mr. A. G. COOPER, electrical engineer to Colne Corporation, having received an appointment on Government work, has resigned the former position, which he has held for over 18 years.

The Ayr Town Council has advanced the salary of the burgh electrical engineer from £400 to £500 per annum.

The Barnstaple Electricity Committee has appointed Mr. ALFRED STONIER, of Newbiggin, Northumberland, as assistant engineer.

The Worcester City Council has resolved to increase the salary of the electrical engineer, Mr. C. M. SHAW, by five annual increments of £50 each, the first commencing as from April 1st, 1918.

General.—The Franklin Institute has awarded the Howard N. Potts medal to Dr. A. GRAY, of Ithaca, N.Y., for his paper, entitled "Modern Dynamo-electric Machinery," which is "an exhaustive discussion of the design of dynamo-electric machinery." An Edward Longstreth medal of merit has been awarded to Dr. J. B. WHITEHEAD, of Baltimore, for his paper, entitled "The Electric Strength of Air and Methods of Measuring High Voltage," which gives "a clear exposition of the underlying principles of the phenomenon of the electric corona at high potentials."

The *Times* says that Sir JOSEPH LARMOR, M.P., has been awarded the Poncelet Prize for the mathematical sciences this year by the French Academy of Sciences.

We understand that Mr. C. S. NORTHCOTE, M.I.E.E., who will be remembered as the deputy-chairman of the Olympia Electrical Exhibition of 1905, also the manager of the Manchester Exhibition, 1908—Mr. Northcote lays emphasis upon the title "CenSatioN" in this connection—is applying for his discharge in bankruptcy, and hopes shortly to resume business as "Wholesale Electric Traders and proprietors of C.S.N.sation patents."

The *Times* announces that Mr. S. F. JAMES, hon. solicitor to the Municipal Tramways Association, has been appointed secretary to the Board of Trade Tramways Committee.

Roll of Honour.—Sapper A. ROBINSON, R.E., who has died of wounds, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Lance-Corporal B. KELLY, Lancashire Fusiliers, who has died of wounds, was an employé of the British Westinghouse Co., Ltd., Trafford Park.

Private EDGAR BERRY, Cheshire Regiment, who has been killed in action, was employed by the St. Helens Cable Co., Warrington.

Private W. BROWN, Loyal North Lancashire Regiment, who has died from pneumonia, following shell shock and gas poisoning, was employed by Messrs. Ferranti, Ltd., Hollinwood.

Second-Lieut. EVAN M. BALFOUR, Scots Guards, who has been awarded the Military Cross for conspicuous gallantry and devotion to duty, was on the staff of the Victoria Falls Electric Supply Co., Johannesburg, where he enlisted for service in the South African Horse under the Transvaal Government. He served throughout the two South African campaigns.

Private JAMES JOBE, N.F., who has been awarded the D.C.M., was an electrician at Elswick.

Sergeant A. NEAL, Rugby Howitzer Battery, formerly engaged at the Rugby works of the B.T.H. Co., has been awarded the Italian Croce di Guerra for gallantry in action.

Private E. HARDISTY, formerly an employé of Messrs. Dixon and Sons, electrical engineers, Leeds, has been posted as missing.

We regret to read in the *Times* that Captain GAUTHIER VILLARS, head of the well-known house of scientific publishers which bears his name, has been killed at the Front while in command of his battery. He was a member of the Legion of Honour, and received the Croix de Guerre. On May 3rd his battery knocked out the long-range gun which bombarded Paris.

Obituary.—MR. I. HOLMES.—The death is reported of Mr. Israel Holmes, of the Keighley Electrical Engineering Co., at the age of seventy-three.

MR. J. MCI. POLLOCK.—The death is notified, at the age of fifty-five years, of Mr. J. McIntosh Pollock, for many years an engineer with Messrs. Elliott Bros., Lewisham.

ALD. J. B. WATSON.—Ald. J. B. Watson, chairman of J. B. Watson & Son, Ltd., sanitary and electrical engineers, of Stockton and Middlesbrough, passed away at Stockton on July 14th. He had been a member of the Corporation for 25 years.

NEW COMPANIES REGISTERED.

Precision Tool Co. (Halifax), Ltd. (150,195).—Private company. Registered July 8th. Capital, £2,000 in £1 shares. To take over the business of tool and jig makers carried on by J. Marsland at Dyson Street, King Cross, Halifax. The subscribers (each with one share) are:—J. Atkinson, 41, Moorfield Villas, Halifax, chartered accountant; A. U. Day, Braeside, Dalton, Huddersfield, engineer; J. R. C. August, Summergate Villa, Parkinson Lane, Halifax, engineer. The first directors are J. Atkinson, A. U. Day, and J. R. C. August. Registered office: 5, Dyson Street, King Cross, Halifax.

Cosmore, Ltd. (150,933).—Private company. Registered July 11th. Capital, £12,000 in £1 shares. To enter into an agreement with A. C. Cossor and W. R. Bullimore, and to carry on the business of manufacturers of oscillation valves and amplifiers for wireless telegraphy and telephony, and all apparatus necessitating low pressure, liquid air, and other liquids of low temperature, tungsten and other targets for scientific and electrical purposes, glass taps and stop-cocks, &c. The subscribers (each with one share) are:—A. C. Cossor, Fawley Cottage, Fawley, Hants, scientific instrument maker; W. R. Bullimore, 5, Museum Mansions, Great Russell Street, W.C.1, scientific instrument maker. The first directors are: A. C. Cossor and W. R. Bullimore. Registered office: 11, Clerkenwell Green, E.C.

Metallurgical Research Co., Ltd. (150,914).—Private company. Registered July 8th. Capital, £3,000 in £1 shares. Iron, brass, aluminium, and metal founders, manufacturers of and dealers in gold, aluminium and other alloys, refiners of residues, chemists, metallurgists, electro-metallurgists, manufacturers of and dealers in electrical and automobile supplies, &c. The subscribers (each with one share) are: R. H. Crossey, 409, Foleshill Road, Coventry, metallurgical chemist; W. B. Crossey, 409, Foleshill Road, Coventry, engineer; E. Sidwell, Alton Hall, Alton Road, Allesley, Coventry, engineer. Table "A" mainly applies. Solicitor: C. Martin, 18, Hertford Street, Coventry.

CITY NOTES.

British Thomson-Houston Co., Ltd.

Mr. H. C. LEVIS presided at the annual meeting held on Wednesday. He said that the past year had imposed exacting demands upon the employés, and he could not speak too highly of their loyal and efficient co-operation. Of the employés who joined the forces 180 had been killed in action or had died in service; 21 were missing and were believed to have been killed. In addition, 163 had been wounded, 13 were prisoners of war, and one was interned in Holland, making the total list of casualties 378. Of the 121 holding commissions, 87 had been promoted from the ranks; 39 had been awarded special honours; 16 were mentioned in dispatches, and 11 had been specially commended for services in the field. As stated in the last report, the company proposed to erect a suitable memorial to those who had died in serving their country. Mr. C. A. Coffin, one of the directors and chairman of the board of the General Electric Co., of New York, had been awarded by the French Government the Order of Officer of the Legion of Honour, in recognition of his energetic and fruitful work in connection with the French Red Cross and other kindred organisations; and the Serbian Government, for the same reason, had likewise conferred upon him a similar Order for work in connection with Serbia. Another of the directors, Mr. Owen Hugh Smith, for the past three years had given practically his entire time to work for the Ministry of Munitions and also as one of the emissaries from Great Britain to America in connection with food problems. They welcomed as a valuable addition to the board Lord Carmichael. After consultation with the holders of a very large majority of the shares, both ordinary and preferred, the directors did not recommend the payment of dividends. For several years they had heavily depreciated their goodwill, patents, &c., account. After very careful consideration as to the value of the goodwill and patents it had been decided to reinstate this account at its original cost, which they believed was fully justified. They had likewise heavily depreciated the office furniture and fixtures account, and pending a valuation, had reinstated an amount of £20,000, which they believed the valuation at pre-war values would fully substantiate. The total amount written back on those two items was £157,958, and to this they had added from this year's profit £80,000, so that the total capital reserve now stood at £237,958, or substantially the same amount as goodwill, patents, &c. During the year they had expended £71,632 on plant account. The securities which they held in lighting, traction and other companies had been depreciated by £7,465, bringing the total valuation down to £90,000, which was conservative. The profit for the year was £329,664, after making provision for the estimated war taxation for 1917. Provision had also been made for the unsettled balance of munitions levy and excess profits duty for 1916. This profit, together with the balance from last year, make the total amount they had to deal with £343,586. They had on hand at the end of the year Exchequer and National War Bonds to the amount of £175,000. It would be interesting if he could make a statement relative to the character of the work they were carrying out. When, after the war, they could speak freely of those matters, he was sure the shareholders would be very well satisfied with what had been accomplished. Many organisations were now engaged in considering matters relating to reconstruction after the war. Many of those were of great value in fostering particular industries and thereby contributing in a marked degree to the welfare of the Empire as a whole, and already a great deal had been accomplished by the B.E.A.M.A., which.

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made a specific study of the problems relating to the electrical and associated industries. It was to be hoped that there would be greater concentration of effort among the many associations which appeared to be pursuing the same ends, so that there would be less overlapping and dissipation of valuable energy.

Callender's Cable and Construction Co., Ltd.

Presiding at the annual meeting on July 11th, Sir TOM CALLENDER (managing director), (who took the chair in the absence, through indisposition, of Sir Fortescue Flannery), said the report was a good one, especially having regard to the circumstances under which they had been working. Great difficulties had attended all engineering work which had been going on during 1917, and the results now shown had not been achieved easily, but were the outcome of much worry and anxiety and strenuous labour on the part of those in charge of the business. In order to arrive at this result close and cordial co-operation had been necessary throughout the whole business. There were few concerns where all pulled together better than they did in this Callender group. The delay which had taken place in presenting the balance-sheet had run all through the operations of the year. There had been many delays in getting goods turned out and in supplying their customers, but these were inevitable, and when they looked at the difficulties which had surrounded this country and the company itself, they could only express surprise that they had been able to do so much; for, in spite of all these difficulties they had done a record year's work. The amount of their output had been very great, and he did not think that the profits which they had made were really commensurate with the work which had been done; but they were all controlled by Government, and at times were subjected to a heavy hand on the part of those in authority. This was especially so in regard to labour, where the competent authority had on several occasions given awards which had been entirely unexpected, and which had applied to men and to industries to which they evidently were never originally intended to apply. In addition, they had had awards given in regard to wages which had been dated back by many months, and which had hit the company in some departments very heavily indeed, and had caused them great disappointment when they had come to look into certain of the accounts which ought to have come out better. These, however, were circumstances which were quite beyond their control. They were endeavouring to pass on these claims to the Ministry, as they held that the Government, having imposed upon the company certain additional expenses, should of necessity bear those expenses when it came to paying for the goods, and although they had said they would probably do so, up to the present they had been strangely diffident in regard to parting with that extra money. These, however, were little difficulties which they must expect to meet. All the factories in which the company was interested had been kept very busy during 1917, and all the work done had been of the greatest national importance. They were full of work at the present time, so that the outlook for the present year was a satisfactory one. With regard to the company's foreign work, they had, as was well known, very widespread connections in all kinds of electrical business in most parts of the world. Since the beginning of the war their operations under this head had been a good deal hampered, and this was particularly so during the year under review; but in spite of this fact they were managing to keep their connections going, and he was pleased to say matters were improving somewhat. There was now the possibility of sending materials to certain places abroad. He wanted to place on record the board's appreciation of the work done by those men abroad, especially in India, who represented this company, and who had had a very difficult time since the war broke out. He desired also to testify to the satisfaction which the board, and, he was sure, the shareholders, felt with the management and staff of the company and those in charge of the factories and contracts for the part which they had taken in producing the results now submitted. The directors recognised that, on the conclusion of the war, whenever that might be, the company would have to face conditions which would be entirely different from those now prevailing. They would have to start again the commercial business which, having been built up after many years of anxiety and trouble, had had to be set aside. They were making all their arrangements with a view to getting that new commercial work; but one point which struck the directors very forcibly was the difficulties under which they were going to labour by reason of the action of the Government in taking from them so much of the profit which had been made. They were reduced practically to their old standard, and they could get little more than they got in pre-war days, and out of that little surplus they had to spend large sums on new machinery, &c., which meant that, when peace came, they would not have sufficient funds in their coffers to be able to fight the enemy whom they would certainly have at their gate. They recognised the soundness of the financial policy of the Government, but regretted that the very sound policy which had been adopted would cause considerable inconvenience to this company and to other manufacturers in many lines of business when they resumed their commercial trade, because they would have no large reserve funds to meet the reconstruction of business which had been so much talked about, having had such a large share of their profits taken from them in the way of income-tax, excess profits duty, &c. Against that they had to bear in mind that Germany, who, in spite of all things, would be one of their chief competitors, had adopted a different method with her large manufacturers. Recent balance-sheets of important companies in the same line of business as that of this company showed immense reserves which appeared to be liquid and ready for immediate use, and it was openly stated that they would be entitled to use these in the rehabilitation of German trade in various parts of the world. He hoped it would be a long time before German trade with this country and with our Colonies and Dominions would be a serious menace, or a menace of any kind, to us; but there were wide stretches of country, especially in South America and in China, which were open to them and to us, and where we had before the war, and had maintained during the war, a certain footing at some expense. Great things had been hoped for in that direction, but that was where we should find the pinch, and our foreign competitors who had been lightly treated by their Government in regard to finance would be at a great advantage as compared with English firms, who had suffered under the heavy hand of the Government's exactions. Following upon this the directors could see it would be necessary that when the happy day of peace came, and perhaps sooner, they would have to ask the shareholders to approve the raising of further capital in this company, because, while they could carry on at present, and finance was easy when they were dealing with the Government and such authorities, it would be a very different case when they were once again in open competition for ordinary commercial business. It would be necessary then that the resources of the company should be increased, and probably considerably increased. When that day came he felt sure that the assistance which they would require from the shareholders would not be found wanting. In order to consolidate the business and to prepare for future work they were making some alterations in the management. He would continue to hold the position of managing director and to be active therein, and it was proposed that Mr. Petersen and Mr. James Callender, who had been assistant managers, should become managers of the company; Mr. Charles Pipkin, who had been with the company practically all his life, being brought in as assistant manager. The demands of the Ministry of War had necessarily made great inroads on their staff, and the men had been replaced to a large extent by women workers both in the factories and in the offices. Having referred to the casualties which had taken place among the members of the staff on active service and to the close touch which was maintained between the company and the men who were still at the front, the chairman proceeded to refer to the accounts. Dealing with the balance-sheet, he pointed out that in the year under review about £60,000 had been spent in additional buildings, machinery and plant, and he stated that the directors were in negotiation with the Government in regard to an allowance being made under this head in the assessment of excess profits duty. The gross profit for the year was £199,023, or an increase of about £9,000, which, as he had already pointed out, was by no means commensurate with the large amount of increased work done. The balance at credit of profit and loss account, £121,783, as compared with £117,590, so that in the net result they were about £4,000 better off than in the previous year. After payment of fixed charges £81,051 remained. The amount brought forward from 1916 was £249,207, and when it became desirable to make an alteration in the capital the directors, in accordance with powers vested in them, transferred from that amount to reserve the sum of £150,000, thus leaving £99,207 as the real carry forward, and giving them now an available balance of £180,258. It was proposed to raise the distribution on the ordinary shares for the year from 20 per cent. to 25 per cent. (5 per cent. of which had already been paid to the shareholders) this extra 5 per cent. being payable by way of bonus. They were carrying to reserve £25,000, bringing that account, after the completion of certain transactions, to the round sum of £100,000. This would leave £111,508 to be carried forward, subject to excess profits duty, if any.

Sir JOHN BORASTON congratulated the directors upon the results achieved, and the chairman and Mr. Tait upon the honours conferred upon them by His Majesty. He suggested that the remuneration of the directors should be increased from £2,500 to £3,000 per annum, but the SOLICITOR pointed out that effect could not be given to this suggestion at the present meeting. Mr. TODHUNTER having also offered his congratulations to the chairman on the distinction conferred upon him, The CHAIRMAN thanked the shareholders for their kind expressions. He mentioned that he had received from one of the leading trade unions in Lancashire a letter of cordial congratulation, expressing their hope that the happy relations existing between him and the company, on the one hand, and themselves on the other, might long continue. He treasured that letter even more than he treasured a great many others that he had received.

At an extraordinary general meeting which was afterwards held resolutions were unanimously passed altering the articles of association and approving the directors' recommendations with regard to the capital of the company with a view to the ordinary shareholders receiving as a bonus one fully-paid ordinary share of £5 for every ordinary £5 share now held by him.

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United Electric Tramways of Montevideo, Ltd.

Mr. GEORGE BALFOUR, chairman, at the fourteenth ordinary general meeting, said that the accounts submitted were in accordance with the not very hopeful forecast foreshadowed last year. During the year the company's cars carried 44,883,520 passengers, an increase of 2,136,450 over last year. The gross receipts amounted to £359,833, being an increase of £12,060, which followed an increase of £17,172 last year. The operating expenses increased by £24,314, or 4.45 per cent. They absorbed 73.14 per cent. of the gross receipts, compared with an average of 57 per cent. under pre-war conditions. Net receipts showed a decrease of £12,254, following a decrease of £11,322 last year. The cost of fuel accounted for 83 per cent. of the total increase in expenses, and the increase due to wages represented slightly over 14 per cent., the balance being due to increased cost of materials for repairs and maintenance. The net profit for the year was £27,373, and it was proposed to carry forward a sum of £13,296. For the first time in the history of the company the payment of the preference dividend had to be postponed, but it was necessary to do so, the increased cost of coal alone, as compared with the previous year, being nearly equal to a year's dividend on those shares. The outlook for the current year indicated a repetition of last year's experience. For the first six months the gross receipts showed an increase of £19,438, but against that the operating expenses showed an increase of £25,202. The increased gross receipts, however, gave confidence in the stability of the undertaking.

Tata Hydro-Electrical Power Supply Co., Ltd.

At the eighth ordinary general meeting held in Bombay, Sir D. J. TATA, Kt., chairman, who presided, said the success so far as it had been achieved in spite of numerous and unexpected difficulties, should be a source of some satisfaction; while in July, 1915, they commenced with only seventeen consumers, these were increased to 31 in June, 1916, and the number of consumers taking power in June, 1917, had been further increased to 38, and the amount of energy supplied to many of them had steadily increased. The present war conditions had prevented a still further extension owing to the difficulty of getting machinery from England. All the transformers required for their second installation were ready for shipment, and some of the motors ordered were partially manufactured and would be completed after the grant of the priority certificates from the Munitions Department of Great Britain. Their arrival would mean that the mills of the second installation, which were now on the waiting list, would be put in commission electrically. Compared with the experience of electric power supplying companies in other countries, the waiting list of consumers for large amounts of energy with a well-regulated and steady load was no small advantage to them. The fifth generating set in the power house at Khopoli had been erected, and had been in operation for some time, so that, as soon as war conditions allowed of the equipment of the mills on the second installation, it would be possible to raise the present output of 30,000 H.P. to 40,000 H.P. at no distant date. This year they had strengthened the whole of their transmission line with the exception of a small section, the material for which was lost at sea. Two years ago he pointed to the extraordinary difficulties of carrying energy at a pressure of 100,000 volts along overhead transmission lines which crossed large creeks and salt pan areas. The moisture and the salt air made it unusually difficult to carry that voltage without mishaps. With increasing experience, their engineers had steadily overcome the difficulties, and they were now having fewer stoppages in a marked degree. The indemnities shown this year in the audited accounts covered stoppages from the commencement in 1915 up to the end of last year. The income had been steadily increasing; the highest point reached was in May, 1917, when they earned a gross income of about Rs. 2,60,000 for that month; as against that operation costs had remained about the same as in the preceding year. Dividends on preference shares at the rate of 7 per cent. per annum, and on ordinary shares, old and new, at the rate of 8 per cent. per annum, were declared.

Pernambuco Tramways and Power Co., Ltd.

At the sixth ordinary general meeting the chairman, Mr. WM. HIGGINS, said that the past year had been one of continued progress in every branch of business, and had it not been for the existing abnormal conditions they might have earned dividends on both classes of the share capital; nevertheless, they recommended a payment that would commence the dividend-earning period in the history of the company. The operating results showed a net increase over those of the previous year of £27,127. The tramway receipts had shown, and continued to show a progressive rate of increase. The whole of the systems of the old mule tramways and the Brazilian street railway had now been electrified, and there remained just over eight miles of steam lines, being part of what used to be the Olinda street railway. Notwithstanding the price of coal, the gas undertaking had shown a profit for the year. Improved plant enabled a saving of 50 per cent. to be made in the amount of coal carbonised. A remunerative future was anticipated for this branch of the business when circumstances and prices again became normal. With regard to the supply of electricity for lighting and power, great difficulties had been met with in obtaining the necessary materials and shipping permits. They still hoped for good results from this branch of the business. The Telephone Co. continued to show satisfactory progress; the number of subscribers and receipts had increased. During the year they had also enjoyed a better rate of exchange, averaging 12.81d., as against 12.06d. in 1916. With regard to the future, the prospects were satisfactory; the total increase in traffic receipts this year to date were £22,000, and the net working results also showed an improvement compared with 1917. A dividend of 3½ per cent., less income-tax, was declared on the 7 per cent. non-cumulative participating preference shares.

Crompton and Co., Ltd.

Mr. C. F. TUFNELL, presiding at the annual meeting on Tuesday, said that they regretted having again to disappoint the shareholders in the matter of accounts. They were not yet able to issue the accounts for the year ending March, 1917, which were postponed from last year. The question of war taxation and other matters in respect of that year had still to be settled. They were, therefore, in practically the same position as they were at the annual meeting last August. The business continued to make progress in a satisfactory manner. Compared with the year ended March, 1916, which was the last year for which they had had the accounts, the output from the works for the year ended March, 1918, showed an increase of 98 per cent., or very nearly double, whilst the work in hand at the present moment was more than double the figure at which it stood in March, 1916. They would never have been able to handle the volume of work which they had turned out this year but for the foresight of the management in providing additions to the company's premises and plant during the early days of the war. Further expenditure under those heads had been incurred during the year under review, including extension and improvement of the accommodation for women, of whom an increasing number was being employed. Since the close of the year they had given notice to the debenture holders of their intention to repay the £100,000 5½ per cent. mortgage debentures in September next. Those debentures in any case were repayable in December of next year, but after careful consideration the directors came to the conclusion that it would be better for two reasons to anticipate that date. In the first place, they had ascertained on what terms new debentures could be issued now, whereas no one could tell with certainty what the conditions of the money market might be in December of next year. Then, in the second place, it gave them an opportunity of increasing the issue from £100,000 to £150,000, a useful addition to their working capital. The new debentures bore interest at the rate of 6 per cent. per annum, and the whole issue, except a reserve of £20,000, had been placed. Their relations with their employés had been entirely satisfactory throughout the year, and the work they were turning out was excellent. He would like again to take the opportunity of thanking Mr. Reeves, the managing director and secretary, and Mr. Britten, the manager at Chelmsford, and their loyal staff for their successful work. The prospects for the current year were good, and so far as regarded trading when the war was over, all he need tell them was that if trade was good they would be in a position to profit by it, and if trade was bad—an unlikely contingency in the opinion of many—he could, at any rate, assure them that their organisation and the arrangements they had made during the last few years would stand them in very good stead.

Following the declaration of the dividends a resolution was passed adjourning the meeting to a subsequent date, of which due notice will be given the shareholders, for the purpose of the presentation of the past year's accounts.

Edmundson's Electricity Corporation, Ltd.

In the annual report to which we referred briefly last week the usual schedule is given of the capital expenditure and gross profits of subsidiary and other companies. We reproduce the figures for the year ended December, 1917 :—

Name.	Capital expended Dec. 31st, 1917.	Gross profit (before providing for capital charges and depreciation). 1917.	Load connected in KW. 1917.
Alderley	£54,692	£2,662	1,193 KW.
Bromley	165,312	9,828	4,771
Folkestone	238,943	15,719	5,455
Guernsey	160,454	3,842	5,027
Isle of Wight	272,026	6,471	5,883
Ilfracombe	35,591	596	861
Lancashire Co. ..	684,352	42,031	25,311
Lymington	36,951	1,419	760
Melton Mowbray ..	40,276	1,956	929
Newmarket	44,637	2,020	1,086
North of Scotland ..	116,164	6,643	3,793
Ramsgate	51,686	2,578	1,452
Scarboro' Trams ..	99,490	82	—
Salisbury	74,079	5,713	1,729
Urban Co.	1,449,670	81,550	36,902
Wycombe	119,287	5,944	2,729
Cromer	34,376	813	616
Dorking	46,126	2,261	1,095
Frome	52,186	2,758	2,077
Hamilton	85,809	4,405	3,015
Surbiton	69,099	4,309	1,970
Total	£3,935,146	£203,600	106,654 KW.
1916	£3,854,931	£187,441	99,095 KW.

The annual meeting was held yesterday.

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Marconi's Wireless Telegraph Co., Ltd.

The net profit for the year ended December, 1917, was £383,835, and adding the amount brought forward there stands to the credit of profit and loss account £763,942. In addition to the dividends paid in February there is now recommended a dividend on the ordinary shares of 15 per cent. for the year ended December 31st, 1917 (making 20 per cent. for the year), and one on preference shares of 10 per cent. for the year (making 17 per cent.). There is to be put to general reserve £100,000, and £376,904 is to be carried forward. The general reserve will now stand at £1,100,000. The shares in associated companies and patents are taken into account in the balance sheet at their cost price, namely, £1,498,083, an increase during the year of £94,159. The par value of the shares now stands at £2,697,286, exclusive of shares which have no capital denomination, which shows an increase over last year of £209,835.

Owing to unfavourable rates of exchange large sums of money received in foreign countries continue to be invested temporarily or placed on deposit abroad. The loss represented by the rates of exchange has been written off against profit and loss account. If upon realisation the rates of exchange will have improved, the differences will appear as profit in another year.

The company is still without any remuneration or compensation from the Government for the use since the beginning of the war of the company's high-power stations, and for the considerable services which have been rendered. For the fourth year in succession, therefore, it has been impossible to include in the accounts any sum in respect of these matters.

The negotiations with the Post Office for compensation in respect of their repudiation of the contract for the Imperial chain of stations, to which reference was made in the report of last year, proved abortive, and the company, having exhausted every effort for a friendly settlement, found itself compelled to proceed with its petition of right. After counsel had opened the case on behalf of the company, the Attorney-General, on behalf of the Crown, consented to judgment being entered for the company with costs. The amount of damages to be paid to the company will be decided in due course by the Referee appointed by the Court.

The Marconi International Marine Communication Co., Ltd., has continued to show very substantial development, and dividends for the past year amounting to 15 per cent. have been declared and paid, and a sum of £105,418 has been carried forward, subject to excess profits duty for 1916 and 1917. The rapid increase in the company's business called for further additional capital, and an issue of 250,000 shares at 15s. premium was offered to the shareholders, and substantially over-subscribed.

The French company, La Compagnie Francaise Maritime et Coloniale de Télégraphie sans Fil, has declared a dividend for 1917 at the rate of 20 per cent. on the ordinary shares, and 281.25 francs per share on the founders' shares.

The Amalgamated Wireless (Australasia), Ltd., has declared a dividend of 5 per cent. for the year ending June 30th, 1917.

The Marconi Wireless Telegraph Co. of America has declared a dividend for the year 1917 at the rate of 5 per cent.

The Russian company, the Societe Russe Telegraphes et Telephones sans Fil, declared no dividend for the past year. There is, however, reason to believe that the position of the company, considering the circumstances, is not unsatisfactory.

Arbroath Electric Light & Power Co., Ltd.—The profit for 1917 amounted to £2,830, plus £373 brought forward. There is to be put to reserve and renewals fund £1,000; dividend 5 per cent., less income-tax, on ordinary shares, £860; carried forward £417. The quantity of current generated and sold was very satisfactory, but the cost of production was much higher than formerly, and this has prevented the company obtaining the full benefit of the additional load. There have been a good many applications for current during the year, but the Government restrictions precluded their acceptance, except in special circumstances.

Stock Exchange Notices.—The following securities are to be quoted officially:—

British Electric Transformer Co., Ltd.—38,012 additional 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 161,989 to 200,000).

Llanelly and District Electric Lighting & Traction Co., Ltd.—100,000 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 60,001 to 135,000 and 150,001 to 175,000).

City & South London Railway Co.—Interim dividends on the 5 per cent. preference stocks 1891, 1896, 1901, and 1903 of 2½ per cent., and on the consolidated ordinary stocks of ¾ per cent.

Application has been made to the Board of Trade for power to extend the time for the payment of interest out of capital provided for under the Act of 1913.

Greenwood & Batley, Ltd.—After placing to depreciation £5,000 and to reserve £50,000, the directors recommend a final dividend on the ordinary shares of 10 per cent., tax free, leaving to be carried forward £13,962.

Edison Swan Electric Co., Ltd.—A petition for confirming a resolution reducing the capital from £888,071 to £698,307 is to be heard on July 30th.

Madras Electric Supply Corporation, Ltd.—Dividend 4 per cent. on ordinary shares for the year; £7,000 is put to depreciation and renewals, and £5,727 is carried forward.

Central London Railway Co.—Interim dividend of 1¾ per cent. on the undivided ordinary shares and 2 per cent. on the preferred ordinary for six months.

London Electric Railway Co.—Dividends, 2 per cent. on the 4 per cent. preference stock and ¾ per cent. on the ordinary for the half-year.

Hadfields, Ltd.—Interim dividend 1s. per share, free of tax, on the ordinary shares.

Cape Asbestos Co., Ltd.—Dividend on the ordinary shares 5 per cent., less tax; £5,908 carried forward.

Singapore Electric Tramways, Ltd.—The report for 1917 states that after charging debenture interest, depreciation, and royalty to the municipality on tramway profits for 1916, the profit was £4,274, plus £7,946 brought forward. After allowing £5,000 for dividend paid in July, 1917, transferring £3,000 to depreciation, £4,221 is to be carried forward. Car mileage decreased 108,292 miles. Passengers per car mile were 6.53, against 6.19. Power expenses were £21,803, against £17,005, due to cost of coal. Sales of energy for lighting and power increased £1,289 to £14,611. Abnormally high price of coal greatly increased cost of energy, and at close of year current was being supplied under contract to Singapore Municipality at a loss. Position was put before Commissioners, who declined to agree to any increase in the rate at which electricity is supplied to them, although the net profits to the municipality for 1917 in their electrical department were £10,614. In December last crank shaft of one Diesel engine broke, causing considerable damage. Engine still out of commission. For the present the bulk of the energy required is being produced by the steam sets.—*Financial Times.*

Metropolitan District Railway Co.—Interim dividends of 2 per cent. on the guaranteed stock, 2½ per cent. on the first preference, and 1½ per cent. on the 5 per cent. second preference.

Calcutta Electric Supply Corporation, Ltd.—Units sold to consumers during the four weeks ended April 26th, 2,509,519, compared with 2,174,348 units last year.

St. James's & Pall Mall Electric Light Co., Ltd.—Interim dividend at the rate of 7 per cent. per annum on the ordinary shares for the June half-year.

STOCKS AND SHARES.

TUESDAY EVENING.

STOCK EXCHANGE markets were not much affected by the commencement of the German offensive on Monday, and the first news of the results achieved by the enemy was regarded as distinctly encouraging from our point of view. Except in a few cases where there had been a little too much buying in advance, prices held their ground with noticeable strength. It is surprising how well the Home Railway market is maintained considering how small is the amount of business. The first dividends to be announced were those of the Tube railways. The City & South London pay ¾ per cent., Central London 1¾ per cent., London Electric ¾ per cent., and the District announces 1½ per cent. on the Second Preference stock. At the same time, the Underground Electric Railways of London have declared a dividend of 4 per cent. on the Income Bonds. These rates are all the same as those of a year ago, and are much in accordance with the market anticipations, except that of the Underground Co. Some optimists had been looking for an advance upon the 4 per cent. declared last year upon the Income Bonds, although it was tolerably obvious that the fare-raising had been in force far too short a time to cause it to have any material effect upon the takings for the last half-year. The price of the bonds has weakened to 82½, and the £10 shares fell to 2⅛. Metropolitans are also lower at 23¼.

Attention is being directed to several of the Tramway issues in the Metropolitan list. London and Suburban Traction 5 per cent. Preference have risen to 7s. 3d., with a fair amount of business doing in the shares. The First Mortgage Debenture stock stands at 60, and the 5 per cent. "A" Debenture stock at 80, while the Ordinary are in the neighbourhood of 2s. London United Debenture keep steady at 41—Metropolitan Electric 4½ per cent. Debenture stock changed hands the other day at 70½. Low-priced Tramway shares are fairly popular amongst a certain class of speculative buyers. Pernambuco Ordinary were run up to 8s. 3d., and the 7 per cent. Preference to 15s.

There is a better tone in the market for Anglo-Argentine Trams, buyers having come along for the First and Second Preferences on the basis of 3⅛ and 2 9/16 respectively, while there is a harder tendency about the debenture stocks. British Columbia descriptions keep firm, and in a private letter just received from Vancouver, the writer refers to the more promising conditions which now prevail in that city, and in the province as a whole. Mexicans continue firm as a whole, but definite news is awaited with an eagerness just tinged with anxiety. Mexican Light & Power preferred are 3 points better on the week.

The course of prices in the Telegraph market continues upwards. Eastern Ordinary, Eastern Extensions, and Direct United States shares are ex dividend. Allowing for the deductions, there is no particular change in prices. Oriental Telephone Ordinary at 4¾ are ex the dividend and bonus, and the 6 per cent. Preference at 20s. are xd. Indo-Europeans have had a big rise of £9 a share to 58½, which brings them within 10s. of the pre-war making up price of July, 1914.

The Marconi report is very satisfactory, and the dividend is raised to 20 per cent. for the year. The profits have risen from £318,400 to £383,800, and allowing for the carry-forward there is a disposable amount of £137,000 more than there was in 1916. The Preference shares get 17 per cent. instead of 12 per cent., and the Ordinary dividend of 20 per cent. is

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5 per cent. more than that for 1916. The reserve is raised to £1,100,000, and £377,000 goes forward. It is stated in the report that no settlement has yet been arrived at with the Government for the use of the Marconi high-power stations and other services, but the claim for compensation will be settled in due course by the referee appointed by the Court of Appeal. The price of the shares is firm at 3⅛, and a good deal of business is doing in the subsidiaries. Canadians are good at 12s., and there has been a rise in Spanish and General to about the same figure, while Americans keep firm at 25s. 3d. xd.

Babcock & Wilcox are a strong market, and have added another 2s. 6d. to their last week's rise of 3s. 9d. British Aluminium have also improved. Callender's recovered their dividend straight away; Henley's are 5s. up at 21½. Telegraph Constructions are also the same price xd., as last week they were cum dividend. General Electric have risen £1 to 27½. The preference at 10¾ are 5s. easier. Edison Swans are a little lower at 3 5/16 for the fully-paid, and 40s. 6d. for the £3 paid, though the Preference are in eager demand at 43s. and upwards. Cromptons are firm at 15s. on the declaration of a 7 per cent. dividend on the Ordinary.

The Electric Lighting list is as quiet as ever, and no changes have occurred except ⅛ rise in Chelseas, and a similar fall in St. James's. The tendency, however, continues to be rather dull owing to the apprehension already noticed that there may be some slight reduction in the dividends in respect of the current year. Other Industrials are mostly on the up-grade. Rubber shares are a trifle harder, attracting very little notice for the time being. In the base-metal markets, nothing of importance has occurred.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price July 16, 1918.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6⅛	—	£7 13 10
Charing Cross Ordinary	5	4	3½	—	6 3 1
do. do. do. 4½ Pref.	4½	4½	3½	—	6 18 6
Chelsea	3	5	3½	+ ⅛	7 13 10
City of London	8	8	11	—	7 5 6
do. do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
County of London	7	7	10¼	—	6 16 7
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	6	7	5½	—	6 13 4
London Electric	Nil	Nil	1¾	—	Nil
do. do. 6 per cent. Pref.	4	5	3½	—	7 13 10
Metropolitan	3	4	3⅜	—	6 8 0
do. 4½ per cent. Pref.	4½	4½	3⅜	—	7 4 0
St. James' and Pall Mall	8	9	6¾	— ⅛	6 13 4
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6⅜	—	7 7 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	95xd	—	6 6 4
do. Def.	1½	1½	22	—	6 14 10
Chile Telephone	8	8	9½	—	4 6 6
Cuba Sub. Ord.	7	7	9⅞	—	*7 3 7
Eastern Extension	8	8	154xd	—	*5 3 3
Eastern Tel. Ord.	8	8	157xd	—	*5 1 7
Globe Tel. and T. Ord.	7	7	14⅜xd	—	*4 17 5
do. do. Pref.	6	6	9⅛xd	—	6 0 0
Great Northern Tel.	24	22	88	—	5 15 9
Indo-European	13	—	48½	+ 9	5 11 1
Marconi	15	20	3⅜	+ ⅛	5 10 4
Oriental Telephone Ord.	10	10	4⅞xd	—	2 2 2
United R. Plate Tel.	8	8	7¼	—	*5 10 5
West India and Panama	6d.	9d.	1 1/16	— 1/16	*3 6 8
Western Telegraph	8	8	15⅞	—	*5 0 10
Home Rails.					
Central London Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	1	1	23½	—1	4 6 0
do. District	Nil	Nil	19	—	Nil
Underground Electric Ordinary	Nil	Nil	2⅛	+ ⅛	Nil
do. do. "A"	Nil	Nil	6/8	—	Nil
do. do. Income	6	4	82½	— ½	*4 17 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4½	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3 1/16	+ 1/16	—
do. do. 2nd Pref.	5½	—	2½	—	—
do. do. 5 Deb.	5	5	65	+1	7 13 10
Brazil Tractions	—	—	42	—	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	61½	—	8 2 8
do. do. Preferred	Nil	Nil	46½	—	Nil
do. do. Deferred	Nil	Nil	41½	+1½	Nil
do. do. Deb.	4½	4½	62	+ ½	6 17 0
Mexico Trams 5 per cent. Bonds	Nil	Nil	44½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	96½	—	Nil
Mexican Light Common	Nil	Nil	21	—	Nil
do. Pref.	Nil	Nil	35½	+ 3	Nil
do. 1st Bonds	Nil	Nil	49	+1	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	8⅛	+ ⅛	4 1 6
British Aluminium Ord.	10	10	1¾	+ ⅛	5 6 8
British Insulated Ord.	20	20	1 7/8	—	5 6 8
British Westinghouse Pref.	7½	7½	2⅜	—	5 14 3
Callenders	20	25	19½xd	+ ¾	6 11 7
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	3 7/16	—	5 16 0
Edison-Swan, fully paid	—	—	3 1/16	—	Nil
do. do. 4 per cent. Deb.	4	4	74½	—	5 7 5
Electric Construction	7½	10	1 1/16	—	7 12 4
Gen. Elec. Pref.	6	6	10¼	— ¼	6 1 0
do. Ord.	10	10	27	+1	*3 12 9
Henley	25	25	21½	+ ½	5 16 3
do. 4½ Pref.	4½	4½	3⅜	—	5 12 2
India-Rubber	10	10	16⅜	—	*6 4 0
Telegraph Con.	20	20	44xd	+ ½	*5 8 8

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, July 17th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic per lb.	1/6	..
a Ammoniac Sal per ton	£80	..
a Ammonia, Muriate (large crystal) "	£75	..
a Bisulphide of Carbon "	..	..
a Borax "	£48	..
a Copper Sulphate "	£65	..
a Potash, Chlorate per lb.	2/6	..
a " Perchlorate "	2/-	..
a Shellac per cwt.	£17 5/-	..
a Sulphate of Magnesia per ton	£15	..
a Sulphur, Sublimed Flowers "	£35	..
a " Lump "	£25	..
a Soda, Chlorate per lb.	1/1	..
a " Crystals per ton	170/-	..
a Sodium Bichromate, casks per lb.	..	..
METALS, &c.		
c Brass (rolled metal 2' to 12' basis) per lb.	..	..
c " Tubes (solid drawn) "	..	..
c " Wire, basis "	..	..
c Copper Tubes (solid drawn) "	1/8½ to 1/9	1½d. inc.
g " Bars (best selected) per ton	£149	£2 inc.
g " Sheet "	£149	£2 inc.
g " Rod "	£149	£2 inc.
d " (Electrolytic) Bars "	£137	£12 inc.
d " Sheets "	£152	..
d " Wire Rods "	£145	£12 inc.
d " " H.C. Wire per lb.	1/5⅜	1⅜d. inc.
f Ebonite Rod "	3/-	..
f " Sheet "	2/6	..
h German Silver Wire "	2/6	..
h Gutta-percha, fine "	6/10	..
h India-rubber, Para fine "	3/1	½d. inc.
i Iron Pig (Cleveland warrants) per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual. "	£37	..
g Lead, English Pig "	..	..
g Mercury per bot.	Nom.	..
e Mica (in original cases) small per lb.	6d. to 2/-	..
e " " " medium "	2/6 to 6/-	..
e " " " large "	7/6 to 14/- & up.	..
d Silicium Bronze Wire per lb.	1/8½	..
r Steel, Magnet, in bars per ton	..	..
g Tin, Block (English) "	..	..
n " Wire, Nos. 1 to 16 per lb.	4/6	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

London Engineers Oppose the Whitley Report.—The *Daily Telegraph* states that the London District Committee of the Amalgamated Society of Engineers has issued an instruction to all shop stewards and branches in the London district not to take part in the formation or working of any committee constituted on the basis of the Whitley Report, on the ground that "the fundamental antagonism of the interest between employer and employed offers an insuperable barrier to any joint control of industry, and that the next step on the road to control by the workers is the creation of a strong, co-ordinated, class-conscious movement in the workshops." The Committee, in a statement issued, says that workers have nothing in common with the sentiments expressed in the Report, and, if its recommendations are carried out in the spirit in which they appear to be made, the consequences to the Trade Union movement cannot be other than disastrous. Mr. Sam Bradley, the secretary of the London District Committee, said it was feared that in practically every district the Whitley Committees would be dominated by the employers, and in ninety-nine cases out of a hundred it would be impossible to reach agreements.

A Solderless Cable Joint.—The Siemens-Schuckert Werke advertises a new method of making joints in electric cables. The bare cables are pushed from either end into an oval sleeve of metal; the sleeve is indented at a number of places along its length by means of a special screw-operated hand-vice. The advantage of this method of making joints consists in the avoidance of damage to the strands of the cable and the efficient protection to the zinc surface on the wires. The joints have the same tensile strength as the cable itself. The process is cheap, and can be carried out by unskilled labour. This method of jointing is described more fully in an article by A. Vilanova, in which photographs are included of joints with the sleeve partly removed. The new joint is compared with riveted and screw joints, and it is claimed as a special advantage that its use will save very great quantities of screws and rivets.—*E.T.Z.*, May 9th.

Gibraltar Straits Tunnel Scheme.—The Paris *Excelsior* published, on July 11th, an article dealing with the advantages of a tunnel under the Straits of Gibraltar. The General Congress of Civil Engineers has drafted a scheme for the construction of such a tunnel, and the Orleans Railway Co. has submitted the draft to the Government, asking for a concession. The Spanish Government has instructed a colonel of Engineers to make an inquiry into the subject.

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THE USE OF HIGH-PRESSURE AND HIGH-TEMPERATURE STEAM IN LARGE POWER STATIONS.

By J. H. SHAW, A.M.I.E.E.

(Abstract of paper read before the Yorkshire Local Section *of the* Institution of Electrical Engineers, *at Leeds.)*

It is apparent that in order to increase the heat efficiency of a steam plant, whose characteristics are that a constant loss is inevitable whatever the temperature and pressure, it is necessary to increase the working range of temperature and pressure.

The lower limit is generally decided by the locality of the power station. A works equipped with cooling towers cannot expect to obtain a lower bottom temperature than 75 deg. F.; a bottom temperature of 80 deg. F. is more to be expected, which will give 28 in. vacuum or 2 in. absolute pressure. With cooling water at a temperature of 60 deg. F. condensing plant for vacua between 28.5 and 28.8 in. can be installed.

As regards the upper range, doubt exists as to whether it is the more economical to increase the temperature of the steam by superheating or to increase the range by the use of higher pressures and a moderate amount of superheat.

Plant has been installed by the British Thomson-Houston Co. at their Rugby power house, consisting of a B.T.H. turbine and a Babcock & Wilcox marine-type boiler, capable of a normal evaporation of 18,000 lb. per hour with feed water at 80 deg. F. (the working pressure being 350 lb. per sq. in., the final temperature of the steam after passing the superheater 700 deg. F., and the test pressure of the boiler 525 lb. per sq. in.). Good results have been obtained from the combination, and an inspection of the machine after about a year's operation showed no undue signs of wear.

At the Carville power station, Newcastle-on-Tyne, the latest section of the boiler house is designed for 275 lb. pressure, and at Glasgow the boiler pressure at the new works is to be 250 lb. per sq. in.

SCHEDULE I.—Absolute Pressure at Turbine Exhaust, 1·5 in. (Hg.) (91·7° F.). Condensate Temperature. 85° F.

Steam pressure at turbine.	215 lb. per sq. in. (abs.)		365 lb. per sq. in. (abs.)		500 lb. per sq. in.
Superheat of steam at turbine, °F.	150	300°	150	300°	268°
Total temperature of steam, °F.	537·9	687·9	586·4	736·4	736·4
Total heat in steam from 32° F., therms per lb.	1,293	1.371	1,307	1,389	1,382·7
Heat drop per lb. of steam, therms.	391	429·2	428·7	470·2	485
Ratio efficiency of turbo-alternator, %.	77·6	79·5	77·6	80	80·2
Internal efficiency of turbine, %.	82	84·0	82·0	84·5	84·6
Steam consumption of turbine, lb. per kw.-hour.	11·25	10·0	10·28	9·15	8·89
Total steam consumption of turbine, lb. per hour.	225,000	200,000	205,600	183,000	177,800
Heat rejected to condenser from 32° F., therms per lb.	973	1,010	955	991	972·7
Circulating water, galls. per hour.	1,012,500	940,000	925,200	840.000	785,000
Total power for auxiliaries, kw.	515	485	530	485	510
Net output to bus-bars, kw.	19,485	19,515	19,470	19,515	19,490
Heat in steam from temperature of hot-well, therms per lb.	1,240	1,318	1,254	1,336	1,329·7
Steam consumption per effective kw.-hour, lb.	11·55	10·25	10·55	9·39	9·124
Pounds of steam evaporated and superheated per lb. of coal, lb.	6·25	5·9	6·2	5·8	5·83
Coal consumption per effective kw.-hour, lb.	1·85	1·74	1·70	1·62	1·565
£ Cost of coal at 10s. per ton, generating 175·2 × 10^6 kw.-hour.	72,000	67.600	66,400	63,750	61,250

A good case can be made out for a jump to 600 lb. pressure with a total temperature of 700 deg. to 800 deg. F., but this will involve a considerable amount of development charges being borne by the first undertakings to adopt such a pressure. On the other hand, it appears that practically all designs of existing apparatus can be so modified as to admit of pressures of 350 to 400 lb. per sq. in.

When considering any results of tests on high-pressure or high-temperature steam generating plant, it is essential that the tests on the boiler side and the tests on the turbine side be studied separately; further, it must be remembered that any results obtained on an extra-high-pressure boiler can be obtained and, considering the boiler apart from the economiser, surpassed on a similar and similarly equipped low-pressure boiler.

For a comparison between the cost of running a power station at 200 lb. pressure (gauge) and at 350 lb. pressure, Schedule 1 has been prepared. It is proposed to consider a riverside station, where the water is suitable for surface condensing. It is proposed to install 20,000-kw. sets, and coal is assumed to be within a reasonable distance; the cost of coal, with a net calorific value of 10,000 therms per lb., is for the purpose of the schedule assumed to be 10s. per ton at the works. The incombustible contents of the coal would amount to 20 per cent. The average water temperature is taken to be 60 deg. F., and the vacuum 28.5 in., with the barometer at 30 in. The overall efficiency of the boiler-house plant is assumed to be 77.5 per cent., which should be obtained with modern boiler control.

A turbine ratio efficiency of 80 per cent. is assumed, at both 200 lb. pressure and 350 lb. pressure with the steam superheated 150 deg. F., and a constant vacuum of 28.5 in. The corrections used for obtaining the consumptions at different steam temperatures are taken from Mr. Baumann's paper.* An alternator of 20,000-kw. capacity can no doubt be built to give an efficiency of 97 per cent. at unity power factor, thus making the turbo-generator ratio efficiency $0.80 \times 0.97 = 77.6$ per cent. Assuming bearing and other friction losses to absorb 2 per cent., the internal efficiency of the turbine will amount to 82 per cent.

Schedule 1 shows the comparisons of coal, steam, and heat consumptions for a 20,000-kw. machine running under the conditions mentioned, at 200 lb. and 350 lb. pressure by gauge at varying superheats; also at 500 lb. pressure absolute and 268 deg. F. superheat, at which pressure and superheat the total temperature will be 736.5 deg. F., which is about the maximum temperature at present recommended for the materials now being used in turbine construction.

The cost for coal when generating 175.2 million kw.-hours with a load factor of 100 per cent. will be £64,400 at the higher pressure (superheat 250 deg. F.), and £69,200 at the lower pressure with corresponding superheat. This is a saving of £4,800 per 175.2 million kw.-hours, or 0.007d. per kw.-hour. Unfortunately, a load factor of 100 per cent. is impossible, and the conditions under which power stations are operated must be considered before even an approximate estimate of working costs can be arrived at.

A method of computation which is sufficiently accurate for this purpose is to assume that the ratio of the station output to the total coal consumed is in accordance with Willans's law, *i.e.*, a straight line.

Fig. 1 is plotted from results obtained at the Bradford Corporation's Valley Road power station for a number of days during the year 1917. On this curve the weight of coal used

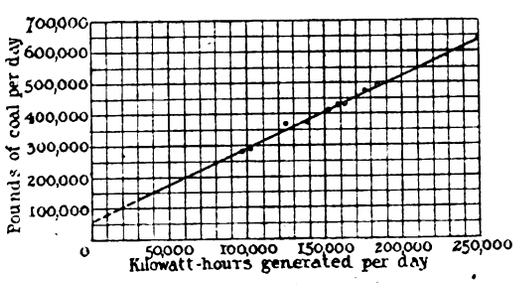

Fig. 1.—Station Conditions:—180 lb. per sq. in. (gauge); 100 deg. F. superheat; 28 in. vacuum; 30 in. barometer.

is shown to be 60,000 lb. per day, plus 2.32 lb. per unit generated. The quantity of coal per day, *i.e.*, 60,000 lb., is the no-load consumption of the works, and will include the no-load consumption of one turbo-generator. In order to make the calculations as simple as possible, it is proposed to deduct the no-load consumption of one machine (5,500 lb. of steam per hour) from the works' no-load consumption, to assume an evaporation of 6 lb. of water per lb. of coal, and to call the figure so obtained the works' standing loss. This = 1,583 lb. of coal per hour.

It is proposed to assume that the standing loss of the station designed for 200 lb. will be the same as for the Valley Road power station, *i.e.*, 1.583 lb. of coal per hour. The same basis is taken for the plant at 350 lb. pressure, with 8 per cent. added to the works' standing loss, representing roughly the higher temperature of the steam at the higher pressure. Standing losses must be approximately proportional to the top temperature, as this affects radiation, boiler exit losses, &c.

For a 20,000-kw. set the no-load consumption will be approximately 22,000 lb. of steam, or 3,666 lb. of coal per hour. These figures plotted in conjunction with the steam consumptions shown in Schedule 1 give the total steam consumption at any load as 22,000 lb. + 9.54 lb. of steam per kw.-hour for the plant operating at 200 lb. pressure, and 22,000 lb. + 8.6 lb. of steam per kw.-hour, and 3,729 lb. + 1.45 lb. of coal per kw.-hour for the plant operating at 350 lb. pressure and 250 deg. superheat.

In order to allow for reduced efficiency due to adverse cir-

* *Journal*, I.E.E., 1912, Vol. 48, p. 768.

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cumstances, it will be advisable to add 5 per cent. to the figures obtained for the load consumption, and 5 per cent. to the no-load loss of the turbine, thus making the consumptions and costs as below. (Maximum load of 20,000 KW. and 50 per cent. load factor, 87.6×10^6 units per annum, 250 deg. superheat, 28.5 in. vacuum.)

	200 lb. pressure.	350 lb. pressure.
Works standing loss in tons of coal ...	6,200	6,700
No-load consumption of turbo-generators in tons of coal	15,100	15,314
Load consumption of turbo-generators in tons of coal	65,300	59,867
Total	86,600	81,881
Lb. of coal per unit on station bus-bars ...	2·211	2·094
Total cost at 10s. per ton	£43,300	£40,940
Cost of coal per unit	0·119d.	0·1122d.

SCHEDULE II.

	215 lb. per sq. in. abs.	365 lbs. per sq. in. abs.
Total heat of steam (from 32° F.) therms per lb....	1,345·5	1,363
Heat drop per lb. of steam, therms ...	401·3	441·6
Ratio efficiency of turbo-alternator ...	79 %	78·9 %
Steam consumption per KW.-hour, lb. ...	10·75	9·85
Heat rejected to condenser, therms per lb....	1,011·5	996
Ratio of circulating water to steam ...	63·5	62
Total power required for auxiliaries, KW.	730	700
Lb. of steam per KW.-hour on bus-bars...	11·1	10·2
Lb. of coal per KW.-hour on bus-bars ...	1·79	1·675
Cost of coal at 10s. per ton per 175·2 × 10^6 KW.-hours	£70,000	£65,200

Circulating water at 80 deg. F. discharged from condenser at 96 deg. F. Efficiency of boiler house, 77.5 per cent. Coal with a net calorific value of 10,000 therms per lb. The head against which the circulating pumps have to work is taken to be 50 ft.

Schedule 2 shows the coal required, and power for auxiliaries, for a cooling-tower station working at 200 lb. per sq. in. (gauge), 250 deg. F. superheat, and 350 lb. per sq. in. (gauge), 250 deg. F. superheat, exhausting against a back pressure of 1 lb. absolute pressure.

The foregoing relates only to the cost of coal; the remaining items which make up the total works' costs are not likely to be affected by the use of higher pressures and temperatures. The capital cost of the plant may be affected to a considerable extent, but unfortunately the increased cost cannot be given at a time like the present. Whereas before the commencement of the war a 5,000-KW. turbine, alternator, and condenser could be purchased for £2.9 per KW., a machine of 20,000 KW. capacity now costs £4.1 per KW.

With regard to the practical difficulties, before pressures of 500 lb. or 600 lb. per sq. in. are adopted, a radical departure will have to be made from present boiler construction. All square boxes and headers will be eliminated, the drums and tubes will be smaller in diameter, and the design of the boiler will be more elastic. The boiler will no doubt assume the the appearance of a flash boiler, with practically no steam or water reserves, and fired by gas on the surface-combustion principle.

For more moderate pressures, up to 350 lb. per sq. in., the existing type of boiler can be modified and successfully used. At Carville power station Babcock & Wilcox marine-type boilers are being used, at 275 lb. per sq. in. gauge pressure, and at the British Thomson-Houston Co.'s works at Rugby a Babcock & Wilcox boiler is installed and successfully working at 350 lb. per sq. in. Further, Messrs. Babcock & Wilcox have two boilers on order for a working pressure of 475 lb. per sq. in. with steam superheated to a final temperature of 700 deg. F., and are quite prepared to supply boilers in their ordinary business for such pressure and superheat.

With higher steam pressures the temperature of saturation is raised, and greater care must be exercised in the quality of the water used for the boiler feed. A feed water that is perfectly satisfactory at 380 deg. F. in a modern tubular boiler might be quite unsuitable for use in a flash boiler. The quantity of air, CO_2, and oxygen will have to be kept down to a minimum, and also the insoluble salts in the water discharged from an ordinary lime-soda water softener. A natural development, and one which is already taking place, is to heat the feed water under atmospheric pressure by means of live or exhaust steam in order to drive off the entrapped and dissolved gases as much as possible. It is necessary to raise the temperature of the water to 100 deg. C. before the quantity of air in the water is appreciably reduced.

The source of water for use in high-pressure plants will have to be carefully traced, and the treatment of the water should be such that a minimum of insoluble salts remains in it after treatment. The purer the water the greater affinity it has for air, CO_2, and oxygen, and every care should be taken that it is not exposed to the air between the condenser and the boiler. In order to avoid such exposure to the air, the feed pump should be an extension of the condensate pump, and the condensed water pumped direct into the feed line.

The natural development of the turbine for higher pressures appears to be in line with the Parsons two-cylinder machine, with a flexible claw-type coupling between the cylinders and a thrust bearing for each cylinder. For very large sets, above 50,000 KW., the cross-compound turbo-generator will no doubt be used, the high-pressure turbine being attached to one generator, and the low-pressure turbine to another. Each set can then be run at its most suitable speed, with resulting high efficiency. This arrangement will no doubt lead to reheating the steam after it leaves the high-pressure turbine and before it enters the low-pressure machine.

With steam initially at the same temperature, but at different pressures, the plant using the high-pressure steam will reject less heat units to the condenser per lb. of steam used in the turbine.

The steam pipes to be used in a station where both high pressures and high temperatures are employed will have to be very carefully designed. The question of expansion at higher temperatures will be of the utmost importance. For example, take the case of a steam pipe 100 ft. in length, and assume that the pipe had been erected at 60 deg. F. It will be found that at a temperature of 388 deg. F., equal to steam at 200 lb. gauge saturated, the expansion is 2.59 in., while at 786.6 deg. F., equal to steam at 600 lb. pressure and 300 deg. F. superheat, the expansion is 5.75 in.

The expansion given can be readily taken care of if the designer can ensure that the expansion will always take place lengthwise in the pipe range. Unfortunately, taking a boiler off a range will cause a considerable cross-strain to the main header, due to the connecting pipes cooling down and contracting.

It appears that the main steam connections of the boiler will have to be designed in a flexible manner, in order to relieve the main range of stress. Further, these connections should be of the manifold or header type, *i.e.*, made up of many small pipe connections.

The specific volumes in cubic feet per lb. of steam at approximately 800 deg. F. and at pressures of 200 lb., 350 lb., and 600 lb. by gauge, are 3.47, 2.10, and 1.25 cu. ft. per lb. Unfortunately the relative areas of steam pipes cannot be reduced proportionately to the specific volumes, as the friction of the denser steam would cause undue pressure drop. Proportioned according to the density of the steam, a pipe to supply a 20,000-KW. set could have a diameter of 12 in. at 200 lb. gauge and 800 deg. F. total temperature, and a diameter of 7.25 in. at 350 lb. pressure and 800 deg. F. superheat, with a velocity of approximately 150 ft. per second. In actual practice the diameters would approximate to 14 in. and 10 in. for 200 lb. and 350 lb. respectively.

There is no doubt that a large portion, in fact the major part, of the pressure drop in steam pipes as at present erected is due to the method of arranging ring mains and duplicate paths for the steam when certain parts of the main are down for joint making, and the provision of a duplicate path often so spoils the design that joints cannot be kept tight.

SCHEDULE III.—SHOWING COAL CONSUMPTION, COST OF COAL, AND THE AMOUNT OF CAPITAL THAT CAN BE EXPENDED TO ABSORB THE ESTIMATED SAVING PER 87·6 MILLION KW.-HOURS.

Steam pressure	215 lb. per sq. in. (abs.)		365 lb. per sq. in. (abs.)		500 lb. per sq. in. (abs.)
Superheat	150° F.	300° F.	150° F.	300° F.	268° F.
1. Coal consumption (lb.) per effective KW.-hr. at 100 % load factor and no station losses	1·85	1·74	1·7	1·62	1·56
2. Coal consumption (lb.) per KW.-hr. delivered to bus-bars at 50 % load factor ...	2·28	2·18	2·15	2·06	2·0
3. Annual cost (£) of coal at 10s. per ton per 87·6 million KW.-hrs. at 50 % load factor	44,575	42,500	41,900	40,350	39,075
4. Estimated saving (£) per 87·6 million KW. hrs., taking 215 lb. (abs.), 100° F. superheat as datum ...	735	2,810	3,410	4,960	6,235
5. £ capital that can be expended for annual payments to absorb amount shown in line 4. Life of plant 15 years, and compound interest at the rate of 5 %	7,650	29,300	35,500	51,600	65,000

If the piping is designed on the unit principle, *i.e.*, a number of boilers practically isolated on to one generating unit, a small equalising main only need be provided at the end of the boiler house. Ample arrangements can be made for expansion with such an arrangement, and drainage is required at two points only in each section, at the turbine steam-separator and in the equalising main. It could be arranged that steam would never enter or leave a pipe at right angles, and each branch would enter the main pipe at an angle of approximately 45 deg.

From inquiries it is apparent that the boiler mounting and valve makers are quite alive to the possibilities of high pressure and high-temperature steam coming into commercial use.

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It is not so much a question of pressure in the designing of a good valve or fitting as of the temperature to which it can be subjected. Metals which are used in the manufacture of this class of material show a decrease in elastic limit when temperatures higher than 750 deg. F. are reached.

The makers of economisers are prepared to manufacture for 350-lb. boiler pressure or higher, either of their standard design, with the details modified, or of a design suitable for use as an integral part of the boiler, if necessary with horizontal and mild steel tubes.

It must be admitted that in order to attain a higher overall efficiency it is necessary to increase both the pressure and the temperature of the steam. An increase of pressure with a constant temperature would mean that the dew point was carried further up the turbine towards the high-pressure end, thus tending to accelerate blade erosion in the lower stages and a reduced stage efficiency of the turbine. Also the high-pressure blading of a turbine is considerably less efficient than the low-pressure stages, and although the losses in the high-pressure end are partly recovered in the low-pressure blades, it is apparent that to assume that a turbine for extra high pressures can be built with the same efficiency as one for a lower pressure (within limits) is taking a hopeful view, and that there is justification for hesitation before adopting extra high pressures on the part of managers responsible for the financial results of large undertakings.

The coal consumption of a station is roughly proportional to the ideal cases worked out in Schedule I; and taking a boiler pressure of 200 lb. per sq. in. by gauge as being representative practice for many power stations of moderate size, the results can be summarised as shown in Schedule 3.

The author expresses indebtedness to Mr. T. Roles, chief of the Bradford Corporation electricity department, for permission to use information gathered from the department's files, and to Mr. Abraham for his assistance in preparing the schedules.

NEW ELECTRIC PASSENGER LOCOMOTIVES.

(*Concluded from page* 46.)

A new type of electric locomotive, presenting rather unusual features, which has been placed in service on the St. Moritz-Tirano line of the Bernina Railroad in Switzerland, is described in the *Electric Railway Journal* of April 27th.

The demands made of the manufacturers, Brown, Boveri and Co., Baden, were exceptionally severe. The purchaser called for a locomotive capable of starting a 110-ton train on the most severe grades of this line, and of maintaining a speed of 11.2 M.P.H. on these grades. Moreover, the weight per axle was limited to 8.6 tons (17,200 lb.). The length of the line is 23 miles, 16¾ miles having an average grade of 7 per cent., as well as numerous curves with a minimum radius of 131 ft. Power is drawn from an overhead contact line at 750 volts, direct current. The motors on this locomotive are designed for use as generators on the down-grade trips, energising the electric track brakes and providing rheostatic braking for the locomotives. The locomotives and cars are also fitted with Hardy vacuum brakes.

It was first attempted to use two motors of 310 H.P. each for this service, but this was found undesirable, as in winter it is necessary to use this locomotive as a snow plough, and to operate it at very low speed. The original plan was therefore changed, and four motors of 155 H.P. each were substituted to provide the desired low speed with all motors in series. The maximum speed of the train on level track is 31 M.P.H.

The details of construction are shown in fig. 8. The central portion carries the track brakes, and is so arranged that it is always pulled by the leading motor truck, but is never pushed by the following truck. It carries eight magnets capable of exerting a total vertical force of 45,760 lb. This system of braking the heavy locomotive on this road has proved very satisfactory, and despite the exceptionally trying conditions during the past winter not a single accident has occurred. The motors are mounted in pairs on each truck; each motor is geared to an intermediate shaft through gears with spring-mounted rims to absorb the shocks at starting. The power is transmitted to the driving wheels by means of connecting rods. The locomotive, completely equipped with snow plough and all necessary equipment and tools, weighs 46.86 tons, of which 28.16 tons is the weight of the mechanical parts, and 18.7 tons that of the electrical equipment. In the middle of the locomotive, between the two equipment sections, is a freight compartment of 3.3 tons capacity, giving a maximum weight for traction of 50.16 tons.

In power per ton of weight this new locomotive is said to be the most remarkable of any of the narrow-gauge type built so far. Its output on an hourly rating basis is 17 H.P. per ton of weight. The gauge is 39.37 in. (1 metre).

Further details of this locomotive are given in the issue of *Schweizerische Bauzeitung* for February 23rd, 1918.

In the *Tramway and Railway World* of May 16th a description by E. LESNIEWSKI is given of the electrified Savona-Ceva mountain section of the Italian State Railway. The railway, which may be regarded as a standard of the Italian electric railways, is noteworthy owing to the technical perfection of its equipment, to which particular attention has been given, as well as to the solidity of construction, owing to its economic and strategic importance. The equipment presents many novel and interesting features, new methods of train conduction, only possible under the system of traction here adopted, having been utilised with great success.

The whole of the electrified section, having a length of some 45 kilometres, has a single track, and comprises numerous tunnels, and curves to the extent of about 60 per cent. of its total length. The least curve radius is 400 metres, and the maximum gradient 2.5 per cent. The track traverses several mountain ranges, attaining an elevation of 1,600 ft. above sea level. Between Savona and Ferrania is a very difficult section, where in a distance of 10 miles the altitude of the track shows a variation of over 1,000 ft. The tunnel in which this section terminates, 1½ miles in length and located on a curve, hindered the traffic considerably when it was under steam traction.

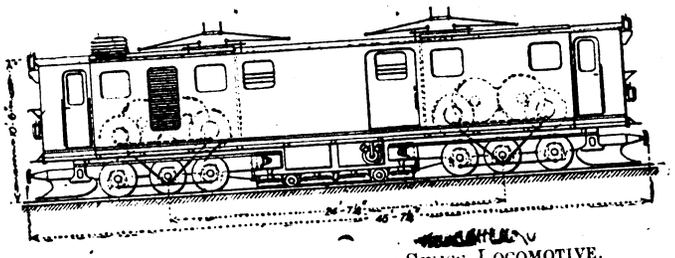

FIG. 8.—GENERAL ARRANGEMENT OF SWISS LOCOMOTIVE.

The necessity of coping with ever-increasing goods traffic, coupled with the desire to accelerate the speed, led to the electrification of the section. This was completed in the spring of 1914, since which time the whole of the goods and passenger traffic has been successfully dealt with by electric traction. The three-phase system was selected for this line, with a voltage of 3,700 on the trolley line, and a frequency of 16.7 periods per second. The capacity of the line was considerably augmented after electrification, while the tunnel referred to above ceased acting as a "bottle neck," and even without forced ventilation there was no essential difference between the traffic conditions in the tunnels and on the open parts of the line. The all-round speed compared with that of the former steam traction has been accelerated to about double, the speed maintained on the steepest up-grade being 31 miles per hour, whereas specially powerful mountain steam locomotives of the "decapod" type were unable to exceed a speed of 15 miles per hour. A further acceleration of speed for express trains is projected, for which purpose high-speed Westinghouse locomotives (type 1—3—1), rated at 2,600 H.P., are being built, capable of hauling trains on up and down grades (2.5 per cent.) at a speed of 47 miles per hour.

The three-phase locomotive used on the Savona-Ceva line combines great mechanical and electrical strength, and a capacity to stand heavy overloads. The locomotive has an amply high centre of gravity, and in consequence of the method of motor suspension, the deadweight on the axles—*i.e.*, the weight not carried by springs—is reduced to a minimum, consisting only of the weight of the axle and part of the weight of the driving rods. The locomotive's weight per one H.P. (ratio weight to H.P.) of its rating is less than in other types of locomotives, as it develops about 36 H.P. per metric ton of its weight, and consequently its power per ton of its weight is 2-3 times as much as the majority of single-phase or high-tension D.C. locomotives.

The total weight of the locomotive is 60 metric tons, evenly distributed over the five axles. The principal dimensions and weight of the locomotive are:—

Weight	**60 metric tons.**
One-hour rating	**2,200 H.P.**
Tractive effort corresponding to one-hour rating	**12 metric tons (26,000 lb.)**
Speed at this tractive effort ...	**31 miles per hour.**
Length over buffers	**9,520 mm. (31 ft. 6 in.)**
Total wheel base	**6,120 mm.; (20 ft. 6 in.)**

The two motors of the locomotive drive the wheel through a so-called "Scotch yoke" system of gearless drive. The motors are fed directly from contact trolley line with a three-phase current at 3,700 volts. Two phases of current are supplied by two-phase contact line, the third by the rails. The locomotive has two operating speeds, 31 and 15.5 miles per hour. The higher speed is obtained with both motors connected to the line with short-circuited winding of the rotor. The lower speed is obtained by putting the motors in cascade; the stator winding of one of the motors is then connected direct to the line, and that of the second is fed from the rotor winding of the first motor.

The use of regeneration on this line has considerably reduced the energy consumption; but of not less importance is the greater degree of safety assured and the smoothness of running on the down grade, as well as the reduction in wear of the track, rolling stock, tires, and of the braking system.

The Swiss Federal Railways have recently ordered a number

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of electric locomotives for use on their St. Gothard line. The principal features of the new locomotives are described in the issue of *Le Génie Civil* for June 15th, and the particulars that follow are taken from that journal:—

The electrical part of the light-type locomotive for express train service is being constructed by the Oerlikon Co., and the mechanical part by the Swiss Locomotive Manufacturing Co., of Winterthur. The overall length of this locomotive is 13.5 metres, and it has three coupled live axles. The two motors are of the single-phase type with series compensated commutators, having 12 poles and displaced auxiliary field, developing 825 H.P. each. They are coupled together, fixed to the frame at the centre of the locomotive, and transmit their power through a symmetrical gear system, ratio 1 : 2.84, to the two intermediate axles, which drive the central live axle by a triangular system of levers and links, and the other live axles by a common coupling rod.

Reversers (with electro-pneumatic drive) and braking gear are placed above the motors. At each side of the motors are placed the transformers, and above these the speed-stage controllers, principal switches, compressors, &c. The normal driving force is 8,900 kg., the maximum tractive force 13,500 kg., and the maximum peripheral power 1,650 kg. The normal speed is 50 kilometres per hour, while a maximum speed of 75 km. per hour can be developed. Total weight, including brake gear, 90 tons (metric).

The heavy-type express locomotive constructed by the firm before-mentioned is of the bogie type; total weight, 106 tons; wheel-base, 16.2 metres. It has two six-pole motors each developing a peripheral horse-power of 560. The arrangement of the motors, &c., is similar to the preceding type. The locomotive body rests on the trucks, and contains at its centre the oil transformer with speed-stage controllers and fan. The converter and compressor groups are fitted at the two ends of the body, and have protecting bonnets.

The construction has been simplified by the use of a single transformer, but the weight of the frame is very great. Normal tractive force, 18,000 kg.; normal peripheral efficiency, 2,250 H.P. for a normal speed of 50 km. per hour, and a maximum speed of 75 km.

Both the above types have 23 speed-control stages, and are also fitted with the multiple-unit system of drive, which allows of the coupling up of a number of locomotives on a gradient which are under the control of one driver.

In the new Oerlikon locomotives the two bogies are direct coupled to each other. The outside two-thirds of the truck contain the motors and control apparatus, which are covered by low bonnets. The body proper is only one-third of the total length of the locomotive. The two controllers, each of the 12-contact type, are mounted close to the transformers. At the two ends of the body are the driving cabs mounted with their pantographs on top. The main switch and transformer covers form part of the body roof, thus reducing to a minimum the number of H.T. conductor inlets, and dispensing with a special H.T. cab inside the motor group. The pivots are easily accessible, and the few flexible cables in their vicinity which lead to the motors can easily be led to the trucks. The driver is very near to the main switch, so as to be able to operate it mechanically if it is desired for any reason to dispense with the multiple drive.

The normal power of the four motors is 2,100 H.P. (peripheral). Weight of electrical part, 58 tons, and of the mechanical part 71 tons. Total length, 19.2 metres.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

10,789. "Limit switches for opening electrical power circuits." H. MORRIS, LTD., G. A. ROBERTSON & G. SMITH. July 2nd.

10,791. "Electrical generators and electric motors." J. SHEPHERD. July 2nd.

10,795. "Electro-magnetic separators." A. DAVIES. July 2nd.

10,799. "Liquid electrical resistances." G. DEARLE. July 2nd.

10,806. "Flywheel magneto devices for internal-combustion engines." F. H. FARRER & G. FUNCK. July 2nd.

10,809. "Spark plugs." W. S. THOMAS. July 2nd. (U.S.A., June 29th, 1917.)

10,816. "Use of audion lamp relay or amplifying apparatus in telephony." M. LATOUR. July 2nd. (France, June 22nd, 1917.)

10,839. "Telephones." SIEMENS & HALSKE AKT. GES. July 2nd. (Germany, July 1st, 1917.)

10,857. "Control of electrically-propelled trucks, &c." P. A. H. MOSSAY AND MOSSAY & CO. July 2nd.

10,858. "Electrically-propelled trucks." P. A. H. MOSSAY & MOSSAY AND CO. July 2nd.

10,859. "Electrically-propelled vehicles." P. A. H. MOSSAY & MOSSAY AND CO. July 2nd.

10,864. "Regulating device for dynamo-electric machines." R. BOSCH AKT. GES. (R. & O. Imray). July 2nd.

10,877. "Electric batteries." S. L. PRICE. July 2nd.

10,925. "Electric ignition apparatus." F. L. HOLLISTER. July 3rd.

10,933. "Automatic switches." WESTERN ELECTRIC CO. (Western Electric Co., U.S.A.) July 3rd.

10,945. "Electric switchgear apparatus." E. S. CONRADI. July 3rd.

10,962. "Electric cranes and hoisting appliances." H. SIMON, LTD., & H. WILLIAMS. July 4th.

10,997. "Treatment of metals and refractory materials, and of tools or crucibles made thereof, and in electric furnaces used therefor." G. MARSH. July 4th.

11,013. "Automatic regulator for dynamo-electric machines." R. BOSCH AKT. GES. & O. IMRAY. July 4th.

11,042. "Electrical instruments and appliances for transmission and reproduction of sound." D. F. MCQUIRE & F. W. MCQUIRE. July 5th.

11,043. "Electrical fuses." R. A. R. BOLTON. July 5th.

11,045. "Automatic telephone exchange systems." WESTERN ELECTRIC CO. (Western Electric Co., U.S.A.) July 5th.

11,048. "Undulating and controlling electric currents passed through the body for medical purposes." E. E. GREVILLE. July 5th.

11,067. "Electric apparatus for lengthening and extinguishing gas burners." P. HAYES. July 5th.

11,084. "Spark plugs." R. CHAMPLIN, R. J. COOK & H. A. TODD. July 5th.

11,110. "Electric conductor connections, and rendering same impervious to fluids." R. B. MOON. July 6th.

11,113. "Electrical apparatus." R. B. MOON. July 6th.

11,125. "Electrical torpedo nets." A. HEDINA. July 6th. (U.S.A., March 6th.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

936. PROCESS FOR THE PRODUCTION OF COPPER TUBES. S. O. Coles. March 6th, 1918. (116,509.)

1,609. LIQUID RESISTANCES, PARTICULARLY FOR USE IN THE ROTOR CIRCUITS OF INDUCTION MOTORS WHEN USED FOR SHIP PROPULSION AND THE LIKE. Brush Electrical Engineering Co. & C. C. Sutton. August 1st, 1917. (116,510.)

4,923. METHOD OF AND APPARATUS FOR USE IN ELECTRIC WELDING, BRAZING, AND LIKE OPERATIONS. F. B. Dehn (Electrical Railway Improvement Co., U.S.A.). April 5th, 1917. (116,513.)

6,525. ELECTRICAL CONNECTIONS FOR CABLES, WIRES, SWITCHES, LAMPHOLDERS, PLUGS, CONNECTORS, AND THE LIKE. R. Reynolds. May 8th, 1917. (116,515.)

7,953. ELECTRICAL MEASURING INSTRUMENTS. G. A. Cheetham. June 2nd, 1917. (116,524.)

8,232. RADIOTELEGRAPHY AND RADIOTELEPHONY. J. Bethenod. May 26th, 1916. (107,581.)

8,343. ELECTRIC INSULATING MATERIAL. A. R. Muller. June 11th, 1917. (116,532.)

8,933. DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. & A. A. Pollock. June 21st, 1917. (116,556.)

8,945. ROTARY TRANSFORMERS OR CONVERTERS. J. G. Shaw, C. R. Shaw and H. G. Sharp. June 21st, 1917. (116,557.)

9,350. DYNAMO-ELECTRIC MACHINES. J. W. Burleigh. June 29th, 1917. (116,571.)

9,501. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES AND THE METHOD OF MANUFACTURE. R. Howarth. July 3rd, 1917. (116,573.)

9,675. DYNAMO-ELECTRIC MACHINES. Vickers, Ltd., & H. F. Brown. July 4th, 1917. (116,577.)

10,794. METHOD OF MAGNETISING CORES AND APPARATUS THEREFOR. Automatic Telephone Manufacturing Co. & P. N. Roseby. July 27th, 1917. (116,587.)

11,249. MAKE-AND-BREAK DEVICES. F. B. Dehn (Pittsfield Spark Coil Co., U.S.A.). August 3rd, 1917. (116,600.)

13,369. SPARKING PLUGS FOR INTERNAL-COMBUSTION OR EXPLOSION MOTORS. G. A. Pariani. September 18th, 1917. (116,623.)

14,175. TREADLES FOR ELECTRIC SWITCHES USED IN RAILWAY SIGNALLING. S. T. Dutton & T. A. White. October 1st, 1917. (116,629.)

17,277. ROTARY RECTIFIER OF ALTERNATING CURRENT. A. D. Macropoulos (C. D. Macropoulos). November 23rd, 1917. (116,646.)

18,042. ELECTRIC INTERRUPTERS. Soc. d'Electricité Nilmelior. January 19th, 1917. (112,931.)

19,065. MANUFACTURE OF CARBON ELECTRODES. C. H. Thompson. December 24th, 1917. (116,661.)

Notes from Spain.—Our Special Correspondent in Spain sends the following:—

Railway Electrification.—After a three days' debate the Spanish Parliament has passed the Bill for the electrification of some 70 km. on the railway of the Compania del Norte, at a point near Puerto Pajares, where the Cantabrian mountains are crossed. The debate brought out some interesting facts, though a good deal of the discussion centred round the advantages and disadvantages of railway nationalisation.

The object of electrification at Puerto Pajares is to assist in the distribution of Asturian coal throughout Spain, and the promoters of the Bill declare that by electrifying the mountainous portion of the line it would be possible to transport 12,000 tons of coal daily past that point. The project will cost 40,000,000 pesetas (£1,600,000 at the pre-war rate of exchange), and some of the speakers advocated a delay until the end of the war, on account of the present high cost of electrical material. Another reason for delay was that after the war foreign coal would be available once more. The supporters of the Bill argued that Spain must develop her own resources, even though she must buy electrical plant from Switzerland to do so, and they showed that the present backwardness in the means of transport was a fatal hindrance to national progress.

It is interesting to note that in this instance hydro-electric energy will be used to develop the transport of coal.

Prof. Sánchez Cuervo has been appointed representative of the Government during the electrification. The Compania del Norte has not yet appointed its engineer.

Projected Hydro-electric Plant.—The civil authorities at Soria have been asked to concede the use of several waterfalls on the River Duero and its tributaries situated in the district of Duruelo. Senor C. Aynso has applied for the use of 1,000 litres of water per second in normal times, reduced to 200 litres in times of low water, at a useful head of 358 metres, the resultant energy being destined to supply electric light in Duruelo and power for a proposed light railway. A canal 1,500 metres long has to be constructed. This does not present any great difficulty, and the fact that all the work will take place on State land is expected to result in a smaller capital outlay.

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THE

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COMMUNICATION THROUGHOUT THE EMPIRE.

SOME years ago in these columns we urged with considerable persistency the importance of providing ample and cheap cable communication facilities between the Mother Country and all parts of the British Empire. Expressing our views thus in support of the appeals which were made by far-seeing Colonial statesmen, we desired to bring about the laying of additional cables completely under Empire control, so that rates might be settled according to the interests of all, and not prejudiced by the dividend-earning requirements of private companies, however great the debt humanity owed them for the pioneering service they had rendered over a lengthy period.

Since those days the facilities have been greatly increased by the laying of additional cables, by technical advance which has increased carrying capacity, and by the introduction and development of wireless telegraphy, while rates have been reduced again and again, with specially favourable terms for Press messages, week-end messages, &c. The lowering of rates was not found to reduce dividends, for in the wake of reductions came increased traffic; and while shareholders' interests did not suffer, the benefit to the Empire as a whole was unquestionable. How could it be otherwise? What is more essential to the binding together of the great family than full and prompt interchange of thought and news between its scattered members? what more important to the maintenance and development of commercial relations?

If such considerations as these seemed of paramount importance ten or twenty years ago, what of to-day? Our arguments of other days are strengthened immeasurably by what has been occurring during the past four years. The service rendered by the cables and by wireless has been of surpassing value—nobody will begrudge them the credit and honour that are their due. Some day, perhaps, when lips can be unsealed, we may be told the full story of how the great ocean cable systems and wireless services have stood the shock and strain of world war. If little is said to-day of the efforts and enterprises of those who control, operate, lay, and repair submarine cables, it is not because their achievements are unrecognised. But beyond all that they have done there lies the necessity for an ever-increasing efficiency and a more ample provision of facilities in the coming years. Whether we gain that goal by means of cables or by wireless or by both, the needs of the Empire will demand, unless we are greatly mistaken, a very large State policy.

The deliberations of the Canadian editors in London, under the auspices of the Empire Press Union, have brought the question of world communication to the front at the right moment, for, in our opinion, it must inevitably, and most appropriately, occupy a prominent place in our reconstruction measures. The relations between the Motherland and the Colonies and Dependencies are to-day warmer than at any previous stage of our history. We cannot suppose that what has been happening will lessen the need for facilities for speedy and cheap communication between us; on the contrary, we believe that there will be such a flow of messages—domestic, commercial and Press—in the coming years as we have never yet experienced.

The Empire Press Union since its formation in 1909 has sought to secure better facilities for the dissemination of news, and to this end it has advocated the further reduction of cable tolls, the extension of cables and wireless, better, quicker, and cheaper means of communication o

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every kind. The Union's vision naturally goes farther than present actual achievement appears to place within easy reach. Mr. Robert Donald, in addressing the Canadian editors, did well, however, to let our guests know that we were in an ambitious frame of mind, wanting "to see and work for more cables, supplemented by wireless, a service of fast oil-driven ships, and an aerial express service of mails and passengers, which would bring Canada within twenty-four hours' journey of London." Our confrères with minds broadened by the wide sweep of the prairies of Canada appreciate that we here have no narrow conceptions of the possibilities of the next decade or two in lessening the great distances of the earth. There is everything to be gained by bringing the whole Empire family closer and closer together by means of cable and wireless communication, as was so excellently set forth in the Blue Book of the Dominions Commission. The Imperial War Conference has not lost sight of the question, and we trust that a policy will be adopted such as will ensure the establishment of an abundant mutual interchange of news for publication throughout the whole Empire, so that the present closeness of communion and intimacy may be continued for the common good after the war has been won. The War Conference last week passed a resolution, on the motion of Sir Joseph Ward (New Zealand), emphasising the need of "further material reduction of telegraphic rates."

Those who have had direct relations with the Colonies during the war when mails have, by force of circumstances, been irregular, and when cabling conditions due to code restrictions, cost, and other difficulties, have been a handicap standing in the way of transmission of information of service in the commercial defeat of the enemy, have reason to sympathise with the appeal which our Colonial brethren make for the Empire Press Union to use its influence "to secure better, quicker, and cheaper facilities for the dissemination of news throughout the Empire *from British sources*." The Union is also asked to ensure that "such co-operation as Governments may give shall be limited to assisting *in the provision of facilities*." What this means is that self-respecting British editors the world over desire to give a full service of useful and interesting news, that it shall be untainted and uncontrolled as to its character, transmission, and source, and that the Government will facilitate their efforts to that end by seeing that either the State or private enterprise, or both working together, shall provide sufficient British-owned cables or other means of transmission. Such a proposition inevitably raises questions concerning ownership and subsidies, and suggests the view that if low rates, even involving an actual loss on working, can promote the fullest possible circulation of intelligence, the Empire as a whole will find the direct and indirect results in development and solidarity, in common purpose, comradeship, and commercial prosperity, so great as to justify considerable capital outlay and substantial annual contributions.

In laying our plans for future reconstruction within these islands we are anticipating huge expenditures, but many of our ideas can only be carried into execution successfully if we consider them in conjunction with our schemes for the good of the whole Empire and for the utilisation of its vast resources for the benefit of all. Can we, then, in trying to contemplate and prepare for the whole situation afford to neglect the appeal for far-seeing enterprise in this particular matter? As the Hon. N. W. Rowell (Canadian Privy Council) said at last week's function in London, the Empire is held together by public opinion, and the Press has a great place to fill in preserving unity. What stronger justification than this could we require for ample Press cabling facilities and nominal Press rates everywhere?

During the war we have felt the lack of the proposed Imperial wireless chain. Sooner or later this matter must come to the front again in the form of practical proposals of some kind: the sooner the better! Electrical men who have made a lifetime study of the problems of submarine telegraphy, experts who have achieved such magnificent results in the wireless department, and manufacturers and contractors who have the staffs and equipments required for bringing schemes to maturity and fruition, will be eager to place their skill, experience, and facilities at the disposal of the State whenever the time is ripe for measures to be prepared for ensuring that, whatever the prospective needs of the larger life of the Empire may be in this connection, they shall be met.

Women in Central Stations.

Referring to the Home Office circular published in our "Notes" last week, a correspondent somewhat fiercely attacks its authors, and expresses indignation at their proposals. We cannot but feel that his remarks are based upon a too-hasty reading of the circular, which, to our mind, will not bear the construction which he places upon it. We do not think the Home Office intends to create difficulties on the score of the employment of women at night without express authority; in view of the urgent requests of the Government that women should be substituted for men wherever it was possible, such a course would be too inconsistent even for a Government department. In our issue of February 23rd, 1917, the positions in which the substitution of women was recommended were clearly defined by the memorandum issued by the Reserved Occupations Committee; they included *junior* sub-station attendants, assistant meter testers, cleaners, labourers, and meter readers. At the same time, the employment of disabled soldiers and sailors was advocated by the Committee. In a later communication the chairman expressly stated that the Committee had no intention to interfere with skilled men.

In the new circular, it is pointed out that the employment of women at night must cease with the end of the war, and, therefore, vacancies should preferably be filled by discharged men, "carefully selected and suitably trained." The necessity of adequate training before such men may be allowed to undertake dangerous work is emphasised.

Our correspondent, however, declaims against the employment of *untrained* men, a question which does not arise, at the same time stating that he has made many applications for discharged men! He misquotes the circular as saying that they are "specially suitable to such work," whereas the true statement was that the work was specially suitable *for them*, an entirely different thing. He also refers to work for which at one time technical education and three years' training was considered essential, conditions which everyone knows do not apply to the posts explicitly defined in the memorandum above mentioned. If he has not secured the necessary permission to employ women at night, that is his own fault, for the memorandum stated that permits would be granted on application; moreover, as he has made *bonâ-fide* attempts to obtain disabled men for this work, without success, it is still expressly left open for him in the present circular to obtain such permits. We feel sure that, on reconsideration of the circular, he will see that he has no valid ground for complaint.

As for the general question of employing disabled men wherever possible, this cannot but commend itself to every patriotic manager. These men have made sacrifices of which they will bear the burden to the end of their lives. We cannot do too much for them—nay, we can never do enough for them, for such losses are irreparable. Let us all, therefore, do everything in our power to enable them to carry on in civil life with comfort and contentment, regarding any inconvenience that we may personally suffer as a small part of our war service.

In his report for the year 1917, Mr. G. Scott Ram refers to the employment of women in electricity works in such posts as those mentioned above, and states that in some cases women are in sole charge of sub-stations containing running machinery. Mr. Ram, however, naturally regards the work as more suitable for disabled sailors and soldiers as a permanent occupation. We may point out that the very fact that women can successfully undertake such routine duties, so remote from their normal occupations, clearly proves (1) that the work is within the scope of discharged men whose injuries are not such as to incapacitate them in any essential respect, and (2) that the kinds of work in question obviously do not call for technical education and several years' training.

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THE EDUCATION AND TRAINING OF ENGINEERING APPRENTICES.

By P. H. S. KEMPTON, A.R.C.Sc., B.Sc.

(*Continued from page* 51.)

In Great Britain.

In this country the systems of apprentice training which already exist or are in active contemplation may be considered under two heads. First, those in which the training is conducted in a works school at the expense and under the direct control of the company concerned. Secondly, those in which the apprentices are advised or compelled to attend evening continuation schools as a condition of apprenticeship, coupled in some cases with limited opportunities for the best students to win day-tuition at the expense of the company, but at an outside technical institute.

The only scheme which may be regarded as well past the experimental stage is the Admiralty scheme already referred to. This is a works school scheme, the expense and the control being administered by the Admiralty through the Director of Naval Education, and the schools are in every case within the dockyards.

The Westinghouse scheme associated with the name of Mr. A. P. M. Fleming is perhaps the best known and most successful works school owned and administered by a private concern. The British Westinghouse Co. was certainly the first commercial engineering firm to establish a course of vocational education for its apprentices with a school in the works and classes during working hours. At the end of last year the number of apprentices at these works was over 300, and during the past two years the courses have undergone some changes and developments, partly in connection with the improvement of the trade course syllabuses, partly with a view to broadening the basis of the education given. In his evidence before the Departmental Committee on Juvenile Education, and also still more recently in connection with the formation of the engineering training organisation, Mr. Fleming, who is the moving spirit in the Westinghouse school, has expressed himself strongly against the narrowing of the curriculum to merely vocational ends: "Vocational education cannot be separated from general education." At present the courses are as follows:—

Class I.	*Classes II. and III.*
Arithmetic.	Mathematics.
Drawing.	Drawing.
Elementary Science.	Mechanics.
General Course.	General Course.
Class IV. (Mechanical Engineering Apprentices).	*Class IV.* (Electrical Engineering Apprentices).
Workshop Materials.	Electrical Machines.
Workshop Practice.	Workshop Materials.
Class V.	*Class VI.*
Trade Subjects.	Draughtsmanship.

Only boys of special capacity are permitted to proceed to Class VI, and it is from among these chosen apprentices that promotions to the drawing offices are made.

The classes meet four or five hours weekly in works hours, and about 60 per cent. of the apprentices also voluntarily attend evening classes. The social side of apprentice life is fostered, and all social activities are arranged by the Apprentices' Association. These include a magazine, dramatic, cycling and rambling clubs, and organised sports. Apprentices are also encouraged to compete for 20-day course studentships at the Manchester School of Technology.

Among the courses of apprentice training involving attendance at outside technical schools some of the most successful have been instituted in connection with our great railways. In 1908 the Great Western Railway Co. inaugurated an apprentice training scheme in connection with its works at Swindon.

As a preliminary course all apprentices are expected to attend evening classes at the technical institute for instruction in elementary mathematics, mechanics, science, and drawing; at the end of each evening course, examinations are held, and, on the result of these examinations a number of free studentships are awarded. These free studentships are limited to 30 at any one time, generally in groups as follows. For a three years' course:—

First year course	...	...	15 students.
Second year course	...	...	9 students.
Third year course	...	...	6 students.

For each year's course there is a competitive examination, successful students passing from one year's course to the next; the age for entry upon the day studentship course is 17 years.

The course consists of day classes at the technical school on two half-days a week (9 hours) for 26 weeks (September to April). Wages are paid to the successful apprentices as if they were at work in the factory, and the Great Western Railway Co. pays all fees.

The courses each year consist of:—

Practical Mathematics.
Practical Mechanics.
Geometrical and Machine Drawing.
Heat.
Electricity.
Chemistry.

The best students in the final year's course are allowed to spend part of their last year in the drawing offices, test house or chemical laboratories.

Similar systems have been in vogue in connection with the large engineering firms on the N.E. coast and on the Clyde, and the following is a brief summary of a detailed scheme suggested by the Committee appointed to inquire into the question by the N.E. Coast Institute of Engineers and Shipbuilders. The committee consisted of Messrs. H. B. Rowell, M.I.C.E., A. Harrison, M. H. Horsley, G. B. Hunter, M.I.C.E., M. C. James, D. B. Morrison, P. Sharp, B.Sc., Gerald Stoney, B.A., F.R.S., R. J. Walker, C. Williams and E. Smith, together with Principal V. A. Mundella, M.A., B.Sc., and Prof. J. J. Welch, M.Sc., and Prof. R. L. Weighton, M.A., D.Sc.

They recommended that in view of the near reform of our educational system the scheme should be put into operation at the earliest possible moment.

1. The N.E. Coast Institute of Engineers and Shipbuilders to be delegated by the employers in engineering, shipbuilding, &c., to act with the local authorities in the development of apprentice training in technical education.

2. The local junior technical and trade schools to be used as a preliminary training ground for prospective apprentices.

3. An advisory committee of representative employers and employés to be associated with the management of these and other technical schools.

4. On entry to apprenticeship the boys to be selected:—

(*a*) A small percentage to spend half the week at the works and half the week at the local technical college for a two years' course.

(*b*) The remainder to be liberated from the works for at least two half-days a week, and if possible three, for attendance at day continuation classes up to the age of 18, with no deduction in wages.

5. Such subjects as Citizenship and English to be included in the curriculum of both classes (*a* and *b*) above, together with usual technical subjects.

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6. Suitable arrangements to be made for transfer of apprentices (*a* to *b* or *b* to *a*) as necessary.

7. All facilities under this scheme to be forfeited by apprentices showing continued lack of interest or application.

It is interesting to notice that the above scheme is designed to apply to all the engineering and shipbuilding apprentices on the N.E. coast, where, according to a recent statement by the Duke of Northumberland, "over one-half of the kingdom's warship and mercantile tonnage, and over one-third of the kingdom's total output of marine engines" are produced.

Messrs. Armstrong, Whitworth started an apprentices' school in connection with their shipyard three years ago, but here the attendance has been voluntary. Its progress has been such, however, that the number of apprentices attending the classes is now nearly double the number in 1915.

In our Colonies.

Developments in apprentice training have proceeded with great rapidity in our colonies, and while we are not aware of the existence of any works schools, yet the system of co-operation with the local educational authorities has a wide vogue. In Durban, a system similar in many respects to the one described above in connection with the G.W.R. Co. is in operation, while a more elaborate course is run in connection with the Australian Government under which the railway and naval apprentices attend classes at the Melbourne technical school.

The following extract from the regulations of the Commonwealth Railway Commissioners indicates the comprehensive and compulsory nature of the training:—

"Every apprentice shall immediately enrol himself as a student at the (Melbourne) college and shall attend at such college the classes of instruction appertaining to the trade to which he may be apprenticed or such other classes as the Commissioners may direct, at such hours of the day or night as may be prescribed, during the complete course of training which shall extend over a period of three years."

"Every apprentice shall provide the books, drawing instruments, &c., required at the college at his own expense, but the Commissioners will pay the college fees as well as the wages of the apprentice for such portion of the ordinary hours of duty as he may be required to attend at the college."

Exactly similar regulations govern the instruction of naval apprentices including artificers, torpedo artificers, armourers, carpenters, and shipwrights, except that in their case the course extends to four years.

The curricula and time-table are given below:—

For Railway Apprentices.

First year attendance	...	5 hours per week.
Second year attendance	...	5½ hours per week.
Third year attendance	...	8 hours per week.

First year Course.—Elementary science, mathematics, projection, and geometry.

Second year Course.—Mathematics, engineering, drawing, applied mechanics (with alternatives of geometrical drawing for some apprentices and electricity for others).

Third year Course.—Mechanics, steam, electricity, engineering drawing, algebra, and solid geometry (with alternatives of trade instruction and drawing for some apprentices).

(To be continued.)

Arbitration.—Arbitration is proceeding between the Yorkshire Section of the National Amalgamated Union of Enginemen, Firemen, Mechanics, Motormen, and Electrical Workers, the Halifax and District Engineers' and Firemen's Associations, and the National Engineers' Association on the one side, and the Woollen and Worsted Federation of Yorkshire on the other side, in regard to wages and hours of labour.

RECONSTRUCTION IN GERMANY AND AUSTRIA.*

Electric Power Supply.

Proposals for the centralisation and development of Electric Power Supply in Germany have received a great deal of attention, and various schemes have been put forward. Reform of the present system has been urged on four grounds:—

1. Economy in coal and its transport.

2. The possibility of using a State monopoly of electricity and of coal as a source of revenue. (This has been opposed on the ground that the industrial necessity for cheap power would not allow the State to make much profit out of such a monopoly.)

3. The importance of plentiful and cheap power in industrial reconstruction, especially in the development of the electrochemical and electrometallurgical industries.

4. The necessity of exploiting all the water-power resources of the country.

For some time past the general trend of opinion has been in favour of increased State action. As early as July, 1916, Dr. J. Klingenberg, in a speech at the War Conference of the Verband Deutscher Electro-Techniker, urged that the generation of electrical energy should be nationalised, while leaving the distribution and the retailing of power in the hands of existing undertakings. He suggested that the Prussian Government should erect 25 to 30 large power stations, and inter-connect them by long-distance circuits. He calculated that the total cost would be 900 million marks, but that when the system was in full working order there would be a return of 9.56 per cent., which, after deducting 5 per cent. for interest on invested capital, would leave a clear profit of 41 million marks per annum to the State. He opposed the distribution of energy by the State on the ground that that part of the electricity business, especially the extension of clientèle, required an adaptability to varying conditions which would be more likely to be found in the existing non-State bodies than in a Government department. He also contended that the State would be expected to extend uniform treatment to all users of electricity, whereas the best business interests required that there should be some scope for discrimination in rates. By confining its action to the generation of electricity the State would interfere as little as possible with existing rights, and it would create a desirable intermediary between itself and individual consumers.

Another expert, Dr. Voigt, also advocates centralisation. He, however, has been in favour of a short distance scheme in place of Klingenberg's long-distance one, and he believes that electricity works would not be able to enter into sufficiently favourable rate agreements with large consumers unless they produced electricity. He thinks, therefore, that the existing large works should be extended and interconnected, and that the desired centralisation should be reached by gradual development.

H. Bueggeln believes that in spite of the usually unwieldy methods of State administration, a form could be created which could hold its own when compared with private concerns. He urges that, in the case of plans for new installations, low working expenses and economy and security should be the first consideration, and, if they can best be attained by a costly installation, such an installation should be preferred to a plant involving smaller capital but higher working expenses. He considers that power stations should be linked up, but believes that turbo-generators of 15,000 to 20,000 kilowatts are the most economical, and that there is no advantage in having larger units.

There has also been a considerable amount of discussion regarding the question of a State monopoly of coal and electricity for revenue purposes.

Professor Ballod is in favour of a State monopoly on grounds of fuel economy as well as on financial grounds. He thinks that all the railways and all industrial and agricultural plant should be electrified, and that electricity should be produced in large plants of 100,000 kilowatts and distributed by high-tension mains at 100,000 volts. He calculates that by electrifying the railways it would be possible to save at least one-third of the coal consumed by them, which amounted to about 20 million tons in the year immediately before the war. He urges that the State should endeavour to reduce home consumption of coal by one-third, and should reckon to make most of its profit on coal for export. The cost of coal should not be increased to home industries, nor should the State attempt to make much profit out of electricity, as its aim should be to provide cheaper not dearer motive power.

Professor Liefmann, of Freiburg, points out that owing to the difficulties which would arise regarding the indemnification of existing works, and the necessary arrangements with regard to the numerous schemes already taken up by the individual States, an Imperial electricity monopoly could not be expected to provide a large revenue immediately after the war. He considers, however, that the existing chaos in the supply of electricity would only be reduced to order by an Imperial monopoly, and that the scheme should be carried through from the point of view of national economy, if not for financial reasons.

Local jealousy has up to the present prevented any In-

* Board of Trade *Journal*. Abstract.

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perial action, but progress has been made in most of the individual States. Bueggeln gives some interesting information about the existing state of affairs in Württemburg. He says that in addition to the important works of Stuttgart, and Esslingen, there are about 270 very small and medium-sized works, of which 260 produce their own electricity; of these only 58 work without water power. The total capacity of all the plants is only 100,000 KW. When water was employed to generate energy the great bulk of it flowed away unused, owing to the lack of a coupling circuit for the whole country into which the power stations could direct their surplus energy.

The Württemburg Central Office for Industry and Commerce is arranging a scheme for the consolidation of all the electricity works for the purpose of the uniform distribution of energy. The State is to participate in the administration of the scheme, but the idea of constituting a monopoly of the industry has been rejected.

In Saxony the Elektro Verband (the federation of the municipally-owned electricity works) prepared a scheme for the joint supply of electricity to its members and for the erection of two great power stations, but the State decided that the proposed rates still further increased the favoured position of large cities, and decided to take over the scheme and carry it out in all its essentials under State control. The Saxon Second Chamber has voted 40 million marks for developing State electricity works on condition that light and power should be furnished at cheap rates for industrial and commercial use.

A scheme for the development of Bavarian water power has been prepared; the output of energy is estimated at 21½ million kilowatt hours. The work will be begun three months after the conclusion of peace, and it will probably take from four to five years to complete. A syndicate has also been formed to exploit the water power of the Lower Inn. The available power is estimated at 200,000-H.P., and the syndicate will undertake the necessary preliminary work. The syndicate has two million marks at its disposal for this preliminary work. The Deutsche Bank considers that about 150 million marks will be necessary.

In Prussia the Government policy was foreshadowed in February, 1917, when the Minister of Public Works declared himself in favour of the principle of State control of electricity. He pointed out that the broad supply belt which stretched from the North Sea to the Main was already under State control, and that the Government had succeeded in supplying cheap electricity without injuring the interests of provinces, communes or cities. He said that if the State intervened and created large power stations at places where transport requirements were reduced to a minimum, it would be able to supply energy so cheaply that third parties would often find it profitable to turn their works into distributing centres, and, while distributing energy cheaply to their customers, they would still be able to make a good profit. The Hanover Steam Power Works Bill authorises the Government to appropriate 13 million marks for the erection of a State power station driven by steam near Hanover. The work will be begun after the war, and will be in operation at the latest two and a-half years after the declaration of peace. When the works are in operation there will be a complete State area of electricity supply from Bremen to the Main, with all the economic advantages of interconnection and uniform pressure. The output will amount to 50 million kilowatt hours, and will be capable of further development. The State Governments will co-operate in developing an adequate supply, in the removal of unsatisfactory conditions, and in obtaining the greatest possible uniformity and economy in the supply of new areas. The Government intends to take over as a general rule the generation and transmission of energy, but not its distribution to consumers. There is no intention of making municipal or private works close down, but the area of supply of distributing works will be carefully defined in order to exclude unnecessary competition and to secure an adequate supply for the whole area.

In Austria very much the same general lines have been followed as in Germany. The Government's programme was outlined in a speech by the Premier in September, 1917. He said that there would be a great development of water-power, and that the electrical system would be placed under the centralised control of a special department of the Ministry of Public Works. An Electricity Bill to give effect to the Government's proposals was introduced by the Minister of Public Works on February 5th, 1918.

The Minister emphasised the importance of developing electricity, and the backward state of Austria, especially with regard to the use of water power. He referred to the lack of method in the electricity system, and to the large number of small works; 59 per cent. of the works had a generator capacity of only 100 KW., and only 1½ per cent. had a generator capacity exceeding 5,000 KW. Those big works, however, represented half the total capacity. Progress must be made on the line of large works and their interconnection. The object the Government had in view was a uniform and economical supply of electricity. The State would give financial help, which would take the form either of State participation in capital advances, permission to issue debentures free of tax, or a guarantee to take a certain amount of energy and to interconnect stations. The technical perfection of stations would be insisted upon, differential treatment of consumers would be prohibited, as would any monopoly of installation by the electrical undertakings, tariffs would be supervised, and the State would take a percentage of the profits. The undertakings would retain 6 per cent. on their invested capital; of the profits between 6 per cent. and 10 per cent. the State would receive one-third, and of those above 10 per cent. the State would receive one-half. In order to make the nationalisation of the electricity supply possible the right to redeem would be incorporated in the Act. The Bill contained provisions for an investigation to be made regarding private works in order to prevent them interfering with the plan for a united system, and also provided machinery for the setting up of an Electricity Commission.

The Ministry of Railways has issued, in connection with the Government programme, a pamphlet on "The Preparatory Measures of the Austrian State Railway Administration for the exploitation of Water Power and the Electrification of the Main Railway Lines," which contains, amongst other things, an estimate that the Alpine water power amounts to 3,000,000 H.P., of which only 8 per cent. is now being used.

The Hungarian Minister of Commerce has ordered an Electricity Bill to be drafted on similar lines to those of the Austrian Bill. The Transition Ministry has in addition worked out a plan for dividing Hungary into districts, each of which will be served by a central electrical station worked by water power. A special energy station of the ministry will deal with the utilisation of water power and natural gas.

THE DYNATRON AND PLIODYNATRON.*

BY A. W. HULL.

THE dynatron belongs to the kenotron family of high-vacuum hot cathode devices. It resembles the kenotron and pliotron in construction, but the action is fundamentally different. The kenotron rectifier utilises the uni-directional property of the current between a hot and cold electrode in vacuum. The pliotron utilises the space charge property of this current, which allows the current to be controlled by the electrostatic effect of a grid. The dynatron utilises the secondary emission of electrons by a plate upon which the primary electrons fall. It is, as its name indicates, a generator of electric power, and feeds energy into any circuit to which it is connected.

The dynatron is a vacuum tube containing a hot filament, a perforated anode, and a third electrode called the plate. The anode is placed near the plate and between it and the filament, and holes in the anode permit electrons from the filament to reach the plate. The anode may be in the form of a perforated cylinder, a spiral of wire or cylindrical network of fine tungsten wire. When the voltage of the plate with regard to the filament is sufficiently raised, the electrons strike the plate with a velocity high enough to cause the emission of secondary electrons from the plate. These secondary electrons are attracted to the anode, which is kept at a more positive potential by a battery connected between the filament and the anode, and the net current received by the plate is the difference between the number of electrons that enter and leave it. As a result the characteristic relation between the current and the voltage is denoted by a curve for the current that rises from zero to a maximum of about 50 volts, thence decreases through zero at 100 volts to a negative maximum at about 150 volts, and then becomes positive again. It will be noted that in the region between 50 and 150 volts the current decreases with increase of voltage, and the tube has the property of possessing a "negative resistance."

This feature of the tube renders it suitable for many important uses. If connected in series with a circuit containing a positive resistance the total resistance may be made as small as desired, and a small change in the voltage applied to the whole circuit will cause a comparatively large change in the current flowing, *i.e.*, the circuit acts as a voltage amplifier. If connected in parallel with a circuit containing positive resistance the total conductivity of the circuit can be made as small as desired, and the circuit then acts as a current amplifier. If connected in a circuit containing resistance, inductance and capacity, the damping may be made very small, so that impressed oscillations may persist for a very long time, or the damping factor may be adjusted so as to be negative, in which case continuous oscillations will be set up. Oscillations of this type will arise if $Rr = L/C$, where R and r are the resistances of the circuit and dynatron respectively and L and C the inductance and capacity of the circuit. Tests are described that confirm these results, and it is found that a dynatron short-circuited by a couple of turns of heavy wire will generate at a frequency as high as 20,000,000 cycles a second or as low as 1 cycle a second. The wave-shape follows a sine law when $Rr = L/C$, and is distorted when this relation is not fulfilled.

The characteristics of the tube are greatly modified if a magnetic field is caused to act parallel to the axis of the anode. The spirally moving electrons are then stopped to a

* *Proceedings* of the INSTITUTE OF RADIO ENGINEERS. Abstract.

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greater extent by the anode, and fewer electrons reach the plate. Furthermore, the field restrains the secondary electrons from leaving the plate. As a result the tube passes from having a negative resistance to having a positive one.

If an electrostatic field is impressed by means of additional plates inserted into the tube, the negative resistance of the tube may be controlled by the strength of the electrostatic field. The tube thus controlled is called a pliodynatron, which may be used as a powerful amplifier, as a radio-generator, or, together with a transmitter, as a radiophone for wireless telephony, or as a sensitive detector in a telephone receiver circuit. A number of these applications are described in detail.

THE STORAGE OF BITUMINOUS COAL WITH REFERENCE TO ITS LIABILITY TO SPONTANEOUS COMBUSTION IN STORAGE.

By JOHN H. ANDERSON.

(*Abstract of paper read before the* Institute of Marine Engineers, *June*, 1918.)

Owing to various reasons, probably more coal is held in reserve at the various works throughout the country at the present time than there ever has been before, yet in how many cases are proper precautions taken to prevent loss either by deterioration or even by fire.

The writer has been called to examine heaps of coal that were on fire, and the results of these examinations have supported the practice embraced in the following lines. On carrying out the suggestions given, no further trouble was experienced. Although these notes are based on a pile of 16,000 tons, this quantity is a very small portion of the tonnage deposited, from which the general experience was gained. Some of the heaps have been deposited over three years. This pile was selected as an example due to its being all small coal, consisting of several kinds—washed and otherwise—some of a supposed dangerous kind for storing, containing a lot of very fine smalls. All the material was of a bituminous nature, fairly high in volatile matters, and the whole was stored in the open, therefore it had to undergo all effects due to atmospheric conditions. As the storing of the coal was considered a temporary measure, very little preparation was done to the site, which was on marsh ground in its original state of alluvium deposit. The depth of the heap was increased here and there for experimental purposes, and owing to the difficulty of securing the particular coal one would desire to store, we made this heap up with various kinds which one would scarcely store under ordinary circumstances. Under these conditions extra carefulness was exercised. Temperature readings were taken at 14 different places nearly every day, at the same depth from the surface, and we occasionally took readings at the vent pipes, of which there were fifty in this heap. To find the hottest part of the heap, whenever there was anything doubtful, we took readings at every foot, from top to bottom, at certain places. The maximum and minimum temperature of the atmosphere and the kind of weather was also recorded.

From previous experience we found the warmest place to be between 6 and 8 ft. deep from the surface, so from this we established a depth of 7 ft. as the standard depth to record temperature. Occasional check readings and all warm places (taken at every foot) was done in addition, personally. Generally speaking, I found the readings taken were very trustworthy; the men took great interest in the work. The temperature tubes were ¾ in. or 1 in. gas tubing, and driven from the top to the bottom of the coal. They should be long enough to project 2 or 3 ft. above the coal, and each tube had a numbered metallic label fixed on, so that it could easily be recognised by whichever person recorded the readings.

Regarding vent pipes, in most cases these were old scrap tubes about 8 ft. long and 3 to 4 in. in diameter. Four holes were punched in the pipes about every 8 in. or so, stabbed from the outside with a square-tapered punch to about ¾ in., thus leaving a burr, which prevented the coal going down inside the tubes. To facilitate the driving into the coal, the ends of the tubes were flattened, chisel shape, just leaving an aperture of about ¼ in., thus preventing the accumulation of water, and allowing for further venting area. The vent pipes were driven down to the 7 ft. mark leaving about a foot projecting above the coal. On this a distinctive number was painted, to which temperature readings were credited similar to the temperature pipes.

The plan of the heap is a triangular-shaped figure with a surface area of about 46,000 sq. ft., with an average depth of 13½ ft. and a maximum depth of 16 ft. The actual pile consists of North Country, Scotch and Yorkshire coals.

Although it would be best to deposit coal during cool, dry weather, no choice could be taken. Some coal was deposited during very hot weather, while other was deposited in heavy rain; again, some of the material was quite dry when discharged from the steamer, while other was as wet as it possibly could be, due to the drainage to the bottom of the hold during the transport of washed coal.

Bearing these conditions in mind, and also that the heap is in the open, one gets as near as possible to the maximum difficulties one could expect as regards the liability to create spontaneous ignition and general depreciation of the heating value of the fuel when finally consumed in the furnace, that is, if care is not observed in the treatment of the pile during storage.

It is generally well known that coal is in a state of combustion at all temperatures, due to its absorption of oxygen from the atmosphere. When the coal is at a low temperature this oxygen absorption is very little, therefore there is not much heat generated. On the other hand, heaps may be composed of small coal, which may be so dense that there will not be sufficient paths for the generated heat to escape; the consequence is that this heat gathers, thereby increasing the temperature of the coal, and incidentally, due to the increase of heat, it increases the rapidity and capacity for further oxygen absorption in a given time, thus giving off more heat in a given time than when the heap was cooler.

By taking periodical readings of the heat of pile, and comparing them with previous readings, one gets ample warning to prevent a fire. We made 90 deg. Fah. a warning temperature. When this reading was obtained at any place four further temperature pipes were driven down north, south, east and west about 10 ft. from the warm pipe. The next day the readings of these four pipes were carefully noted. The highest one would then be made the centre, and further pipes would be put down in this direction. The idea is to locate the source of heating, which may be communicating only a portion of its heat to the standard temperature tube. When this warmest place was found an additional vent pipe would be put in there, which generally arrested the rise of heat. We would then pull out the smaller temperature tubes. We made 100 deg. Fah. a danger reading—that is, if the insertion of a vent pipe failed to arrest the rise of temperature—but let it reach 100 deg. Fah. We gave orders for a trench to be dug, one foot deep, on every occasion. Thus if the daily readings were at 100 deg. Fah., say, for three days, then this spot would be found trenched three feet deep. Originally this danger temperature was 95 deg. Fah., and on four occasions we trenched at one place. This was the only trenching done in the heap.—about 10 tons of material removed in all. At no time did the readings of this pile reach 100 deg. Fah.; probably the trenching on this occasion may have been unnecessary if additional vent pipes had been inserted. However, this was the hottest part of the pile throughout the whole period. This part was in the neighbourhood where the coal was deposited to a depth of 16 ft.

The handling of the coal so many times makes a great difference in the appearance of same when it arrives at its destination, and with some of the more friable coal quite a large percentage of smalls are made from the coal, which was all screened pieces at the colliery heapstead. The liability of this small coal to create spontaneous combustion is very pronounced, both from its size and also from it closing up the paths, whereby the heat generated would otherwise escape freely to the atmosphere. This will be better understood by considering the greatly increased area of coal that is exposed when a lump is broken up; therefore, more surface to absorb oxygen. There is one safe height that must not be exceeded, but as there are other factors to be taken into consideration, it will almost be impossible to fix this safe height for every heap. The height of pile can be increased providing means are taken to vent it, the more it is vented the higher the heap can be piled. Generally speaking, 12 to 14 ft. is about as much as one should deposit small graded coals. Nine to 12 ft. for unwashed mixed coals. For slacks it depends a great deal on the composition of same. Two heaps of this material we allowed to rise up to 120 deg. Fah. before moving it. These heaps gave considerable trouble at the height of 10 ft. Eventually we reduced this height to 6 ft., when even then its tendency was to increase in temperature. My opinion of the cause of trouble was bad washing of the material; thus after a shower of rain the shaly-like material formed a sort of plastic mass with the coal, practically preventing any escape of the heat. Heavy clouds of vapour rose from this when it was grabbed. As a rule little trouble is experienced with the storage of large coal, but in the event of a fire great difficulty will be experienced in putting it out owing to the ready access of oxygen for supporting combustion. Care should be taken not to make any smalls when depositing this coal, and if possible the coal should be selected that will weather best, otherwise that on the top will crumble up and fill up the interstices underneath.

The sun, rain and frost play a very important part in disintegration. I have split many a piece of coal that was exposed to the sun for some time by simply pouring a glass of water on the lump. Again, the brassy streaks or pyrites, decompose, resulting in their swelling and causing a certain amount of breakage of the piece. Personally, I am inclined to believe that they play a very important part in the storage of coal, particularly in conjunction with rainy weather, thus being an incentive to set the pile in active oxidation.

I had rather an anxious time for some weeks with several heaps, due to the rain during last summer. Up to this time all our heaps were in a perfect state of balance regarding

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the escape of heat as it was being generated, but soon after many of the readings began to rise. Vapour rose quite freely out of the vent pipes, and continued to do so for several weeks afterwards. Several additional vents were inserted, and we trenched at one place where the highest readings were obtained. On close examination during trenching we found that active oxidation of the pyrites had taken place, and that quite a layer of fine pyritic shale had formed, thus practically sealing the coal underneath. This material, I suggest, is from the weathered, disintegrated coal from the top, which probably had been washed down with the rain; as it further oxidised it would swell and close up still more.

Regarding the nature of coal and its liability to heat, generally speaking, I find that the geological age is a fair guide, the anthracites being the safest to store and the lignites the most dangerous. A good guide is the weathering effect on a sample rather prominently exposed and occasionally moistened with water by hand, that which readily crumbles up being the most dangerous. But, of course, a great deal depends on the composition of the coal, considering the impurities and foreign material that may be mixed with it.

Anything that ignites at a lower temperature than the fuel should be kept out of the heap. In case of fire, although plenty of water should be available to quench out a fire if flames were seen issuing, it is better to dig all round the fire, and remove the hot coals away from the heap.

If it were possible to get the water to the fire, quite a lot of it would get heated; it would gravitate to the bottom of the heap, and there spread out. This heated water may then just be sufficient to set the whole heap into active oxidation. Again, some of the steam formed may be decomposed and assist the formation of a flaming gas. I certainly should not flood a burning heap of coal except when there was an actual fire that could not be treated otherwise.

As a rule, the greatest danger is up to about three months from the time of taking the coal from the pit.

It must be clearly understood that the term "vent pipes" used in this paper does not mean ventilating pipes; but that they are used purely and simply as escape pipes for the hotter gases in the heap.

The losses in calorific value as a fuel are exceedingly small, particularly if stored in a method reducing the exposed area to the atmosphere, such as shown on the plan rather than in heaps of a triangular vertical section, or coned heaps. The losses are the surface weathering, plus that given off as heat from oxidation. If the heaps are kept cool, this latter item can be neglected; as regards the former, this could be overcome by covering. But this would be rather costly for large heaps; it can be minimised by choice of coal. These losses are more apparent than real. There is a further loss, but this is mostly lost shortly after the coal is mined, in a gaseous form, and it can be neglected so far as storage is concerned.

Generally speaking, the elements lost in storing are those which in most cases are thrown away by imperfect combustion in the furnace, and I believe if the stoking of stored coal was given more consideration, practically the same results would be obtained from an evaporative point of view, as from ordinary coals.

An allowance must be made for interest on capital cost of stock, rent of space occupied, together with expenses of handling, and, of course, insurance of the whole. This latter item is quite nominal providing systematic methods of storing are employed, as suggested in this paper.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

National Electric Power Supply.

In returning to this subject I wish to deal with one point which seems to be the sheet-anchor of many advocates of the scheme; I refer to the question of the conservation of coal.

The President of the Board of Trade, replying to the deputation of members of the Trade Union Congress Parliamentary Committee, referred to the Coal Conservation Sub-Committee's report and the statement that a national scheme would mean a saving of 50 million tons of coal and 100 millions sterling a year, and went on to say what a colossal waste this was. No mention, however, was made of the colossal sum that would need to be expended to make such saving possible.

Now let me deal with the first point, viz., the saving of 50 million tons of coal per annum. This amount is arrived at by taking all the coal consumed in power production, including factories, mines, *and railways*, assuming the average consumption at 5 lb. per H.P.-hour, and assuming also that all such concerns will in future take their supplies in the form of electrical energy from large power stations, and that the coal consumption under such conditions will be 1½ lb. per H.P.-hour.

You have first of all to persuade all the users, including the railways, to consume electricity instead of coal, and this will be a prodigious task; to quote an old proverb, "You can lead a horse to the water, but you cannot make him drink."

Many factories there are whose coal consumption is considerably lower than 5 lb. per H.P.-hour, arising, no doubt, from the good load factor of their works, and from this point of view they are most desirable customers for the power-station manager, but, from their existing low costs, will be most difficult to persuade to change.

Not the remotest evidence is vouchsafed as to the length of time or the probable cost that will be involved in installing electricity for all factories, mines, and, not least important, railways.

No proof is given that electricity can be supplied to all these concerns on a coal consumption of 1½ lb. per H.P.-hour; transmission and distribution losses will certainly increase this figure very considerably if the *whole* of the coal-consuming concerns are to be supplied with electricity from the proposed super-power stations.

Therefore, when the actual number of concerns whose coal consumption will be affected is considered in conjunction with the actual consumption that will be realised under the new conditions, we shall arrive at a figure nearer five than 50 million tons as the saving in coal.

Then, as to the second point, viz., the saving of 100 millions sterling; according to the Coal Conservation Report, this is arrived at by various assumptions, seven in all. It will be sufficient to take three of them, which all labour the same point, and that is the extended use of electricity for domestic purposes. Now, I am not one to belittle my own wares, but the problem must be faced fairly and squarely, and, even with the super-power stations, I cannot possibly conceive the extension of the domestic supply to the extent of realising the saving in coal, &c., put forward in the report. To anyone who has actually been up against the whole details of supply for domestic purposes the idea is fantastic. The supply has been as cheap under the "Point Five" Tariff as it is ever likely to be, and even this tariff was not sufficient to cause anything approaching a rush for supply.

Equally exaggerated are the claims under the other headings, so that the claim of 100 millions sterling as "*total possible national advantage*" (not saving) is as much a dream as that of the Kaiser for world-wide domination.

Now, on the general question, we have not been told what is the meaning attached to coal conservation. Is it to save the coal being produced, or to have it available for export? We are told there is only sufficient to last for 500 years, and we must be careful with it; and yet, in face of this, we have the coal trades recommending that our export of coal should be increased as much as possible. Are we to make the economies of coal at home for other countries to waste it?

If the output of the mines is to be conserved, what are the colliery owners going to say, or who is going to compensate them for loss of business unless the price is increased sufficiently to cover the losses?

The more one probes the question the more is revealed of the artificialities upon which the report is based.

How is the Government going to reconcile all the reports which have been presented to it? We have the Coal Conservation Report pressing for super-power stations because it is necessary to conserve our supply of coal; we have the Coal Trades Report pressing for a still greater amount of coal to be exported; we have the Electric Power Report pressing for super-power stations, as cheap electricity is the vital point for the future of our industries; and we have the Textile, Iron, &c., Industries Reports pressing for tariff reform and lower railway charges, as these are the essentials to their future welfare. Where are we, indeed?

Veritably this is another instance in which the Government will have to set up a committee to report on the reports which have been presented to it.

The whole case of the super-power stations has been bolstered up with hysterical and exaggerated claims as to saving, together with tempting baits of a universal "given away with half-a-pound of tea style" of cheap electricity.

If the advocates of the scheme had had a really good case they would not have hesitated to state what the cost of setting up the new systems would be, what prices were likely to be charged for the supply, who was going to benefit, and to what certain extent this benefit would reach. Instead of that, we are simply told that a saving of 55 million tons of coal per annum can be expected, and in other directions a total possible national advantage of £100,000,000 per annum.

If on these bare statements we swallow a national electric scheme, then we shall more than ever justify the ridicule that we are a "nation of shopkeepers."

Fredk. W. Purse,
City Electrical Engineer.

Carlisle, *July 16th*, 1918.

The Electrical Propulsion of Ships.

Except in one point the remarks of your correspondent, Mr. William P. Durtnall, in your issue of June 21st, need no comment. He does not apparently defend Mr. Eskil Berg's extravagant claims

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for an economic advantage of electric propulsion over mechanical gearing, which it was my object to correct.

Mr. Durtnall is entirely wrong in stating that at the present time it is not economically possible to bring about such a high ratio with gears as is being done with electrical transmission. In one vessel a ratio of 26 to 1 has already been successfully adopted with a single reduction, and by using a double reduction train there is no difficulty or disadvantage in dealing with much higher ratios. The disability that Mr. Durtnall alleges would really appear to lie on the other side, since one system of electric propulsion actually adopts mechanical gearing for a final reduction to the speed of the propeller shaft, doubtless with the object of minimising the weight of the motors.

With the turbine revolutions and the propeller revolutions alike for either system, the simple issue is, as I pointed out, between the losses by transmission in the two systems. The loss with mechanical gearing is about 1 per cent. for a single reduction and about 2 per cent. for a double reduction. Can Mr. Durtnall show anything approaching this efficiency for his system?

Stanley S. Cook.

Wallsend-on-Tyne, *July 17th*, 1918.

Women in Central Stations.

In the early days of the war, volunteering and other causes depleted the trained staffs of electricity generating stations. Much hard work and the introduction of female assistance got us through pretty well, and, after a fashion, we are now carrying on, though the days of record costs, &c., are gone, and "busts" are frequent; the only object left, apart from filling returns to a dozen Government Departments, is to keep the supply going. Now we get from the Home Office, which has been strangely quiet, a lengthy screed promising to upset everything again, because some of us have not made application to an "*inspector* for permission to employ females at night," this being the excuse, while the ostensible motive is the employment of disabled sailors and soldiers who (lumped together) are so "specially suitable to such work"—work, by the way, for which at one time a good general and technical education and three years' training was considered an essential preliminary. Why an untrained soldier, unless he comes from the Engineers, or an untrained sailor, unless he comes from the Torpedo School, should be specially suitable, possibly only a Whitehall clerk, directed by a politician, is capable of discerning; mere professional engineers and managers who have to deal with facts get shocked when such brain waves beat on them, and wonder dully whether even the engineering trades are to go into muddled limbo.

No one objects to give a man who has served his country in the Army or Navy, especially if he has been one of those in uniform who actually fight the enemy or the elements, a chance; and I for one have asked, not once but many times, for such men from my Labour Exchange, but they do not swarm this way. There is another point: Are generating stations to be free training schools with highly-paid alumni, or commercial undertakings?

Some Corporations are apt to be nasty when there are no profits to aid the rates—*i.e.*, the owners of compounded cottage property and their friends in the Councils; and it is desirable, if we are to be free training schools, that station managers should not be held more responsible than road surveyors for their financial results.

Finally, are we going to take it lying down?

E. H. H.

Instruments for Central-station Switchboards.

My attention has been called to an article by Mr. G. W. Stubbings and a letter thereon by "A.M.I.E.E.," also the reply thereto by Mr. F. A. Nield, of the Aron Co.; and as I carried out the tests referred to by "A.M.I.E.E.," some explanation seems desirable.

As the latter gentleman has written to me on the subject, I know him to be a supply engineer, and not a manufacturer, and I regret that, having quoted my tests, he prefers to remain anonymous; but that is purely his own concern. I must say I think he is rather too outspoken on the question of "bias"; yet Mr. Nield's reference to a "spiteful and personal attack" seems also to be rather overdone.

I recently had occasion to make a series of comparative tests of the two types under discussion, for which both manufacturers were told what was required, and were asked to submit their latest production.

Hence our tests were made on a type of mercury watt-hour meter that probably has not yet come to the notice of Mr. Stubbings. I do not understand Mr. Nield's reference to the then Aron type being now superseded, as he was to send us any such improvement along; but up to now he has not done so.

I wish to make it quite clear that we made these tests with no "bias," or, indeed, with a bias in favour of the Aron type, for I quite expected it to beat the other.

Both makers did their utmost to meet the stringent conditions we imposed, and the pairs of meters were sent specially for the tests, which were carried out in consultation with their representatives.

Actually the results show a greater divergence than your correspondent states, and they are most easily seen on the accompanying sheet of curves, if you, sirs, are able to reproduce it. The two temperatures represent actual winter and summer conditions in our large power and sub-stations. Need I add that every precaution was taken to ensure accuracy and fairness?

With reference to Mr. Nield's last paragraph, the consistency tests were the main feature of our comparison, but I do not see any objection to mentioning that the latest patterns of the two types at that time (1917) gave the following percentage changes due to the effect of (*a*) volts reduced by 10 per cent.; Aron meter, nil; mercury meter, 0·8 per cent.; (*b*) ambient temperature raised from 68° F. to 108° F.; Aron meter, 6·0 per cent.; mercury meter, nil.

Whether the Aron meter gains on the balance, I leave your readers to decide.

E. Fawssett, M.I.E.E.

Newcastle-on-Tyne, *July 15th*, 1918.

[We have received the curves mentioned by Mr. Fawsett, which fully bear out his statements with regard to the effect of temperature changes on the two types of meter.—Eds. Elec. Rev.]

Tubular Earths for Lightning Conductors.

You published a letter from a correspondent, I think, in the Review of May 10th, who commented on the tests mentioned in my article of May 3rd. The following tests have been sent to me by a departmental electrical engineer, and I think confirm my statement that the resistance of tubular earths decreases, to a certain extent, from the date of installation:—

Earth sunk.	Resistance.
December 3rd, 1917	2·1 ohms.
„ 13th, „	1·78 „
March 26th, 1918	1·73 „
June 17th, „	1·68 „

Killingworth Hedges.

London, S.W., *July 22nd*, 1918.

THE ELECTRICAL POWER ENGINEERS' ASSOCIATION.

A meeting of electrical engineers was held on July 17th at Newcastle-upon-Tyne to consider the question of joining the Electrical Power Engineers' Association. Mr. A. H. Marshall, chairman of the Local Section of the I.E.E., was in the chair, and there was a large attendance.

The Chairman said the meeting was called to consider matters arising out of the meeting held there on June 3rd, at which delegates were appointed to represent them at a mass meeting to be held in London for the formation of an Association of British Electrical Engineers. It had been arranged to hold similar meetings at the headquarters of each of the local sections of the I.E.E., but at all these places, with the single exception of Newcastle, there was a great deal of hostility shown to the proposals of the I.E.E. As the result the London meeting had to be abandoned. This hostility arose partly because the I.E.E. was supposed to have some ulterior motive in taking the action it had done, and partly because of the existence of other associations, notably the E.P.E.A., who thought they were better able to look after the interests of supply engineers. The President and Council in endeavouring to form an association or union were guided solely by a desire to benefit their members and others engaged in the electrical industry; they wanted an association which would look after the economic interests of the younger men, and promote unity amongst the various associations which existed. That they did not go the right way about it was evident from what had happened. From what he could gather, the committee appointed by the Council to get into touch with the existing bodies and to consider the matter, was misled as to the true position, and it was evident from the results that it was ill-advised in backing the A.B.E.E. As soon as it was found that the general feeling of the country was against setting up a new association, the president of the I.E.E., Mr. Wordingham, after negotiation with the executives of the E.P.E.A., the C.T.A.A. and the A.M.E.E. (Mr. Robinson's party), arranged a conference of delegates and members of the council of the I.E.E. for July 9th, in London, to discuss what further steps should be taken to bring about unity amongst the existing associations, and to decide how the help of the I.E.E. could best be given to set up a strong protective association. Mr. Clothier, the secretary (Mr. J. R. Andrews), and himself, met the delegates who had been appointed at the meeting of June 3rd, and told them what had occurred, and as a result of the discussion it was decided to ask the committee of the Local Section of the I.E.E. to call another mass meeting of electrical engineers for the purpose of rescinding the resolution of June 3rd "that this meeting of electricity supply engineers of Newcastle and the district, promoted by the Newcastle Local Section of the Institution of Electrical Engineers, supports the formation of an association of British electrical engineers, and appoints delegates to represent it at a mass meeting to be held in London under the chairmanship of the president of the Institution of Electrical Engineers." At a committee meeting of the local section held on July 8th, the whole matter was again thoroughly discussed, and the committee passed a resolution agreeing with the amended action of the council in supporting the E.P.E.A. At the London conference on July 9th, it was agreed that a protective association be formed from the existing associations,

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adopting, for the present, the title of the E.P.E.A., seeing that it was the only association registered as a trade union; that the qualification for membership of the association should remain as at present, but that after December 31st, 1921, all new members should have passed the I.E.E. Associate Membership examination, or its equivalent. He had stated that, in view of the decisions arrived at, he thought Newcastle would be prepared to support the E.P.E.A. He wished to say, as chairman of the Local Section of the I.E.E., that the action of the Institution had been misrepresented by some, and that the president and council were only aiming at the good of its members, and of those others who should be members, but, unfortunately, were not; they had no other object in view. All they wanted to do was to give the support of the I.E.E. as a body to that organisation which showed itself best adapted to look after the interests of the profession. The body which had the greatest claim on their support at the present time was undoubtedly the E.P.E.A.

Mr. HESLOP, of Barrow, reviewing the origin of the E.P.E.A. and the position at the present time, said that if the position of staff engineers was to be improved it could only be done by co-operative effort. They had divided the country into Southern, Midland and Northern sections, with London, Birmingham and Manchester as headquarters. The scheme of government was this: Branches were formed in different parts of the country, committees were elected, and representative members were sent to the divisional committees, and the divisional committees elected representatives to the national committee. The total possible membership was 4,000 or 5,000, estimating about 400 stations in the country, and averaging the staffs at ten per station. In six months' working they had got from 1,200 to 1,500 members, or about one-third of the total possible. In Lancashire and Cheshire, about 90 per cent. were in the association. Yorkshire, also, was strong, and he hoped that a strong and active branch would be started on Tyneside. They had also formed a branch at Glasgow.

Mr. SIMPSON submitted the rules so far as they had been approved, and published.

Mr. H. W. CLOTHIER thought they should make it their duty to study the reports issued by the Board of Trade and other Government bodies regarding the development of the trade of the country. Owing to bad legislation and to blindness on the part of Great Britain they had allowed their electrical industry to proceed with that ultra caution and slowness that had given advantage to their Continental and American competitors. The last report of the Board of Trade issued after the war was most strong on that subject. To put matters right, they must have very strong and keen co-ordination and co-operation, and they must make the electrical industry attractive to the best brains in the country.

In the course of the discussion, Mr. THOMAS (Manchester) stated that the men in charge of the electrical plant in large works should be included. The question whether a foreman fitter was eligible for membership or not, depended on his training and technical knowledge. These matters would be submitted to the committee and decided upon the merits of the case. Most station men would have passed, or ought to have passed, some standard examination; but they insisted on the men having some technical knowledge. After a certain date a qualifying examination would be instituted, and no one would be admitted unless he had passed it, or some other similar examination. The idea was to make it broader until the Association was firmly grounded, and then stiffen the examinations and tests, and make it essential that the men should have obtained some qualification. They took chief engineers, provided they were not employers. Mr. SIMPSON said there were few individual employers in the electricity industry, except in the case of private plants, and usually such men were not practically responsible for the running of the plant. Where a matter arose concerning a member of his staff, the chief engineer would withdraw for the time being, but if he did not withdraw they could ask him to do so. When the question of salary arose there was no doubt as to whether the chief engineer was an employé or not.

Mr. THOMAS said the entrance fee was 5s. and the subscription one guinea; the benevolent fund contribution was optional.

The rescinding resolution having been carried, the meeting terminated, and a gathering of prospective members of the E.P.E.A. was held, Mr. THOMAS in the chair.

[Further information appears in our "Notes" columns.—EDS. ELEC. REV.]

LEGAL.

RIO TINTO CO., LTD. *v.* A. E. G. ELECTRIC CO., LTD., AND A. E. G. ELECTRIC CO., LTD. *v.* RIO TINTO CO., LTD. (Consolidated).

(*Concluded from page* 56.)

Mr. CONWAY, in summing up the case for the defendants, submitted that the A.E.G. Co. were not liable for the defects which exhibited themselves in the machinery after it had been started up by the Rio Tinto Co. in the absence of any representative of the A.E.G. Co. Had that company, he said, been permitted to make the tests in the ordinary way before the plant was started up the defendants would have been in a position to remedy any small defects which might have shown themselves, and so have prevented the failure of which the plaintiffs complained. After dealing with the question of non-payment by the plaintiff company, counsel proceeded to discuss the matter of costs of the proceedings before the arbitrator. The plaintiffs had set up issues which were not material to the action, and he therefore asked that the costs of the arbitration should go to the defendants. He submitted that the defendants were entitled to the balance of the contract price, at any rate as from August, 1915, when the plaintiffs started the plant themselves, and they were also entitled to interest by way of damages.

Mr. GRANT, K.C., summing up the case for the plaintiffs, said the first point was whether he had established a right to damages—and he submitted that he had—and if so, to what amount. The arbitrator having found that the defendants had supplied a machine which had radical defects in design, the defendants, to escape from liability occasioned by the finding, fell back on something in the nature of confession and avoidance. It was absurd to say that it was a bad finding. The arbitrator was sitting as a jury to decide technical points, and one of the questions submitted to him was whether the machine supplied was defective in design or not, and his answer was that it was defective, the critical speed being too low, viz., that it was below, whereas it ought to have been above, the running speed. If it were to be held that the finding of the arbitrator was *ultra vires* he would have nothing more to say, because his whole case rested upon the finding, and he submitted that his right to damages immediately followed from the finding.

The REFEREE, at the close of Mr. Grant's speech, reserved his judgment, the hearing having occupied fourteen days.

ISAACS *v.* HOBHOUSE.

THIS case came before Mr. Justice Darling and a special jury in the King's Bench Division on Tuesday of last week. It was an action by Mr. Godfrey Isaacs, managing director of the Marconi Wireless Telegraph Co., Ltd., against Sir Charles Hobhouse, M.P., an ex-P.M.G., to recover damages for alleged libel.

The action was the outcome of litigation between the Marconi Co. and the Government for breach of contract, which, during the hearing in court, was settled in favour of the company, but when the case was before the Court, Sir Edward Carson, K.C., counsel for the Marconi Co., made certain statements which Sir Charles Hobhouse described in the House of Commons as untrue.

Mr. Leslie Scott, K.C., Mr. Hawke, K.C., and Mr. Stuart Bevan appeared for the plaintiff; and Mr. D. M. Hogg, K.C., and Mr. Eustace Hills for the defendant.

Mr. SCOTT said that the defence was that the libel was true, the alleged libel being contained in a long statement made by the defendant in the House of Commons, and repeated by him in a letter which he subsequently published upon being challenged by Mr. Isaacs to repeat in public the statement which he made in the House of Commons. In February, 1914, Sir Charles Hobhouse, who was then P.M.G., went to Berlin and inspected the installation of the Telefunken Co. In June, 1914, Mr. Isaacs, being in Paris, met two of the directors of the Telefunken Co., and in the course of that interview they informed him that the defendant had invited their company to compete with the Marconi Co. in England in respect of three of the stations of the wireless chain, the Government having the right to cancel the rights of the Marconi Co. in respect of these. Mr. Isaacs received confirmation from the directors of the German company of what they had told him in Paris. On February 4th, 1915, an interview took place between the plaintiff and the defendant at the latter's house in London, nobody else being present, when defendant admitted that when he went to Berlin he had sought to get the Telefunken Co. to come over to this country and compete with the Marconi Co. At that interview the defendant did not dispute the truth of the statement made in the Telefunken Co.'s letter that he had asked the Telefunken Co. to compete. On February 5th, at the defendant's request, Mr. Isaacs went to the Automobile Club, and there defendant asked him what his intention was, saying, "You have your foot on my neck. Do you intend to crush me?" and adding that it would mean his leaving the Government, he asked the plaintiff whether he was disposed to help him. Mr. Isaacs replied that he did not want to crush anybody, but that he wanted fair treatment for his company. Mr. Isaacs said that his company were unwilling to resume the contract, as they mistrusted the Post Office and the conduct of the defendant as P.M.G., and suggested that the contract on the Government side should be handed over to the Admiralty; and afterwards, when the stations had been constructed, the Admiralty should hand them over to the Post Office. Negotiations, however, went on, but nothing came of them. Subsequently the defendant officially denied that he had invited the Telefunken Co. to compete, and stated that the plaintiff had taken advantage of the absence of witnesses to give a wholly untrue and malicious account of a private interview which he had arranged to get the Government and the Post

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Office out of a difficulty. Mr. Scott proceeded to relate the terms of the contract eventually made with the Government, the essence of which was that the company were to be repaid by royalties.

At the conclusion of the opening address of Mr. Leslie Scott, Mr. Isaacs gave evidence, generally bearing out the statement of his learned counsel.

Cross-examined by Sir JOHN SIMON, Mr. Isaacs said he believed defendant's memorandum of the first interview he had had with him was fabricated, for it contained a number of things which never took place.

Sir JOHN SIMON, in his address to the jury on behalf of the defendant, said he would prove that Mr. Isaacs never mentioned the mysterious German letter from the Telefunken directors at the interview he had with the defendant. That interview took place at the Automobile Club in September, 1914, not February, 1915.

At this stage the Attorney-General (Sir F. E. Smith, K.C.) was interposed as a witness by Sir John Simon, and stated that he had charge of the case for the Crown in the Marconi petition of right, and was responsible for the settlement. Sir Charles Hobhouse did not make any representations nor had he anything to do with the settlement.

Resuming his address, Sir JOHN SIMON said it was untrue that the plaintiff went to the defendant's house on February 4th, or had any conversation with the defendant on that day. It was also untrue that he gave Sir Charles the long-winded lecture about the woes of the Marconi Co. from the day of its birth. He submitted that Mr. Isaacs's story was invented to win the Marconi action against the Crown, and if money was the only thing in the world it was worth his while to invent it, for it was very likely it would be worth £2,500,000 to the Marconi Co., and of that Mr. Isaacs would get a substantial percentage.

Sir CHARLES HOBHOUSE then gave evidence, stating that this was the first occasion on which any imputation had been made against his honour, public or private. Dealing with his visit to Berlin, he said he spoke no German, and selected as his companion for the visit Sir H. J. Norman. They were attracted to the station of the Telefunken Co. in consequence of a statement that the Telefunken had been able to communicate with Togoland. It was understood that the Marconi Co. had a working arrangement with the Telefunken Co. in order to avoid competition. While he was in Berlin he never requested the Telefunken to come and compete with Marconi, nor did Sir H. J. Norman do so as far as he knew. At the interview which he had with the plaintiff at his house in Rutland Gate, the latter never made any suggestion that he had received the letter from the Telefunken Co. Mr. Isaacs's statement that witness said "You have your foot on my neck. Are you going to crush me?" was an absolute fabrication.

Witness had had nothing to do with the settlement of the Marconi action against the Crown, and far from attempting to avoid going into the witness-box, when he learned that the case had been settled he protested to the Attorney-General that he had not been called as a witness.

Cross-examined by Mr. LESLIE SCOTT, witness stated that it was a mistake when he told the House of Commons that he had had two interviews with Mr. Isaacs after communicating with Lord Reading and with Sir H. J. Norman. In September both the Post Office and the Marconi Co. were each saying that the other had broken the Imperial contract. He therefore saw Mr. Isaacs about the matter at night at his private house. That meeting was inconclusive, and therefore he made no note of it. When he assumed office as P.M.G. he was in favour of competition as against monopoly.

(To be continued.)

LONDON ELECTRIC RAILWAY: COMPENSATION CLAIM.

AT the Surveyors' Institution, on Friday, Mr. H. F. LOFTS, F.S.I., as Arbitrator, heard a claim against the London Electric Railway Co. for £3,209 16s., as purchase money and compensation in respect of the compulsory acquisition of certain land in the district of The Broadway, Westminster, under Parliamentary powers. The claimants were Mr. Henry Charles Wheeler (the freeholder) and his mother, Mrs. Caroline Jessie Wheeler, who is tenant for life.

Mr. Herbert Jacobs was counsel for the claimants, while Mr. H. W. Liversidge represented the Railway Co.

In opening, Mr. JACOBS explained that Mr. H. C. Wheeler was carrying on a coal and wheelwright's business on the property, and a claim by him in respect of this trade had been agreed at £500. It had been further agreed that the Arbitrator should be asked to add that amount to his award, but to show it separately. Therefore, the only question in issue was the value of the land.

Evidence was given by both sides, and Mr. LOFTS announced that he would give his decision in due course.

STOKE-ON-TRENT CORPORATION *v.* TRINER.

AT the Nisi Prius Court at Staffordshire Assizes last week, this case, in which the defendant was a haulage contractor, was heard by Mr. Justice Lawrence. The Corporation claimed £182 from defendant for damage done to a weigh-bridge and an electrical converter rotor in November, 1916. The resident electrical engineer at Stoke, Mr. Cuthbertson, asked defendant for an estimate for removal of the electrical machine from the works to the railway station for repair. Defendant undertook to remove the machine for £3 10s. On November 10th he brought a tractor with a view to fulfilling the contract, but while getting the tractor into position the wheels sank into a cable trench, and the removal was left until the next day, when it was decided to proceed by the weigh-bridge road. In what followed the platform of the weighing machine was broken in, and the off wheels of the tractor went into the pit, while the converter rotor was damaged. Compensation was now claimed for the actual cost of the repairs, £182. The Corporation said that the defendant was negligent in four ways. It contended that he was negligent in driving over a weigh-bridge which he knew had only a capacity of five tons; that if he did drive over it, and was right in driving over it, he was negligent in driving over it in such a way as to put more weight on the weigh-bridge than he need have done; that if he had to drive over the weigh-bridge at all, he should have protected it by putting timber over it, so as to avoid damage to it; and further, that the defendant had an alternative road by which he would have avoided the weigh-bridge altogether. What the defendant said was that whatever he did was done under the direction or with the knowledge of Mr. Cuthbertson. Defendant held that with regard to putting timber or some other protection on the weigh-bridge, it was the duty of the Corporation to do that.

After Mr. Cuthbertson and the defendant had given evidence, his Lordship gave judgment for the defendant. His Lordship said that he could not say it was negligence to choose the one road rather than the other, seeing that Mr. Cuthbertson agreed that if the two off wheels of the tractor were the only wheels to pass over the weigh-bridge all would be well. On the other hand, he warned him about the existence of the electric cables on the "scrap" way. It seemed to him quite reasonable for the defendant to say, "Well, I am not going to run the risk of damaging those cables." It was impossible for him to proceed by the weigh-bridge way without some part of the tractor going over the weigh-bridge. He could not hold that it was negligence on his part. He did the very best he could.

WAR ITEMS.

Non-Ferrous Metal Industry Act.—A further list of names of companies or individuals to whom licences have been granted under this Act appears in the *London Gazette*, July 19th.

Reconstruction Policy.—According to Mr. Bonar Law, it will not be possible to have a House of Commons discussion on the work of the Ministry of Reconstruction before the recess, but he will try and find a day immediately after.

Commercial Treaties.—Mr. Bonar Law states that the Government intends to have its hands free in regard to commercial treaties containing most-favoured-nation clauses when Peace comes. A general statement on the Government policy regarding the question will be made as soon as possible after the recess.

German Factory Fire.—Reuter reports that great damage was done on July 19th by the partial destruction by fire of an ammunition factory of the General Electricity Co. at Plauen, "presumably by spontaneous combustion of explosives." A great number of lives are reported to have been lost.

Winding Up the German Banks.—Under the Trading with the Enemy Amendment Act, 1916, the Board of Trade has made Orders, dated July 15th, for the winding up of the following German Banks (Mr. H. de Vaux Brougham, Senior Official Receiver in Companies' Liquidation, 33, Carey Street, W.C., is the Controller in all cases):—

Dresdner Bank, formerly at 65, Old Broad Street, and now situate at Austin Friars House, London, E.C.

Kais. Koen. Privilegirte Oesterreichische Laenderbank, 9, Bishopsgate, London, E.C., bankers.

Anglo-Oesterreichische Bank (Anglo-Austrian Bank), 31, Lombard Street, London, E.C.

Deutsche Bank, formerly at 4, George Yard, Lombard Street, and now situated at 9, Bishopsgate, London, E.C.

Direction der Disconto-Gesellschaft, formerly at 53, Cornhill, and now situate at Corbet Court, Gracechurch Street, London, E.C., bankers.

Demobilised Electrical Apprentices.—As a result of the efforts of the Manchester and district members of the Electrical Trades Union, an educational committee has been formed to further the better education of apprentices in the electrical industry. Naturally, a good number of the younger members of the trade have had their period of apprenticeship broken through their joining the Forces, and the idea is to help them, when discharged from the Army, to make up for lost time. The committee which has the matter in hand, is arranging a series of lectures and tours of inspection of works connected with the electrical industry. Classes are to be held, and practical demonstrations given, and it is also intended to form a library of works on electrical subjects to be at the disposal of the younger members.

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Munitions Dispute Regarding Skilled Labour.—During the past week, while such splendid achievements have been reported from France, contributing to the securing of Victory for the Allied cause, there has been a menacing situation in some parts of the Labour world at Home. The Ministry of Munitions is faced with an unsatisfied demand in munition factories for skilled men to the extent of between 50,000 and 60,000, for whom war work can immediately be found. The Ministry has found it necessary to place an embargo upon certain firms (about 100), refusing them permission to add to their staffs, as they already have more than their proper share considering the present scarcity of skilled labour. The Ministry desires to share the available labour fairly among munition firms, and to prevent competition among firms in securing such labour. It is understood that some firms have been overcrowded with skilled men, while others doing equally important work have been stopped for want of them. In exercising its legal powers limiting the right of employers in the above connection, the Government is doing what is described as absolutely necessary if a proper supply of munitions to the armies in the field is to be maintained. While men of 40 to 50 are being called to the Colours, young men are being left in the munition factories because they are needed there. The nation will only agree to their being left there if they are prepared to accommodate themselves to the skilled labour needs of the present situation. A stoppage of work was threatened, the dispute beginning at Coventry and other large centres where a large number of workers handed in their notices. In our opinion, the Ministry of Munitions did the correct thing in placing the particulars of the trouble before the public at the end of last week. Such a crisis as we are passing through just now demands from those at home a spirit of self-sacrifice and co-operation, and we believe the nation as a whole would condemn traitorous conduct. The atmosphere became less highly charged early in the week, when the Coventry Joint Engineering Committee, district committees, and workshops representatives met on Monday, and after three hours' deliberations passed the following resolution:—

"That we recommend to the workshops representatives and aggregate meetings that we suspend our notices pending a national conference of the joint engineering allied trades, to which we shall send delegates, in order that all skilled workmen shall cease work on a given date, the said conference to be held as early as possible."

Unfortunately, the good atmosphere did not last over Tuesday, for the strike began at Coventry on that day, some 12,000 skilled men ceasing work. According to the official statement of the Ministry of Munitions, an aggregate meeting of members of the A.S.E. and other unions held at Coventry decided that all A.S.E. men and skilled men at Coventry should remain out until the embargo was removed. At Birmingham the Joint Trades Committee proposed a suspension of the embargo on the employment of additional skilled labour for 14 days, otherwise they would cease work on Wednesday evening. The Ministry replied that they could not consent to a suspension. At Manchester notices were put up in some works stating that the men would cease work on July 30th unless the embargo was withdrawn. Lincoln men gave July 24th as the date for action under similar conditions.

Economic Policy.—In the House of Commons last week, Mr. Bonar Law said that it would not be possible to carry the Imports Bill before the recess. It was intended to deal with it immediately after the adjournment, when the statement on economic policy would be made. He said that the problem was being pursued as seriously as anything could be in war time. The problem was one for after the war, and it would not be rushed. In this connection, interest attaches to the interview of a correspondent of the Associated Press of America with Lord Robert Cecil (*Times*, July 19th) on the economic policy of the Allies. He shows how the coming into the war as our Allies of a number of other nations has a bearing upon the resolutions of the Paris Economic Conference. "It is no longer a question of forming some narrow defensive alliance, but of laying down the economic principles of the association of nations already in existence now, and to membership of which we are committed." President Wilson, in January last, advocated the removal, so far as possible, of all economic barriers, and the establishment of an equality of trade among all the nations consenting to the peace, and associating themselves for its maintenance. He also said that free economic intercourse must inevitably spring out of the other partnership of a real peace. Lord Robert Cecil said that we gave our warmest assent to these declarations, but they did not necessarily mean that the associated nations were to have no protective tariffs and no international competition in trade after the war. As was set forth in the programme of the Inter-Allied Labour Conference, the right of each nation to defend its own economic interest could not be denied in face of world shortage. Our arrangements for mutual assistance could not exclude all competition, "though we are most anxious that co-operation should be the keynote of our commercial relations." Germany, "living under ambitious and intriguing masters," was the one obstacle to this economic association of nations. "Economic independence," said Lord Robert, "and free choice are the last things which Germany will ever allow to the peoples within her reach." While the war lasted we must take as measures of war all the steps required to destroy the economic basis of her military effort. When Peace is restored the place of Germany in the commonwealth of nations will be determined by the test established by President Wilson. "If she abandons her old ways and her restless and aggressive policy, if she ceases to use economic policy as a preparation for future war, we shall not be slow to recognise the change, but . . . . a complete change of mind and purpose in her Government are the necessary preliminaries to her admission to participation in our economic partnership." Lord Robert Cecil concluded by stating that neither the U.S.A. nor the British Empire would pursue any selfish policy, and the pre-occupations of out internal reconstruction would never blind us to the obligations which we owed to our associates. He hoped we should soon meet round the council board to discuss in detail the economic association which would combine the resources of the civilised world in the joint work of reconstruction and the restoration of prosperity.

Exemption Applications.—In asking the Halifax Tribunal for the withdrawal or variation of the exemption granted to M. W. Brophy, aged 33, Grade 2, tramcar driver, whose medical class had been reduced on July 1st from Class A, the National Service Representative said subsequent grading did not take a man out of the clean-cut. It was shown, however, that the man held a protection order, on which he would rely, and the application was refused.

The Halifax Tribunal gave exemption to October 31st, open, conditional on Volunteer drilling, to W. Chapman, electrician, aged 44, Grade 1.

At Castleford, exemption was claimed for W. T. Burrows (32, Class A 2), tramway traffic inspector, and three months was granted, without the Volunteer condition.

At Lewes (Sussex), the Lewes & District Electric Supply Co., Ltd., applied for exemption to R. Woodward (27, Class A), shift engineer. The Tribunal had previously allowed temporary exemption subject to substitution, and this was renewed for three months.

Before the Cornwall Appeal Court, on July 15th, J. J. Light (50, Grade 2), electrical engineer, of Falmouth, was granted a medical re-examination.

The Rotherham Tribunal has allowed three months' exemption to M. Martin (40, Grade A), a repairer on the tramways.

At Chesterton (Cambs.), three months' exemption was awarded to W. C. Giddens (45, Grade 2), electrician, of Stapleford.

At Weymouth, exemption until December 31st was granted to R. A. Clarke (44, Grade 2), wireman with Messrs. Brooking & Co., electrical engineers.

Barnes Tribunal has withdrawn exemption held by A. T. Ellis, electrical engineer, as he possesses a munition card.

Maidstone Tribunal has allowed six months' exemption to H. O. Baker (18, Grade 3), stores clerk and stores keeper in the Corporation tramway department.

At Chelmsford, in the case of E. Hockley (46), electrical engineer, it was reported that he had been enrolled as a war-work volunteer, and the appeal was not proceeded with.

At High Wycombe, S. F. Root (41, Grade 3), electrician at the Marsh Paper Mill Co.'s works, was given a month, he having been promised a protection card.

At Barnsley, Messrs. C. Marsden & Sons appealed for the retention of H. R. Bate (30, Grade 1), electrician, but exemption was refused.

At Ross (Herefordshire), the Electric Light Co. appealed for W. W. Maddy (24, Grade 1), who was stated to have been lent to the Chepstow Electric Light Co. Exemption was refused, and the man was directed to join up forthwith.

Surrey Appeal Court has allowed a National Service appeal against exemption to September 30th held by W. P. Philpot (31, Grade 2), manager of the Dorking Electricity Co., and has reduced the period to one month from July 13th.

At Reigate, on the appeal of Mr. G. Martin, temporary exemption was granted to E. Harvey (46, Grade 2), wireman, and lighting and telephone fitter.

At Tunbridge Wells, an appeal was made by A. E. Hills (Grade 3), electrician, and six months' exemption was conceded.

Aged 46, married, and in Grade 2, an electrician employed at the Sloane Gate Hotel appealed on medical grounds to the Fulham Tribunal. His application was adjourned with a view to his obtaining national service work.

Detempering Steel.—The Swiss journal, *Die Elektroindustrie*, gives particulars of a process for removing the temper from hardened steel. The piece to be softened is placed on a plate of iron at red heat and covered by a plate of cold iron. After the whole has cooled, the piece of steel, whatever was its previous quality and degree of hardness, is detempered completely, and can easily be worked, without its quality having undergone any change by, for example, decarburisation. The method is specially applicable to the unhardening of tools, more particularly punches and dies. Tests have given excellent results, and the method has the advantage that shaped pieces of steel do not show any shrinkage after treatment.

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BUSINESS NOTES.

Government Control of Trade.—The London Chamber of Commerce some time ago placed before the Prime Minister its views on the above subject, and the main points of principle on which it desired to have his re-assurance, are as follows :—

(*a*) That it is not the settled policy of the Government as a whole to stop the business of merchants, brokers and agents, in cases where they perform services which entitle them to reasonable remuneration for such services. (See typical complaint from Iron, Steel and Metal Trades.)

(*b*) That the tendency of certain Government Departments, notably the Board of Trade, the Ministry of Munitions and the Ministry of Reconstruction, to ignore merchants, brokers and agents individually, or the organisations representing them, is undesirable on the economic ground that all sections of the community should be allowed to serve the national cause.

(*c*) That the Government recognise that the present control of trade and industry during the war should be relaxed so far as national necessities will allow, and that, where possible, individual enterprise, organised by those concerned in co-operation with Labour, should be reverted to as far as practicable.

(*d*) That closer co-ordination on questions of principle between Government Departments in regard to the supply and distribution of essential commodities should be provided for in the interests of efficiency.

(*e*) That the interests of importers, distributors and exporters should be treated on an equal basis with producers, and that individual Chambers of Commerce and other Traders' Associations should be recognised equally with Manufacturers' Associations and Trades Unions in the constitution of all Committees set up for the purpose of advising the Government on questions of trade, commerce and industry.

(*f*) That no effect shall be given to so-called schemes of "reconstruction" without report to Parliament, and ample opportunity being given to the business community to consider them, and that, broadly speaking, the State should not intervene in matters which the individual singly, or in combination, is able to carry out unaided by the State.

Under date July 1st, 1918, Mr. Lloyd George has intimated to the Chamber that he is "sympathetically disposed" toward all the above points, and that "he is satisfied, after consulting the several Departments, that those points of principle are being taken fully into account." The Chamber now suggests that any trades that consider that the policy of Government Departments is not in accord with its contentions toward which the Prime Minister is "sympathetically disposed," have an opportunity of raising the matter with the Department concerned, either as individuals or through the medium of their Chamber of Commerce or their organised Trade Association.

Sweden.—Among the new electrical engineering concerns recently organised in Sweden is the Aktiebolag Elektroturbins Werkstader, Stockholm, which has been registered with a maximum capital of £7,500.

The American Electric Vehicle Industry. — It is announced that the Walker Vehicle Co., of Chicago, has purchased the parts, jigs, and tools of the General Vehicle Co., whose works at Long Island City have been taken over by the American Government for war work. The manufacture of G.V. electric motor trucks will, it is understood, be discontinued, but service in connection with those already in use will be maintained by the Walker Co.

Electric Wagons for Milk Transport.—We understand that Messrs. Featherstone (London Agents), Ltd., of Westminster, have placed a contract with Messrs. Mossay & Co., Ltd., for six "Orwell" electric motor wagons for milk transport, two of the vehicles being of 3½ tons capacity and four of 2½ tons.

Works Holidays.—The British Westinghouse Electric and Manufacturing Co., Ltd., announce that their works will be closed from 5.30 p.m. to-day (Friday), until 7 a.m. Tuesday, August 6th, to enable them to overhaul and carry out the necessary repairs to their plant. Special arrangements to accept materials during the period mentioned have been made.

Messrs. L. Gardner & Sons, Ltd., Patricroft, Manchester, are closing their works from to-night, July 26th, until the morning of Tuesday, August 6th.

Manufacturers' Conference.—At a Conference of Manufacturers convened under the auspices of the National Union of Manufacturers (Incorporated), and held at Central Hall, Westminster, S.W., on Tuesday, the following resolution, proposed by Sir Edward Carson, K.C., M.P., was passed :—

"This meeting, consisting of members of British manufacturing firms, desires to represent to H.M. Government that on the declaration of Peace many firms now engaged on war work will be greatly disorganised, and will find it difficult to continue to give employment to their workpeople. They therefore wish to impress on the Government the urgency and importance of putting an end to the present uncertainty, and of at once making a declaration of our national economic policy as it affects our Empire, our Allies, Neutral and Belligerent Countries. This meeting further desires to express its opinion that it is essential that the Government should so frame its policy that the reconstruction of industries should not be hindered or threatened by undue foreign competition or dumping, and that the resources of the whole Empire and of our Allies may be made available for rehabilitating their commercial position."

Book Notices.—*Dynamo and Motor Attendants and their Machines.* By F. Broadbent, M.I.E.E. Ninth Edition. London : S. Rentell & Co., Ltd. Price 3s. 6d. net. Pp. xv. + 212 ; figs. 107.—This well-known and popular handbook has been out of print for some time, and its reappearance on the market will be welcomed. Owing to the conditions of the times, only minor alterations have been made ; the book has been reset, and a page of errata and addenda which is inserted should not be overlooked. As may be stly inferred from its popularity, the book is a most useful guide to the man who has to live with electrical machinery ; essentially practical, it aims to provide him with just that class of information which will be most immediately useful to him in his daily work, but, at the same time, it is a truly technical work, giving the reasons for its recommendations. The section dealing with A.C. motors should be particularly useful, as there is a great demand for information on this class of apparatus.

"Scope and Application of the National Electrical Safety Code." (Circular of the Bureau of Standards). Washington : Government Printing Office. Price 20 cents.

"Manual of Radio-Telegraphy and Telephony for the Use of Naval Electricians." By Capt. S. S. Robison, U.S. Navy. Fourth Revised Edition. Pp. 256 ; 117 figs. London : S. Rentell & Co. Price 8s. 6d. net.

"Names of Streets and Places in the London Postal Area, showing the Initials of the Postal District and the Number of the Office of Delivery." London : H.M. Stationery Office. Price 4d. net.

"Annales des Postes, Télégraphes et Téléphones." June, 1918. Paris : A. Dumas. Price 14 fr.

The *Anglo-Italian Review* for July contains an article by Mr. E. Strachan Morgan on "Electric Developments in Italy."

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVII, No. 6. June, 1918. New York : The Institute. Price $1.

Trade Announcement.—The British Utilities, Ltd., have removed from South Park Road to a larger factory at Wandle Bank, Wimbledon.

Moonlight.—Already Messrs. C. A. Vandervell and Co., Ltd., have sent us the moonlight chart for August, which is compiled by their chief engineer, Mr. A. H. Midgley, and admirably illustrates the lunar changes during the month.

For Sale.—Ipswich Corporation has for sale a continuous-current multipolar dynamo ; Bradford Corporation invites tenders for a vertical Corliss steam engine and 1,000-kw. Westinghouse D.C. generator. See our advertisement pages to-day.

A Canadian Labour Dispute.—The directors and workmen of the Canadian General Electric Co., of Peterboro, the largest industrial company in Ontario, have agreed to the appointment of a Conciliation Committee, and a strike has been averted.—*Times.*

LIGHTING AND POWER NOTES.

Argentina.—Strike.—Owing to the general strike the German Electric Supply Co. has only a few days' supply of fuel on hand, and is trying to buy large quantities of maize for use as fuel.

Australia.—Sydney.—Bulk Supply.—The following conditions are proposed with reference to the bulk supply to the Sydney Municipal Council by the Railway Commissioners : Castlereagh Street Sub-station.—The Council to pay 3d. per unit, with an additional £1 10s. per kw. of the maximum demand each year, to bear the cost of energy lost in conversion and transmission, to pay rent for the use of the H.T. mains at the rate of £250 per annum for the first two years, beyond which period the rent is to be fixed by agreement, and to pay the cost of the switchgear used in the sub-station. Lang Park Sub-station.—The Council to pay 3·5d. per unit, to bear the cost of energy lost in conversion and transmission, to pay £1 10s. per kw. of the maximum demand, to pay for the switchgear required at the sub-station, and to connect the tramway city sub-station and the Lang Park sub-station, at an estimated cost of £324.

The Council has instructed the city electrical engineer to draw up a specification, as a basis for the purchase by the Council of a developed or undeveloped colliery.

East Perth.—The new power station, which has been erected by the W.A. Government, although not yet working quite up to a third of its capacity, is supplying electricity over a radius which includes the Blackboy Hill Military Camp, 12 miles north of Perth, and the Naval Base, 14 miles south. It is also supplying energy for the city electric tramways, and a portion of the lighting for the City Council. It is intended, at a later stage, entirely to replace the City Council electricity works, and to supply the whole of the requirements of the city from the Government station.—*Aus. Industrial and Mining Standard.*

Barnsley.—Mains Extensions.—Subject to the consent of the Ministry of Munitions and the L.G.B., the T.C. has decided to lay a new cable to the works of Messrs. Wood Bros., at an approximate cost of £4,000.

Barnstaple.—Wages.—A Consultative Committee has recommended the T.C. to appoint an assistant engineer, at a salary of £180 per annum, rising to £200, to engage a switchboard attendant, and to grant an all-round increase to the men at the electricity works of 7s. 6d. per week.

Bingley.—Year's Working.—The annual accounts of the T.C. electricity department for the year ended March 31st last show a revenue of £3,051, whilst the expenditure amounted to £2,772—including £1,088 paid to Keighley Corporation for supply in bulk for three-quarters of the year, the last quarter's account not having been yet received. Interest and redemption fund absorbed £799, leaving a net loss of £522.

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Bury.—Price Increase.—The Electricity Committee has increased the price of electricity by a further 10 per cent. as from October 1st next.

Canada.—Toronto.—The seventh annual report of the Hydro-Electrical Commissioners shows that the total income for the year ended December 31st, 1917, was $2,049,383, an increase of $343,200 over 1916. Expenditure amounted to $1,294,023, and, after allowing for interest ($336,382), depreciation ($258,174), and redemption funds ($126,337), $34,467 were carried to the surplus account; 171,691,213 units were sold during the year, against 139,003,756. Owing to a shortage of supply, no new consumers were connected after October.

Carmarthen.—Price Increase.—The T.C. has granted permission for the E.L. Co. to increase the price of energy from 5d. to 6d. per unit.

Continental.—Spain.—E.L. Concession.—The municipal authorities of Villagarcia de Campos (Province of Valladolid) have recently invited tenders for the concession for the electric lighting of the town during a period of 15 years.

Deal and Walmer.—The Deal and Walmer Gas and Electricity Act, 1914 (Extension of Time) has been extended for a further year.

Dublin.—E.L. Restrictions.—The Electricity Supply Committee has given notice that, owing to Government restrictions on coal delivery, the electricity supply must be reduced during the six months commencing September next. Only two-thirds of the units used during last December-March quarter can be supplied, and where more than the allotted two-thirds is used the supply will be cut off for the following quarter. Theatres, and especially picture theatres, will be required to abolish outdoor lighting, and to reduce auditorium lighting. Conditionally upon the carrying out of these regulations the Corporation will try to give the supply necessary for carrying on entertainments. The Committee does not favour the closing of the theatres at 10 p.m., as the saving would be immaterial, but aims at giving a full supply to power consumers who can give satisfactory guarantees that they will not use energy between 4 p.m. and 6 p.m. in November and February, and between 3.30 p.m. and 6 p.m. in December and January. It recommends the discontinuance of shop-window lighting as far as possible, the elimination of outdoor signs, and the reduction of the candle-power of lamps.

Draft regulations to be submitted to the Corporation by the Port and Docks Board in connection with coal economy include the reduction of electricity supply to not more than two-thirds of last year's supply, and the refusal of new consumers during the remainder of the present year. It is also provided that the Coal Controller should have power to prevent private persons or public companies continuing to use coal to generate electricity for power purposes. The proposals, which would also apply to the Gas Co., have excited a good deal of opposition.

Finchley.—Price Increase.—The B.C. has increased the price of electricity for power purposes by ½d. per unit.

Frinton-on-Sea.—Price Increase.—The U.D.C. has received from the B. of T. an amending order authorising the E.L. Co. to increase the charge for energy from 7d. to 9d. per unit for five years. The maximum price is not to be charged in the event of the price of oil fuel falling below a certain figure.

Great Harwood.—Prov. Order.—The B. of T. has granted the Council an extension of its E.L. Order until August 7th, 1919.

Huddersfield.—Proposed Extensions.—The Electricity Committee reported to the T.C. last week that there was an immediate need for extensions costing £90,000. The Committee was prepared to spend the money if the Government would make a grant of a portion of the excess capital expenditure due to war conditions. Up to the present several applications for more power had been refused.

Hull.—Year's Working.—The past year's working of the Corporation electricity department has resulted in a net loss of £4,464, which has been met from the reserve fund. To meet this deficiency and to provide for the future it has been decided to increase the flat rate for lighting by 1d. per unit, making 5¾d. per unit, and for other units, except long-term agreements, by 35 per cent. on existing charges. The output in units amounted to over 20 millions, an increase of 3¾ millions on the preceding year. The revenue from all sources amounted to £119,734, and the gross profit was £34,777. With regard to long-term agreements without coal clauses, the engineer recommended that some arrangement be made with consumers on the question of the increased cost of production. During the last quarter of the year the department had had the full use of the 5,000-kw. turbo-alternator, with very beneficial results. The cooling towers were also nearing completion.

Kirkheaton.—Prov. Order.—Having received applications from the Electrical Distribution of Yorkshire, Ltd., and the Huddersfield Corporation for consent to their applications for a prov. order for a supply of electricity within its district, the U.D.C. has decided to support that of the Corporation.

Knottingley.—The 1914 E.L. Order has been extended by a further year to July, 1919.

Lincoln.—Price Increase.—The T.C. has decided to increase the price of electricity to all consumers, including the tramway department, by 20 per cent. Power users under contract are to pay 10 per cent. extra.

London.—Poplar.—Price Increase.—The Electricity Committee has recommended the B.C. to increase the price of electricity, as from July 1st, by 10 per cent. to private consumers and by 25 per cent. to power consumers and for public lighting. This makes a total increase of 30 per cent. and 50 per cent. respectively over pre-war charges.

Year's Working.—In his report for the year ended March 31st, 1918, the borough electrical engineer states that the number of units sold was 20,505,024, a decrease of 2,972,018 compared with the previous year. The net income was £107,366, an increase of £3,488, and the working expenditure amounted to £74,679, against £67,069. Of the gross profit (£32,687), interest absorbed £11,093, and loan redemption £13,296, leaving a net profit of £7,554. Generating costs were ·567d. per unit against ·537d., and the total costs per unit sold were ·874d., compared with ·686d. The engineer states that he has drafted a revised agreement for the inter-working with Hackney, Shoreditch, and Stepney, which, if put into operation, will allow for full advantages to be taken of the linking-up system.

Mexboro'.—Price Increase.—The U.D.C. has advanced the price of electricity to 5d. per unit for lighting purposes and by 5 per cent. for power.

Power Co.'s Bills.—The Select Committee of the House of Commons has approved the preamble of the Shropshire, Worcestershire, and Staffordshire E.P. Bill, the object of which is the erection of a large generating station at Stourport, which is to be linked-up with the Birmingham Corporation's undertaking.

In connection with the Parliamentary Bills of the Rotherham Corporation, the Yorkshire E.P. Co., and the Electrical Distribution of Yorkshire, Ltd., the B. of T. has decided that there should be an amalgamation as regards the electricity supply.

Rathmines.—Strike.—A number of men in the U.D.C. electricity department struck work on July 13th, on the refusal of a demand for £1 per week increase on pre-war wages. The Council had offered 2s., and has now decided to advertise for men to take the places of those on strike. The supply was maintained.

Stroud (Glos.).—Proposed E.L.—The R.D.C. has referred to a Committee, with watching powers, an application by the Stroud E.S. Co. for power to supply energy in the Council's area.

York.—The 1914 E.L. (Extension) Order has been extended for a further year to July, 1919.

TRAMWAY AND RAILWAY NOTES.

Ashton-under-Lyne.—Tramway Lease.—Notice has been given that the Hurst U.D.C. intends, as soon as the consent of the B. of T. is obtained, to grant a lease of the tramways constructed by the U.D.C. to the Ashton-under-Lyne Corporation for a period of five years.

Bingley.—Fare Increase.—The Tramways Committee has recommended that the Bradford Tramways Committee be asked to increase certain fares, and to pay 2·05d. per unit from the date of the proposed increase.

Blackpool.—Proposed Purchase.—The Corporation has opened negotiations for the purchase of the undertaking of the Blackpool and Fleetwood Tramroad Co. With the amalgamation of Bispham and with Thornton's application for amalgamation, more than half the tramroad will be within the borough. The lease to the Tramway Co. is due to expire in about a year's time. The proposal has been approved by the T.C., but has not yet been submitted to the shareholders of the company. It is stated that the offer on behalf of the Corporation is £15 for each £10 share, and to clear off the debenture issue at par, which would mean a total capitalisation, so far as the Corporation is concerned, of £260,000. It is expected that when amalgamation with St. Anne's and Lytham arrives the Corporation will probably negotiate for the purchase of the Blackpool, St. Anne's and Lytham Tramway Co., though nothing has so far, been done in this direction.

Bradford.—Wages.—The Committee on Production has given its award on the demands of the tramway employés for a 12½ per cent. bonus on present gross earnings and for the same rate of pay for women as for men. An extra 5s. per week has been awarded to the men, making 25s. per week over pre-war rates. The Committee considers that the claim of the women has not been established, and their pay will remain at 13s. over pre-war rates.

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Canada.—BRITISH COLUMBIA.—Demands were received from the employés of the British Columbia Electric Railway Co. for increased wages and altered working conditions which would increase the present wages bill by approximately 50 per cent. As the demands could not be met, the matter was referred to a Conciliation Board, but the men struck before the award was given. It was finally decided, as a result of a meeting with the Mayor of Vancouver and several leading public bodies, that the employés' demands should be paid, and the right given to the company to charge a 6-cent fare (in place of six tickets for 25 cents) pending further negotiations. The whole of the system has now been re-opened on the basis of a 6-cent fare, with further additional charges in respect of the outlying districts.

Huddersfield.—FARE REVISION.—The Tramways Committee has revised the tramway fares, providing for fares up to 2½d. to be increased by ½d., except those of children and scholars; the 3½d., 4½d., and 5½d. fares to be discontinued, and the remaining fares to be advanced by 1d.; all workmen's fares up to 2½d. to be advanced by ½d., and the workmen's fares of 3d. and over to be advanced by 1d. above the new ordinary single fares.

Leeds.—SERVICE REDUCTION.—The tramway department announces that, in spite of the approximate 50 per cent. increase in fares imposed five weeks ago, the latest weekly figures show an increase of 175,000 passengers compared with the same week of 1917, the increase in receipts being £2,575, or about 16·1 per cent. The reason for the increase in fares was the hope that it would bring about a reduction in the number of passengers, and it is now expected that there will be a drastic reduction of the number of cars in operation, so as to meet the wishes of the Coal Controller. A small economy in power has been effected by the abolition of about 25 per cent. of the stopping places, but further economy is essential. It is proposed to reduce the evening services, and to induce large employers of labour to arrange for workpeople to take their meal times at varying times, and so avoid the pressure of traffic at particular moments.

London.—UNDERGROUND RAILWAY ACCIDENT.—Considerable delay was caused in the early part of Friday morning, last week, on the Piccadilly and Brompton Tube Railway by the breaking of an axle of an East-bound train at Piccadilly Circus Station.

Nottingham.—REDUCED SERVICE.—It is proposed to curtail the tramway service on Sundays by not commencing the service until after 2 p.m.

Padiham.—LEASE EXPIRATION.—The town clerk has been instructed to interview the Burnley town clerk with reference to the leasing and working of the tramways after the expiration of the agreement made in 1900, consideration of which has been deferred by the Burnley Tramways Committee.

Scotland.—GOODS TRAFFIC.—The suggestion of the Road Transport Board that tramway cars should be used to carry goods and parcels is being considered by Scottish tramway authorities. The idea is that a saving of horse haulage and petrol can be secured, and tramway authorities have been asked to prepare a return, showing what can be done by day and night.

United States.—NEW YORK.—In the *Electric Railway Journal* of June 1st and the *Railway Gazette* of July 19th there appear illustrated articles dealing with the electrification of the New York Connecting Railway, which forms an important connecting link in the heart of greater New York City between the existing railway lines of the Pennsylvania and New York, and the New Haven and Hartford Railway Companies. The system is used for both passenger and goods-train services, separate tracks being provided for each. Formerly the interchange of a few passenger trains between the two railway systems was effected by a car-ferry route of about 11 miles, from Jersey City to Harlem River, whilst the freight interchange involved the use of a still longer ferry—viz., one of about 13 miles between Greenville and Oak Point. These ferry services were conducted by the New Haven Railway, and the connecting railway which takes their place is worked entirely by the same company. The articles referred to deal with the constructional details of the electrification, and it will be seen that, although the total distance covered is relatively short, the work has been of a heavy character, due to the character of the territory and the traffic conditions which apply in cases of this sort, operating within populated and extensively built-upon areas. In the case of the freight lines the need of a ferry still exists, but the distance is only very short—viz., about three miles. The passenger trains work through tunnels laid under the East River. The electrification has been carried out on the single-phase over head catenary system, having the same characteristics as those employed on the New Haven Railway. The articles will be found to describe the system in detail.

TELEGRAPH AND TELEPHONE NOTES.

Canadian Telegraphs.—The shortest telegraph strike on record in Canada occurred on Tuesday morning last week, when the telegraph operators of the Great North-Western Telegraph Co. throughout Canada went on strike at 10 o'clock and returned to work at 10.20, owing to the fact that, on the order of the Government, the company met the demands of the employés, which concerned the re-instatement of two men who had been dismissed.

Imperial Cable Rates.—On the motion of Sir Joseph Ward, the Imperial War Conference passed a resolution emphasising the need, in the highest interests of the Empire, for cable rates to be materially reduced.

Japan.—Owing to a breakdown of Chino-Japanese cables, due to a storm, communication with Tokio was interrupted last week.

United States.—President Wilson has issued a Proclamation stating that the taking over by the Government of the telegraph and telephone cables and the wireless systems for the duration of the war will come into effect on July 31st. The authority to operate the wire systems will be vested in the Postmaster-General.

According to the *Telegraph and Telephone Age*, the Western Union Telegraph Co. refused to recognise its employés as members of the Commercial Telegraphers' Union of America, preferring Government control. Correspondence took place between the company and the National War Labour Board, but the former declined to accept a compromise or submit to the jurisdiction of the Board, which consequently published a report upon the circumstances. The company maintained that it could not surrender control of the employés to an outside organisation, and made membership of the Union a condition that entailed discharge from its service.

Wireless Telegraphy on Aeroplanes.—The third annual report of the American National Advisory Committee for Aeronautics, reviewing the work of the Committee during the year ending June 30th, 1917, has just been issued. It is mentioned that the Committee co-operated in the development of a generator for wireless transmission from aeroplanes intended to satisfy the requirements of the Army and Navy. Methods of receiving wireless signals in an aeroplane were also investigated, and it was established at several receiving stations that the sound method was practicable.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—September 4th. Victorian Railway Commissioners. 800 lighting transformers for signal system. A copy of the specification may be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence) in London.

Belfast.—August 16th. Corporation. Two 6,000-KW. turbo-alternators, &c.; one 500-KW. turbo-alternator, &c.; one 30-KW. balancer-booster; four 48,000-lb. per hour water-tube boilers; four fuel economisers, &c.; two steel chimneys, with fans, &c.; two electrically-driven boiler feed pumps, &c.; accumulators; three 500-KW., and five 1,000-KW. rotary converters, with transformers, &c.; two 250-K.V.A., two 350-K.V.A., and six 1,250-K.V.A. transformers. See "Official Notices" to-day.

London.—OFFICE OF WORKS.—July 30th. Carbon-filament tubular lamps. July 31st. Incandescent electric lamps. See "Official Notices" to-day.

Southend.—Corporation. Booster.

CLOSED.

Government Contracts.—List of new contracts placed in June, 1918:—

WAR OFFICE.

Chatterton's compound.—General Electric Co., Ltd.
Air compressors.—Murray Workman & Co., Ltd.
Conveyors.—W. & D. Conveyor Engineering Co., Ltd.
Dynamos.—H. T. Boothroyd, Ltd.; City Electrical Co.; General Electric Co., Ltd.
Ebonite sheet and rod.—Siemens Bros. & Co., Ltd.
Fans, &c.—Davidson & Co., Ltd.
Motors, &c.—British Thomson-Houston Co., Ltd.; Electric Construction Co., Ltd.; General Electric Co., Ltd.; Wright & Wood, Ltd.
Power plant.—Harland Engineering Co.
Switchboards and spares.—British Thomson-Houston Co., Ltd.
Transformers.—Brush Electrical Engineering Co., Ltd.

H.M. OFFICE OF WORKS.

Engineering works.—Generating Set, Fuel Research St., E. Greenwich.—The Vaughan Crane Co., Ltd.; Harrow Electricity Supply; Rotary Converters, Wiring, &c.—North Metropolitan Electric Power Supply Co.: Electric Motors, National Physical Laboratory, Teddington.—Mawdsley, Ltd.; Electric Wiring, National Physical Laboratory.—S. Reed & Sons; Switchboards, National Physical Laboratory.—The New Switchgear Construction Co., Ltd.

POST OFFICE.

Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.; Gent & Co., Ltd.; North British Rubber Co., Ltd.; Peel-Conner Telephone Works Co., Ltd.; Western Electric Co., Ltd.
Telegraph and telephone cable.—British Insulated & Helsby Cables, Ltd.; Craigpark Electric Cable Co., Ltd.; Enfield Electric Cable Manufacturing Co., Ltd.; General Electric Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Western Electric Co., Ltd.
Ducts.—Albion Clay Co., Ltd.
Terminal irons.—Walls, Ltd.
Insulator spindles.—Bullers, Ltd.; F. W. Cotterill, Ltd.; Guest, Keen and Nettlefolds, Ltd.
Steel wire.—Whitecross Co. Ltd.

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INDIA OFFICE (STORE DEPARTMENT).

Copper wire.—Callender's Cable and Construction Co., Ltd.
Copper plates.—T. Bolton & Sons, Ltd.
Telephone material.—Peel-Conner Telephone Works Co., Ltd.

Barnes.—U.D.C. Coal for the electricity works (2,400 tons of Gedling peas). Kaye, Son & Harper, Ltd., 25s. 3d. per ton.

Birmingham.—Education Committee. Accepted tender:

A. Finney & Co.—Machinery and equipment for the electrical workshop, at the school extension, Ludgate Hill, for the technical training of disabled service men.

Glasgow.—The T.C. Cleansing Committee has accepted the tender of Messrs. Woodward & Co., for the supply of electrical materials for six months.

Some time ago the T.C. Cleansing Department ordered from the Edison Accumulators, Ltd., two 2-ton tipping wagons, and at the last meeting it was reported that information had been received from the firm named that it was improbable that the two chassis (which were being made in America) for the vehicles would, owing to transport difficulties, be delivered this year, and stating that they were prepared, with a view to giving immediate delivery of the wagons, to substitute other chassis therefor, at the same price as those specified in the contract. It was agreed to accept the substitutes.

Tramways Committee:—
Hadfields, Ltd.—Special track work.

Southend.—Corporation. Light Railways Committee. Scott Anderson, electric welding plant, £340.

Swansea.—The B.C. has adopted a report of the Corporation Electricity Committee stating that correspondence had passed with the British Thomson-Houston Co., Ltd., the contractors for the additional turbine plant at the electricity station, regarding the incorporation in the contract deed of a clause, whereby an extra price of £270 would be paid them for 18 standard gauge condenser tubes, owing to 19 standard gauge tubes being unobtainable due to Government instructions. The report recommended that the amount should be paid.

NOTES.

No Minister of Commerce.—Mr. Bonar Law states that it is not the intention of the Government to appoint a Minister of Commerce and a Consultative Committee.—*The Times.*

Volunteer Notes.—LONDON ARMY TROOPS COMPANIES, VOLUNTEER ENGINEERS.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Corps Orders No. 30, by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Captain of the Week.—Capt. E. G. Fleming.
Monday, July 29th.—Adjutant's Technical Lecture ("Earthworks") 6.30—7.30 p.m.
Tuesday, July 30th, to Thursday, August 1st.—Drills as usual.
Friday, August 2nd.—Adjutant's Technical Lecture ("Earthworks"), 6.30—7.30 p.m.
Saturday, August 3rd.—Annual Camp at Esher. Parade, Waterloo Station, 2 o'clock.

C. HIGGINS, *Capt.* R.E., *Adjutant.*

Starting-Motors for Petrol Motor-Cars.—The Society of Motor Manufacturers and Traders in this country, and the Society of Automotive Engineers in the United States, are considering the question of the standardisation of the details of electric motors for engine-starting purposes on petrol motor-cars. The Committee of the British body which is considering the matter has just decided to recommend 5 in., 5½ in., and 6¾ in. as the maximum diameters of such motors, and that the teeth on engine fly-wheels and the motor cog-wheels shall be No. 10 diametrical pitch for the 5-in. and No. 8 for the others, the form of the teeth to be involute. The Sub-Committee of the American body having found that present practice in starting motor pinions varies from 9 up to 13 teeth, has reported that as long as this variation exists it is impossible for engine designers to maintain gear centres and provide for complete interchangeability of starting motors of different makes. It is considered that an 11-tooth pinion would serve practically all purposes, and, in view of this, it has recommended that fly-wheel starting motors shall be equipped with an 8 to 10 pitch, 11-tooth pinion wherever possible.

Census of Railway Wagons.—Under an order of the Board of Trade, dated July 25th, 1918, any person in possession of railway wagons not owned by a railway company on August 1st, must make a return to the Board stating the sizes and number of the wagons. Application for the form of return should be made to the Board of Trade, Statistical Department, 68, Victoria Street, S.W. 1.

A Trench Truncheon Torch.—This electrical torch is made on quite a novel system, and takes the place of a weapon for the man provided with it. According to the inventor, Mr. C. S. Northcote, it is guaranteed against all defects electrically for 12 months, will give 30 hours' continuous light, and can be used as a flash-lamp for three months. By a patented system of filling, 50 are put into a rack at once, and can be charged in one hour.

Charges for Public Services.—On Monday the Statutory Undertakings (Temporary Increase of Charges) Bill was considered in Committee of the House of Commons. An amendment to enable the undertakers to raise the charges sufficiently to allow of the payment of the pre-war rate of dividend was opposed by the Government, but Sir Arthur Stanley left it to the Committee to decide whether the rate might be two-thirds or three-quarters of the pre-war rate, and in the end an amendment substituting "three-quarters" for "one-half" was carried by a large majority.

In our last issue we pointed out the inequity of the proposal of the Board of Trade, and it may be of interest to describe the simple and unobjectionable system which has been adopted in France since the outbreak of war. This system is based upon the price of coal, and is, therefore, analogous to the contracts which are in force in connection with many of our own undertakings. The supply authorities are allowed to charge for electrical energy at the pre-war price plus 0·2 centime per franc of increase in the price of coal above the pre-war price. On this basis it is tacitly assumed that the consumption of fuel is about 2 kg. per KW.-hour; but in the case of small and uneconomical stations the addition of 0·3 centime per franc may be authorised, while large modern undertakings are allowed an addition of only 0·15 centime. In many places the cost of coal is based upon the contract prices paid by the French State Railways. The price to be charged during the coming quarter is often fixed in accordance with the actual cost of coal during the current quarter. No difficulty is experienced in carrying out this system, which is perfectly fair to all parties.

Engineers' Protective Associations.—At the invitation of the Council of the Institution of Electrical Engineers, a Conference of representatives of the Associated Municipal Electrical Engineers of Greater London, the Chief Technical Assistants' Association, and the Electrical Power Engineers' Association was held at the temporary offices of the Institution, on the 9th inst. The number of representatives sent by each Association was in proportion to its membership.

The chair was taken by Mr. C. H. Wordingham, C.B.E., president of the Institution, and the Council was further represented by Messrs. R. A. Chattock, G. W. Partridge, and Roger T. Smith, vice-presidents; and Messrs. A. H. Marshall, R. Howard Fletcher, and W. Lang, chairmen of the Newcastle, Western, and Yorkshire Local Sections respectively.

At the close of the proceedings the following resolutions were passed, subject to ratification by the governing bodies of the three Associations:—

1. That one single combined protective Association be formed for the whole electric supply industry.
2. That chief engineers be included in the membership, provided they are not employers or employers' representatives on an Industrial Council or similar body dealing with technical staffs, subject also to proper safeguards for special staff questions that may arise.
3. That a protective Association formed from existing Associations adopt the constitution, and, for the present, the title, of the Electrical Power Engineers' Association, seeing that it is the only existing Association for the purposes in view which is constituted as a Trade Union.
4. That the qualifications for membership of the Association be those of the Electrical Power Engineers' Association, but all new members elected after December 31st, 1921, shall be required to have passed the A.M.I.E.E. examination or an equivalent examination, and that this be the link between the Institution and the Association.
5. That the Chief Technical Assistants' Association and the Associated Municipal Electrical Engineers of Greater London each appoint two representatives to meet the National Executive Committee of the E.P.E.A. at Manchester, on July 27th, to discuss and approve the draft constitution of the E.P.E.A. This draft in turn to be submitted to the Institution for final ratification. The representatives of the two Associations first named, if members of the E.P.E.A., to remain as part of the National Executive Committee of the E.P.E.A. for the current year (*i.e.*, until June, 1919).

The Institution also to send a representative of the Council to attend the meeting of July 27th in an advisory capacity.

Electrical Power Engineers' Association.—A meeting of the Divisional Council of the London Division was held at St. Bride's Institute, on Friday last. The report of the Conference between the I.E.E., A.M.E.E., C.T.A.A., and E.P.E.A. was under discussion. Exception was taken to Clause 5 of the report, and after discussion the following amendment was unanimously agreed upon:—

5. Provided that the C.T.A.A. and the A.M.E.E. agree to the previous resolutions, these Associations may appoint two representatives—who shall be members of the E.P.E.A.—to attend the meeting of the National Executive Council of the E.P.E.A. at Manchester, on July 27th, to discuss and approve the draft constitution of the E.P.E.A. This draft, in turn, to be submitted to the I.E.E. The representatives of the two Associations first named to remain as part of the National Executive Council of the E.P.E.A. for the current year.

Royal Visit to a Power Station.—The King and Queen visited the London and South-Western Railway Co.'s power station on Saturday afternoon last.

Educational.—MUNICIPAL COLLEGE OF TECHNOLOGY, MANCHESTER.—We have received the Prospectus of the 1918-19 session, containing particulars of the University Engineering courses. Prof. Miles Walker is the head of the electrical engineering department.

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Electric Power Supply in War-Time. — The annual report of the Chief Inspector of Factories and Workshops contains the following extract from a short report by Mr. G. Scott Ram, electrical inspector:—

The use of electrical energy has enormously increased during the war, and it may be safely stated that the marvellous output attained by munition works of all kinds would have been impossible but for the augmented public supply of electrical energy in the manufacturing districts. The increase is not only for power purposes but for other uses as in electro-chemical processes, steel making, welding, &c. The demand on the power houses has been such that, in many cases, it has been impossible to lay off the plant for overhaul or cleaning at the proper times, and shortage of staff has led to longer shifts having to be worked. Manufacturers of steam and electrical generating plant and switchboards have been very busy in supplying additional machinery to meet the requirements of the supply undertakings, and manufacturers of motors and accessories for use in the works have been equally pushed. In some districts, large applications for power supply are held up pending delivery of plant.

In general it may be stated that the new installations particularly at the larger munitions works have been of a satisfactory nature, the work being well done and in accordance with the Factory Act requirements, although certain exceptions to this rule have been met with. At many works difficulty has been experienced in obtaining competent electrical engineers to supervise extensions or to look after the plant in operation, and several of the accidents occurring during the year appear to have been due to the employment of persons having inadequate training or experience.

A new feature, due to the shortage of male labour, owing to the war, is the employment of women in electrical stations. In generating stations women are employed as general cleaners, including the cleaning of standing machinery. Others of a better educated class are employed as assistants on the switchboards, working under supervision. In a few sub-stations they are employed on still more responsible work, being in sole charge of the operation of the plant, including the running of motor generators or rotary converters, with the accompanying switching and regulating duties. For such work the women have to be very carefully selected and have to undergo a period of training under supervision before being put in charge. The sub-stations selected have also to be suitable as regards the type and protection of the plant and the duties of the women limited to the routine working of the same. In general, however, the work of sub-station attendants is, for obvious reasons, more suitable for men, and schemes are in operation for the training of disabled sailors and soldiers for this work. A number are, in fact, already so employed. This work appears to offer very suitable employment for such men where their form of disablement permits, and opens up a useful field for their permanent occupation, but of course for a very limited number.

Electric Vehicle Progress.—According to the Electric Vehicle Section of the N.E.L.A., U.S.A., arrangements have been completed for the installation of electric battery chairs at the New York Zoological Park. These chairs will operate at a speed of 3½ miles per hour, and are capable of travelling twenty miles on one battery charge. Each chair will accommodate two, or if of slight build, three persons, and they are simple in construction and operation so that anyone may, with absolute safety, drive at will through pedestrian traffic. The cars are equipped with a safety guard which, if it come in contact with any obstruction, will apply emergency brakes, causing the car to stop promptly without injury to object or car. The vehicles are also fitted with a positive governing device which controls the speed on down grades. These electric chairs are similar in design to those successfully employed at the San Francisco and San Diago Expositions.

Electric vehicles are being used extensively in hauling mail and parcel post matter and also in the Navy yards and arsenals of the Government in Washington, at Panama, and by the Bureau of Insular Affairs in Manila. The electric truck is given preference on the score of economy and ease in handling by incompetent drivers. Also the freedom from fire risk is much in their favour in the Navy yards and arsenals, where inflammable stores and ammunition, &c., are handled.

Ice after being stored and cut (natural ice), or made, must be delivered at considerable cost. It was found that nearly one-half of each dollar paid by the consumer went for transport. American ice dealers are installing electric vehicles in increasingly large numbers, as they have proved to be the most economic means of city transportation. A Philadelphia manufacturer has developed a special type of electric truck for meeting conditons that cannot be economically handled with the ordinary 5-ton equipment. The special truck is arranged to drive on the front wheels only, the large rear wheels being steel tired; the speed is lower and the battery smaller, resulting in a materially reduced first cost, and a reduction in amortisation and interest. Maintenance is also greatly reduced, resulting in a total cost lower than the cost of doing the same work with the horse equipment.

Electric trucks are also successfully being employed in coal deliveries; coal dealers are rapidly discarding inefficient motive power and turning to electric vehicles to relieve their delivery problems. An interesting comparison of the performance of an electric truck and two gasoline trucks operated in Boston, follows: Three trucks were employed on a contract for coal delivery. The round trip from the loading platform was 3.7 miles, conditions of loading and unloading were exactly the same, and the time constituted a full day's performance for each truck. The electric was a 6-ton unit, while the gas trucks were 5-ton, and 4.5-ton respectively. The 5-ton gas truck delivered 49 tons of coal in 12 trips; the 4.5-ton gas truck 40 tons in 13 trips, and the 6-ton electric 86 tons in 13 trips. The actual running time of the electric truck was from 7.12 in the morning until 4.40 in the afternoon with one half-hour out for lunch. It will be noticed that the electric was consistently overloaded, while both gas trucks were underloaded. The battery of the electric truck was boosted once during this period. The two gas trucks hauled practically the same amount of coal during the day that was hauled by one electric truck. That this was not a freak performance of the electric is evidenced by the fact that the next day the electric carried 12 loads of 78 tons, and the following day 12 loads of 76 tons, making a total of 240 tons in three nine-hour days. This same electric, a few days later, on shorter hauls, delivered 123.5 tons of coal in 19 loads, leaving with the first load at 7.12 a.m. and finishing at the garage at 5.05 p.m. with about three-quarters of an hour rest at noon. The loading time was six minutes per load, and the actual miles covered were 26.5. The company operating these trucks estimates that its per diem cost on the gasoline trucks is from 50 to 70 per cent. greater than it is on an electric.

The Wandsworth National Kitchen.—On Thursday last week the Food Committee of the Council opened the national kitchen and restaurant installed at the public baths, Wandsworth. Guided by the experience of other London boroughs, electricity has been adopted for all cooking purposes, except those for which the existing steam supply could be successfully employed. Provision is made for supplying between 1,500 and 2,500 daily, and there is seating accommodation for 200 people. The prices charged are about the same as those ruling at other national kitchens, and food can be eaten on the premises or taken away in vessels brought by customers. The Brompton & Kensington Accessories Co., Ltd., installed the electrical equipment, which comprises two fish fryers, four boiling plates, and two "F" type roasting and baking ovens, a five-tier electric steamer being on order. The ovens are of substantial cast-iron construction; they are finished black, the mouldings of the doors being polished bright. Each oven has a cooking space measuring 2 ft. 4 in. by 2 ft. 7 in. by 2 ft., giving a capacity of 12 cu. ft., and is fitted with three grid shelves, meat hook, and a drawer underneath to catch the fat. The ovens are heavily lagged on all sides; standard B. and K. elements are fitted at back and sides, the loading being at full heat 7.2 KW. Heat control is effected at a switch panel mounted above the oven; two rotary three-heat switches, double-pole fuses, and pilot lamps are provided.

The four boiling plates are each fitted with a 6-in. open-type ring mounted flush with the surface of a polished cast iron plate measuring 18 in. by 11 in., each ring being loaded to a maximum of 1.2 KW., and arranged for three-heat control from a switch panel fixed on the wall behind, fitted with a pilot lamp, d.p. fuse, and rotary switch. The Jackson fish fryers consist of oval cast-iron pans, 18 in. by 12 in. by 10 in. deep, with elements bolted to the base, and controlled from the wall behind. Each pan is loaded to 2.5 KW.

The five-tier steamer which is on order will be loaded to 4 KW., and will be used for steaming vegetables, puddings, &c.; it will cook 200 lb. of potatoes in 35 minutes, a ham being boiled in the water vessel at the same time.

The electrical equipment will have a connected load of 28.2 KW. when the steamer has been installed. The cookers are balanced across the three-wire A.C. system, the pressure between outers and neutral being 205 volts. All baking, roasting, fish frying and boiling will be done electrically, and much of the duty at present carried out by steam will be performed by the B. and K. steamer when it has been delivered.

A Super-station for the Midlands.—In view of the Government's national scheme for the better utilisation of the coal resources of the country, the Nottingham City Council recently appointed a committee to deal with the bearing of the matter upon the East Midlands district, of which Nottingham is the centre, and to consider the possibility of the establishment therein of one of the great electrical power stations which it is proposed to set up in various parts of the country. This report, involving considerations of a far-reaching character, has been prepared, and came up for consideration at a special meeting of the Council last week. The committee recommended that in view of the natural advantages possessed by the city, steps should be taken to secure the establishment in the district of one of the new large electrical power stations. Four sites regarded as possessing in a peculiar degree the advantages necessary for the purpose were brought under consideration, these being situated within close proximity to the city—one near Clifton Colliery, Milford; another half a mile below Trent Bridge; the third a mile below the weir at Colwick, and the other near Colwick sidings. It was suggested that a radius of supply extending over 40 miles might be economically dealt with under

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the scheme, this including within its scope Sheffield, Chesterfield, Mansfield, Newark, Retford, Lincoln, Loughborough, Leicester, Kettering, Burton-on-Trent, Derby and Ilkeston. The report pointed out that Nottingham district had the essential factors required for so large a station as the one proposed, these including an ample water supply, proximity of collieries, suitability of communications, and large industries requiring electric power. With regard to the method of working, it was suggested that the most economical plan would be to convert the coal into gas and recover the ammonium sulphate, using the gas to produce electrical power. The fuel proposed to be used is Top Hard Slack and "Jacks," both inferior fuels which in normal times are unsaleable, and of which a large proportion is left in the mines, the scheme being thus designed to convert into national wealth what has hitherto been a national loss. The recovery of by-products, as to which the report embodied elaborate figures, was regarded by the committee as one of the important elements in the scheme.

As an outcome of the meeting of the Corporation, the special committee was reconstituted upon a larger basis, and power was given to engage expert advice in preparing a scheme, it being suggested that in all that was done the committee having charge of the city electricity undertaking should be consulted. Mr. R. H. Swain, chairman of the Electricity Committee, urged that the proposed area of supply, embracing territory within a radius of 40 miles of Nottingham, was much too extensive, and that it ought not on any account to exceed 25 miles. He added that it was never intended that Sheffield, which would have a scheme of its own, should be included. Mr. Atkey, the chairman of the committee, whose report was adopted, explained that as large rings were being drawn upon the map by other public bodies to indicate the possible sphere of their activities, Nottingham had acted similarly. He emphasised the importance of the scheme from, among other points of view, the possibility which it would afford of producing motor spirit, for which hitherto they had been too much dependent upon foreign supplies. A great national purpose would, he urged, be served by effectively handling the national question of electricity supply from large power stations, and it was intended that Nottingham, situated in the midst of a rich coalfield, should not be left behind in the matter. Sir Arthur Duckham had told them that the Government was more likely to yield to the wishes of those public authorities which had themselves shown the initiative by taking action than to give precedence to those which had done nothing. An amendment was proposed, but was not seconded, limiting the powers of the committee to those of an advisory character, without executive functions, Mr. Atkey pointing out that there was no reason to fear that in any action that was taken the committee would run counter to the general wishes of the Council. Major Walker, managing director of the Clifton Collieries, one of the chief undertakings in the neighbourhood of Nottingham, contended that the time was ripe for action, and that if the Council did not do what was necessary, somebody else might step in. The committee by the vote of the Council was empowered to take all requisite steps.

Advantages of High Pressure and High Superheat in Steam-plant Operation.—The advantages of high pressure and superheat as affecting steam-plant efficiency, by Eskil Berg, and condensers, by D. W. R. Morgan, were the topics of papers presented before a joint meeting of the A.I.E.E., the Western Society of Engineers and the American Society of Mechanical Engineers at Chicago on June 17th.

Mr. Berg strongly favoured the adoption of higher pressures and higher temperatures than are now considered standard in this country in order to improve plant efficiency. He especially favoured higher pressure. His paper was replete with data showing the possible saving in fuel which could be made by such means. As indicative of the character of these data, Mr. Berg presented a table showing that a plant operating with 800 lb. boiler pressure and 800 deg. superheat containing turbines 85 per cent. efficient and boilers 88 per cent. efficient, could produce 1 KW.-hour on 11,750 B.T.U.

Answering a question on the cost of high-temperature and high-pressure equipment, Mr. Berg expressed the opinion that after development charges had been eliminated this equipment would be cheaper than now produced for standard pressures and temperatures.

Mr. Morgan described the improvements in condenser building which had been made by the Westinghouse company. He also predicted that the war would probably make it necessary for central stations to use more jet condensers and to use steel tubes or tubes of other than bronze metal in surface condensers in order to conserve for actual war uses metals more sorely needed.

Mr. Morgan, in his closing remarks, urged attempts to go from 28 in. to 29 in. (71 cm. to 73 cm.) of vacuum, thus effecting a saving of 4 per cent.

The Future of the Electric Pump in Lybia.—The system used by the Arabs to draw water from the wells is centuries old; hence it is not surprising that the installation of the first electric pumping plant met with an extraordinary success. Unluckily, to the first triumph suceeded a bitter illusion, which has considerably discouraged the natives. In the first place, the local electrical company had not prepared for a great call, and its stock was soon exhausted; in the second place, and most important of all, the lines and transformers and network were not suited to the local conditions, and especially the atmosphere. Hence resulted an ineffective service, which disgusted new users. Furthermore, the electric pumps were not set up in accordance with any rational technical method, and were left to be worked without any supervision, and the consequent accidents made a disastrous impression. Nevertheless, these plants have a great future before them in Lybia on condition that makers do not limit their operations to merely supplying the plants to local agents, but themselves direct the installations and supervise their working until such time as the users have become masters of their new acquisitions.—*Elettroteonica.*

Foreign Trade.—THE JUNE FIGURES.—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

	June, 1918.	*Inc. or dec.*	6 *months*, 1918. *Inc. or dec.*
IMPORTS.			
Electrical goods ...	115,822	+ 31,550	— 194,242
Machinery	1,139,833	+471,790	+ 1,581,407
EXPORTS.			
Electrical goods ...	151,994	— 92,303	— 572,420
Machinery	1,571,980	— 46,144	— 1,961,026

The County of London Royal Engineer Volunteers (London Army Troops Companies).—This Corps arose out of the amalgamation of three Volunteer organisations—those of the Engineering Institutions, the Architects, and the staff of the L.C.C.—and its doings have been regularly chronicled in our columns. Important duties have been assigned to the Corps, and recruits are urgently required to enable them to be effectively carried out. Its work is of a character particularly interesting to

engineers, who, moreover, would find themselves in the congenial company of brother engineers, and would enjoy the annual camps, during which pontooning, bridging, obstacles, demolitions, &c., form part of the exercises undertaken. An illustrated brochure has been issued giving details regarding the Corps and its work, and can be obtained from the Adjutant, Headquarters, Balderton Street, W. 1. We reproduce herewith in miniature a poster which suggestively invites recruits to join up.

Appointments Vacant.—Fitter for the Urban Electric Supply Co.; electrical mechanic for gas works plant for the Warrington Corporation; resident electrical engineer for Ebbw Vale U.D.C. at £250: assistant electrical engineer for the Welsh Metropolitan War Hospital, Whitchurch, near Cardiff; assistant mains engineer for the Calcutta Electric Supply Corporation, Ltd.; shift engineer (£2 10s. + £1 8s. 9d) for the Oldham Corporation; electrical artificers (2s. 6d. + 1s. 8d. per day) for the Royal Marine Submarine Miners; shift engineer for the Rawtenstall Corporation; electrical draughtsman for the Admiralty; shift engineer (£3 5s. + 12½ per cent.) for Radcliffe U.D.C. See our advertisement pages to-day.

Imperial Preference.—In a speech delivered on Wednesday at the West India Club, in London, Mr. Walter Long, Secretary of State for the Colonies, said that the Committee of the Cabinet which had considered the question of trade within the Empire after the war had decided in favour of Preferential trade within the Empire, and the Cabinet had given approval to the scheme.

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OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—The South Lancashire Tramways Co. has appointed MR. WM. R. ANDERSON, cable and sub-station superintendent, to the position of resident engineer, and MR. A. WILLIAMS, charge engineer, to that of cable and sub-station superintendent.

The Lincoln T.C. has decided to increase the salary of MR. STANLEY CLEGG, electrical engineer and tramway manager, by £250 a year from August 1st.

The Barnsley T.C. has appointed MR. E. C. LAZENBY as shift engineer at the electricity works at £156 a year, plus 12½ per cent. war bonus.

The Barnsley T.C. has resolved that CAPT. BARKER act as consulting engineer at the electricity works for the remainder of the war at a salary of £225 a year.

The Brighton Lighting Committee recommends that the salary of the engineer and manager, MR. J. CHRISTIE, be increased by £100 as from January last. It states that Mr. Christie, whose salary is £1,000 a year, is debarred from participating in the scheme of war bonus granted to every other member of the staff, under the awards of Sir George Askwith and the Committee on Production.

MR. R. S. PILCHER, tramway manager at Aberdeen, is recommended for the appointment of tramway manager under the Edinburgh Corporation, at £1,000 per annum.

General.—The Officers, N.C.O.'s, and men of the Warwickshire R.E. (Volunteers) have recognised the services rendered to them by CAPT. S. T. PEMBERTON, who acted as Adjutant for nearly three years, by presenting him with a handsome silver centre piece and side dishes on July 20th. The presentation was made at a full muster of officers and men by the Commanding Officer (Major D. Shanks), who referred to the ungrudging efforts made by Capt. Pemberton to maintain the membership and efficiency of the Corps during the time he acted as Adjutant. Capt. Pemberton was one of the first to join the Volunteers shortly after war broke out, and has been associated with the Engineers ever since. He retains his position as Captain of the Signal Company, and the Corps will continue to have the benefit of his experience. Mr. R. A. Chattock (Hon. Colonel) testified to the good work done by Capt. Pemberton, and appreciative remarks were made by Capt. Jenkins, Lieut. G. O. Donovan, Lieut. Marples, and Lieut. Varnom, who have all been associated with him since the Corps was raised.

In consequence of extra services, an additional payment of £130 has been made to MR. W. BREW, head of the electrical engineering department of the Municipal Technical School, Birmingham. MR. H. SPOONER has been engaged as workshop teacher for the Electrical Engineering Classes for Disabled Soldiers, at a salary of £156 per annum, plus £52 war allowance.

MR. REGINALD GRIFFIN, electrical engineer, who was responsible for the introduction of public electric lighting in Monasterevan, Co. Kildare, has been appointed district engineer to the Board of Trade Coal Mines Department.

Roll of Honour.—CAPTAIN A. E. GORE, N. Staffs Regiment, formerly a draughtsman at the Dynamo Works of Siemens Bros., Stafford, has been mentioned in French Army Orders for bravery in action on June 6th.

SERGEANT F. G. GORING A.S.C. (M.T.), who was partner with Mr. Bruce Collier in the Electric and General Lighting Co., Farnham (Surrey), has been awarded the Meritorious Service Medal.

PRIVATE J. H. JOHNSON, who has died suddenly at Salonika, was chief assistant engineer of the Merthyr Tydfil Electric Traction and Lighting Co., Ltd.

PRIVATE W. SILCOCK, Duke of Wellington's Regiment, who has died after discharge owing to wounds, was at the Chesterfield Corporation electricity works.

SECOND-LIEUT. B. M. BADCOCK, Sherwood Foresters, who has fallen in action, was in the electrical engineering department of the Staveley Coal and Iron Co., Ltd., of Chesterfield.

PRIVATE J. T. PRICE, of the Aberystwyth E.L. works staff, is a prisoner of war at Limburg.

WIRELESS OPERATOR CECIL F. NEWBERY, of the Marconi School, London, has lost his life on his first voyage.

WIRELESS OPERATOR C. E. MATHER has been awarded the Distinguished Service Medal for services rendered on a mine-sweeper mined last November.

PRIVATE WM. HULME, Lancs. Fusiliers, who has died of wounds, was in civil life engaged in the electrical department of the Wigan Coal and Iron Co.

PRIVATE W. A. CHAPMAN, Welsh Regiment, who has been commended for distinguished conduct in the field, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

PRIVATE A. J. MCQUAID, Manchester Regiment, who is a prisoner of war in Germany, was employed at the Wigan Corporation electricity works.

SERGEANT W. W. HUGHES, who, previous to enlisting in August, 1914, was on the telegraph staff of the Leeds General Post Office, has been awarded the Meritorious Service Medal for services rendered with the R.E. Wireless Signals Section.

MAJOR H. C. THOMAS, who in civil life was an electrical engineer in London, has been gazetted lieutenant-colonel. Colonel Thomas, who is 28 years of age, has seen three years' service at the Front, and is an Assistant Director of Signalling at the Horse Guards.

Obituary.—The death is announced from Berlin, at the age of 65 years, of HERR ARNOLD VON SIEMENS, eldest son of the late Werner von Siemens; the deceased was a director of the Siemens & Halske Co. and of the Siemens-Schuckertwerke.

We regret to announce the death of MR. T. HAYES, resident engineer of the South Lancashire Tramways Co. Mr. Hayes, who was only 40 years of age, had been connected with the company for the past 14 years.

The death occurred suddenly, on July 17th, at Birmingham, of MR. F. W. V. MITCHELL, in his 77th year. He was one of the original directors of the Birmingham Electric Supply Co., whose undertaking was taken over by the Corporation.

NEW COMPANIES REGISTERED.

Engineering Proprietary, Ltd. (150,985).—Private company. Registered July 17th. Capital, £100 in £1 shares. Manufacturers of aircraft and component parts thereof, manufacturers of electrical appliances and material, electrical and general engineers, &c. The subscribers (each with one share) are:—C. Nathan, Clanricarde Gardens, S.W., secretary; E. R. White, 29, Malvern Road, Thornton Heath, secretary. The first directors are to be appointed by the subscribers. Registered office: 97, New Bond Street, W.1.

Non-Conductors, Ltd. (151,000).—Private company. Registered July 19th. Capital, £500 in £1 shares. To acquire from W. Sumner and G. F. Dagnall the benefit of certain inventions relating to non-conducting substances and compositions, &c., and to carry on the business of manufacturers of mineral, rubber, asphalte, compounds for use in refrigerating chambers or cold stores, insulating compositions, packings, &c. The subscribers (each with one share) are:—A. Lawson, 27, Stalbridge Avenue, Liverpool, cashier; J. B. Kenny, 35, Wellington Avenue, Liverpool, accountant's clerk. The first directors are to be appointed by the subscribers. Solicitor: H. T. Smith, 6, Newington, Liverpool.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Aluminium Corporation, Ltd.—Two mortgages dated June 26th, 1918, to secure £300 and £1,000 respectively, charged on farms in Llanrhychwyn, Carnarvon. Holders: (*a*) Misses M. and E. Davies, (*b*) R. S. Chamberlain and Miss L. G. Chamberlain.

CITY NOTES.

Great Northern Telegraph Co., Ltd., of Denmark.

At the meeting held on June 29th at Copenhagen, Consul-General W. WEIMANN said that the difficulties of European cable maintenance were felt more intensively now than at any previous time, with the result that several of the company's most important European cables were useless for the present. The cable steamer "H. C. Orsted" had been occupied for 161 days. The two cable steamers in the Far East, the "Store Nordiske" and the "Pacific," had been occupied for 250 days, 128 of which were for the account of other administrations. Owing to the circumstances prevailing in Russia, the Wladiwostock and Kiachta routes had taken only a very small share in the transmission of the traffic between Europe and the Far East. They had tried to remedy the interruptions mentioned above by appropriating the remaining cables in the most advantageous way to the use of the several countries served by the lines. After the fire in their building at Shanghai they took steps to provide for suitable fireproof premises for station and offices. The building was expected to be completed by the end of 1920, when the lease of the present building expires. In the new building they would be able to accommodate the telegraph stations and offices of the Eastern Extension, Australasia and China Co. and the Commercial Pacific Co., besides other tenants. The cable depot at Tuborg will be adandoned, and a new cable depot will be built on a leased plot of ground within the Free Harbour of Copenhagen, the harbour of Tuborg being too shallow for the new cable steamer which it has become necessary to build, as soon as circumstances permit, to replace the "H. C. Orsted." The Government of Iceland obtained from the company a loan of £27,500 for developing the Icelandic telegraph and telephone systems. The difficulties of the food supply have made themselves felt in nearly all the countries in which the staff is employed. The company has tried to remedy these difficulties by granting liberal extra allowances and, whenever necessary, by sending supplies of provisions from Denmark. This specially applies to Petrograd, where the company continues to keep a rather large staff in order to be able to resume the instrument service itself at the shortest notice, as soon as the necessary permission has been given by the Russian authorities. A year ago he said that they had to be prepared for a considerable decrease of the net receipts, at all events after the conclusion of peace. The decrease had already commenced, and the net result of the year's working was about £157,400 lower than that of the preceding year. The cause of this considerable decline was to be found, partly in the great loss on exchange, partly in the heavy increase of the expenses. While the rates of exchange might approach the par rates within a reasonable space of time after peace, even with the exercise of strict economy the expenses were likely to continue abnormally high for a long time to come. The result

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of the year's working had, however, been so satisfactory that they proposed a total dividend and bonus of £22 per cent. (only 2 per cent. less than last year). Nobody could cast the horoscope of the company at the present moment. A considerable change had taken place in regard to the traffic transmitted by the company, the important telegraphic correspondence with Russia having been reduced to a minimum, owing to the revolution, the possible effects of which on their future position could not as yet be foretold. On the other hand, the traffic in the Far East had continued to develop satisfactorily.

Singapore Electric Tramways, Ltd.

Sir FRANK A. SWETTENHAM presided at the ordinary general meeting, held on July 16th. The profit for the year was £4,274, compared with £9,913 for the preceding year, and subject, as usual, to the royalty payable to the Municipality Commissioners in Singapore. Traffic receipts were £1,140 better than the previous year, and the sale of electric energy also increased by £1,080. Costs in all directions had increased, especially the cost of coal; energy generated by steam cost about 3½ times more than when generated by Diesel plant. Endeavours had been made to induce the Municipal Commissioners to modify the terms of the contract for the supply of energy, but without success. There was a profit on the sale of energy in 1917, but towards the end of the year they were making a loss, and the loss would be severely felt during the current year unless the Commissioners could be induced to pay a fair price for energy. The expenses of the whole undertaking represented 65.9 per cent. of the total receipts, while Singapore expenses were 65.1 per cent. of Singapore revenue. These figures compared with 59 per cent. and 57.8 per cent. for 1916. An interim dividend of 5 per cent. was paid on July 3rd, and it was decided not to distribute any further profits at present.

German Companies.

The A.G. fur Elektrotechnische Unternehmungen, of Munich, reports net profits for 1917 which allow of the payment of the arrears of interest on the preference shares for 1916.

The Elektro-Salpeter Werke A.G., of Zschornewitz, which obtains power from the Electrowerke (Bitterfeld lignite), reports a loss of £23,000 in 1917, after having allocated £43,000 to depreciation, as against £4,700 in 1916. As a consequence the deficiency becomes increased to £65,000 on a share capital of £150,000.

The Elektra A.G., of Dresden, which owns supply works, and is also interested in others, reports that most of the undertakings yielded unsatisfactory results in 1917-18. After making provision for depreciation, the accounts reveal a loss of £2,200, as compared with a loss of £6,000 in the previous 12 months, which has been covered out of the reserve fund.

The directors of the *C. Lorenz A.G., of Berlin*, state that the profits realised in 1917 did not correspond with the considerably greater turnover, and the constantly growing expenses were accompanied by partly unprofitable sale prices. The net profits amounted to £100,000, as against £110,000 in 1916, and the dividend is 35 per cent. on the share capital of £225,000, being the same as in the previous year.

The Elektrizitats A.G. vorm. W. Lahmeyer & Co., of Frankfort-on-Main, which continues a purely investment company, reports a considerable expansion in the supply business of the lighting and power undertakings and in the tramway traffic on the one hand, and a large increase in the working expenses on the other. As net profits the accounts indicate the sum of £134,000, as against £130,000 in 1916, and the dividend is 8 per cent. on share capital of £1,500,000, as in the preceding year.

The Deutsch-Niederlandische Telegraphen Gesellschaft, of Cologne, reporting on the year 1917, states that only scanty news was received from the Far East, from which it was concluded that no material alterations had taken place in the conditions of the stations and cables since 1916. The net profits and balance forward are returned at £26,000, as compared with £25,000, and a dividend of 6 per cent. on the ordinary share capital of £350,000 is proposed, being the same rate as in the preceding year.

The Electro Treuhand A.G., of Berlin, which was originally formed by the Siemens & Halske Co. and the Siemens-Schuckert Works for the financing of undertakings projected jointly by these companies, and which holds a large block of shares in the Hamburg Elevated Railway, reports net profits of £34,000 for 1917, as against £31,000 in the previous year. A dividend at the rate of 5½ per cent. is recommended on the paid-up share capital, as was also paid in 1916.

The Deutsch-Atlantische Telegraphen Gesellschaft, of Cologne, reports a loss of £21,000 for 1917, as contrasted with losses of £25,000 and £42,000 in the two preceding years respectively. By transferring, however, £65,000 from the special reserve fund, as against £75,000 and £100,000 in the two previous years respectively, it has been possible, as already reported, to declare a dividend of 3½ per cent. on the ordinary share capital of £1,200,000, as compared with 4 per cent. in 1916 and 6 per cent. in 1915.

The Continentale Gesellschaft fur Elektrische Unternehmungen, of Nuremberg, which acts as a financing undertaking for the Schuckert group, reports a slight improvement in the results as compared with the previous year in consequence of the raising of fares and prices in connection with the tramways and lighting stations. As net profits the accounts show a total of £52,000, as against £44,000 in 1916, and the dividend is 3 per cent. on capital of £1,556,000, this contrasting with 2½ per cent. in each of the two preceding years.

The directors of the *Akkumulatoren Fabrik A.G., of Berlin and Hagen*, reporting on the past year, state that the turnover was considerably greater than in 1916. It was possible for the company advantageously to dispose of its share in the Oerlikon Accumulator Co., but no reliable information was obtained concerning its undertakings in hostile countries. After allocating £6,000 to depreciation, as against £3,000 in 1916, the accounts indicate net profits of £176,000, as compared with £193,000, and it is proposed to pay a dividend of 25 per cent. on share capital of £600,000, as was also the case in 1916.

The Deutsch-Sudamerikanische Telegraphen Gesellschaft, of Cologne, states that the company's property at Monrovia was placed under the supervision of the Liberian Government before the departure of the staff to France, and the buildings at Pernambuco were damaged by fire during excesses of the mob. There was no question of any dividend from the Compania Telegrafico-Telefonica del Plata, of Buenos Aires, for 1916 and 1917, and a further sum of £14,000 had been written off the company's investment in the Buenos Aires Co. The accounts of the Cologne Co. exhibit net profits of £34,000 for 1917, as compared with £54,000 in the previous year, and the dividend of 5 per cent., as recently reported, is the same as in 1916.

The report of the *Felten & Guilleaume Carlswerk A.G., of Cologne-Mulheim*, is very brief, and merely states that nearly all departments contributed towards the considerable increase in the turnover in 1917, and corresponding profits were yielded by the subsidiary companies and investments. After setting aside £243,000 for depreciation, as contrasted with £156,000 in 1916, the accounts show net profits of £519,000, as against £415,000, permitting of the payment of a dividend of 15 per cent. on the share capital of £3,000,000, as compared with 12 per cent. in 1916. The report mentions that the company's interest in the Steinfort Iron & Steel Works Co. had been augmented as a result of the latter's expansion of capital, and that an investment had been made in a lignite mine so as to ensure the supply of fuel to the Carls Works.

Chile Telephone Co., Ltd.—Mr. C. W. PARISH, speaking at the annual meeting, said that there were signs on every hand in Chile of general confidence and prosperity. They had studied the developments of their territory so as to be prepared with plans for meeting increased telephonic needs, and for acquiring some small businesses bordering on that territory. They were laying some important underground lines in place of the old overhead wires, and they were adopting modern switching apparatus in place of the former magneto system. They had in view the introduction of the automatic system. If the Chilean Government would grant them the necessary tenure which would justify such a large expenditure, they were inclined to erect in Valparaiso a full automatic plant which would place that city in the first rank telephonically, and they would doubtless eventually adopt this policy in other important towns. The net revenue had increased by 41 per cent during the year.

Madras Electric Supply Corporation, Ltd.—At the annual meeting, Mr. James Gray said that the shipping difficulties had been greater than ever, restricting their obtaining essential materials, but they had made steady and satisfactory progress. When conditions improved there would be a considerably increased demand for lighting and power. The total costs per unit in 1917 had been 1.07d., against 1.06d. in 1916. Owing to higher prices of wages, coal and materials there would be further increase in costs in the current year. After referring to the financial results, Mr. Grav said that the supply for Kilpauk was now available, but it might be some time before they obtained full advantage of the extension owing to difficulty of procuring fans and material. They believed that the progress of the last two years would be maintained. The position would be greatly strengthened if they secured sanction for their renewed application for leave to increase the flat rate for lighting and fans from four annas to five annas.

Power Gas Corporation, Ltd.—A petition for confirming the reduction of capital from £300,000 to £280,000 is to be heard on July 30th.

Bournemouth & Poole Electricity Supply Co., Ltd.—Interim dividends on the 4½ per cent. preference shares and the 6 per cent. second preference shares, less income-tax, for the half-year, and an interim dividend on the ordinary shares at the rate of 5 per cent. per annum, less income-tax.

Metropolitan Electric Supply Co., Ltd.—Interim dividend 2 per cent. per annum (1s. per share), less tax, on ordinary shares.

Metropolitan Railway Co.—Dividend at the rate of 3½ per cent. per annum for the past half-year on the deferred stock.

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Stock Exchange Notices.—Application has been made to the Committee to allow the following to be quoted in the Official List:—

Henley's (W. T.) Telegraph Works Co., Ltd.—400,000 ordinary shares of £1 each, fully paid, Nos. 1 to 400,000, in lieu of the £5 ordinary shares quoted.

Howard & Bullough, Ltd.—250,000 additional ordinary shares of £1 each, fully paid, Nos. 750,001 to 1,000,000.

Stewarts & Lloyds, Ltd.—850,000 deferred shares of £1 each, fully paid, Nos. 1 to 850,000 (special application).

Mather & Platt, Ltd.—Interim dividend 5 per cent., less tax, for half-year ended June.

Liverpool Overhead Railway Co.—Interim dividends for the half-year ending June 30th at the rate of 5 per cent. per annum on the preference shares, and 2½ per cent. per annum on the ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets have been in buoyant and confident mood on the news of the splendid advance and captures by the gallant French Army. Money has come pouring into the markets; some of it might, perhaps, have been better employed in the purchase of National War Bonds than in the buying that has taken place in speculative ventures. However, investment securities are well represented in the long strings of improvements secured by nearly every department round the Stock Exchange, where jobbers raise the familiar lament that there is more money than stock, and that there is not nearly enough of the latter to satisfy would-be purchasers.

Home Railway stocks have benefited from the generally better tone, and Districts continue to be in prominent favour, with a 10s. rise to 9½. Underground Income bonds recovered to 8⅜, though the shilling shares fell back to 5s. 9d. Most of the steam stocks are strong on the first dividends

On the other hand, British Columbia Electric Railway stocks have weakened in consequence of the very substantial rise in wages granted to employés. The company has received permission to put up its fares, but at present it is doubtful whether this concession will cover the extra cost involved by the increase in the wages bill. The market had been a good one until this was announced, when reaction set in. There is nothing doing in Mexicans; securities connected with that country are amongst the few spots in the Stock Exchange to suffer from neglect and stagnation. Mexico Tramways 5 per cent. bonds are 44½, and the First Mortgage Bonds of the Mexican Light & Power Co. remain at 49.

Shares in the manufacturing companies have gone ahead sharply. Babcock & Wilcox have gained another 3s. 9d. on the anticipation of an early announcement of a bonus, either in shares or cash, probably the former. British Insulated have risen ⅛ to £2 a share, and British Westinghouse Pref. the same at 2¾. Edison Swan £3 paid are higher at 41s. 3d. General Electric Ordinary have added another 30s. to their quotation, although the Preference at 10¾ are 5s. down. There has been considerable demand for General Electric Ordinary on the idea that when the new shares are distributed, the ex rights quotation will render the price attractive and bring in a fresh set of buyers. Moreover, those who claim acquaintance with the company's working declare that it is doing extremely well at the present time. Telegraph Constructions are 10s. higher at 44½. Henleys are quoted for the first time to-day in their new shape as £1 shares instead of the old denomination of £5. The price is 2 to 2¼, with buyers about in the market who would probably give 2⅜. Most of the shares in companies connected with electric and telegraph work are better, and there is a substantial amount of business doing where sufficient shares come in to enable buyers to be supplied.

The Electric Lighting list is quiet, and the tendency remains on the dull side. This is due to the same set of conditions as that to which we have drawn attention lately. Gas and Electric Lighting companies find their position anything but enviable under the regulations of the Select Committee, and although there has been something of a rally in gas stocks, no support has yet been forthcoming for those concerned with the supply of electricity in London. County of London Ordinary have eased off to 10½, and this is the only change throughout the London list. Para Electric Ordinary drooped to 4, this, in company with other Brazilian issues, being somewhat dull in consequence of the adverse movement in the Rio Exchange. Singapore Electrics eased off to 4s.

Telegraphs and Telephones are firm, with Anglo-Americans better. Attention has been directed to the yield on Anglo-American Deferred, which works out to about 6¾ per cent. on the money, and the stock is thoroughly well secured. With income-tax at 6s. in the £, however, the net return is reduced to 4¾ per cent., which can scarcely be called exciting. Eastern Telegraph Ordinary is 10s. up, and Indo-Europeans at 58½ are holding their dramatic rise of last week.

Great Northerns at 37½ are 10s. down on the dividend declaration, which, with the bonus, makes 22 per cent. for the year. This compares with 24 per cent. paid in the previous 12 months. The principal feature of the market is the strength of Marconis, the parent shares spurting to 4 on a somewhat tardy recognition of the company's position as disclosed by the recent report. Marconi subsidiaries have gone ahead in sympathy with the others. Americans jumped to 26s. 9d., and Marines to 58s. 6d., while Canadians are steady at 12s., Spanish and General remaining about 11s. Business has been done during the past few days in Anglo-Portuguese Telephone Ordinary at 18s. United River Plates at 7 5/16 are 1/16 better, and Orientals gained a similar attraction at 4 13/16.

Rubber shares are firm, but there is still very little doing in them. Iron and Steel descriptions remain active and strong, taking armament shares under their ascending wing. Victoria Falls keep steady, despite a slight dulness in South Africans caused by seismic disturbances around Johannesburg. The base-metal groups move in consonance with the general trend of other markets.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price July 23, 1918.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6½	—	£7 13 10
Charing Cross Ordinary	5	4	3½	—	6 8 1
do. do. do. 4½ Pref.	4½	4½	3½	—	6 18 6
Chelsea	3	5	3½	—	7 13 10
City of London	8	8	11	—	7 5 6
do. do. 6 per cent. Pref.	6	6	9¾	—	6 0 4
County of London	7	7	10⅜	— ⅛	6 17 7
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	6	7	5½	—	6 13 4
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	4	5	3½	—	7 18 10
Metropolitan	3	4	3⅛	—	6 8 0
do. 4½ per cent. Pref.	4½	4½	3⅜	—	7 4 0
St. James' and Pall Mall	8	9	6⅞	—	6 13 4
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6½	—	7 7 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	95xd	—	6 6 4
do. Def.	1½	1½	22½	+ ½	6 14 10
Chile Telephone	8	8	9½	—	4 6 6
Cuba Sub. Ord.	7	7	10	+ ½	*7 0 0
Eastern Extension	8	8	15½	—	*5 3 3
Eastern Tel. Ord.	8	8	157½	+ ½	*5 1 7
Globe Tel. and T. Ord.	7	7	14⅜xd	—	*4 17 5
do. do. Pref.	6	6	9⅜xd	—	6 0 0
Great Northern Tel.	24	22	37½	— ½	5 17 4
Indo-European	13	—	58½	—	5 11 1
Marconi	15	20	4⅜	+ ⅜	5 0 0
Oriental Telephone Ord.	10	10	4 13/16	+ 1/16	2 2 2
United R. Plate Tel.	8	8	7 5/16	+ 1/16	*5 9 5
West India and Panama	6d.	9d.	1 7/16	—	*8 6 8
Western Telegraph	8	8	15⅝	—	*5 0 10
Home Rails.					
Central London Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	1	1	23½	+ ½	4 5 0
do. District	Nil	Nil	10½	+ ½	Nil
Underground Electric Ordinary	Nil	Nil	2⅜	+ ⅛	Nil
do. do. "A"	Nil	Nil	5/9	—6d.	Nil
do. do. Income	6	4	83	+ ½	*4 16 5
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4½	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3 1/16	+	—
do. do. 2nd Pref.	5½	—	2½	—	—
do. do. 5 Deb.	5	5	65	—	7 13 10
Brazil Tractions	—	—	44	+2	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	61½	—	8 2 8
do. do. Preferred	Nil	Nil	45	—1½	Nil
do. do. Deferred	Nil	Nil	40⅜	—1	Nil
do. do. Deb.	4½	4½	61½	— ½	6 18 8
Mexico Trams 5 per cent. Bonds	Nil	Nil	44⅝	—	Nil
do. 6 per cent. Bonds	Nil	Nil	36½	—	Nil
Mexican Light Common	Nil	Nil	21	—	Nil
do. Pref.	Nil	Nil	35½	—	Nil
do. 1st Bonds	Nil	Nil	49	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	8⅞	+ 3/16	3 17 4
British Aluminium Ord.	10	10	1½	—	5 6 8
British Insulated Ord.	20	20	2	+ ⅛	5 0 0
British Westinghouse Pref.	7½	7½	2¾	+ 1/16	5 19 6
Callenders	20	25	13½	—	6 11 7
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	3 7/16	—	5 16 0
Edison-Swan, fully paid	—	—	3 1/16	—	Nil
do. do. 4 per cent. Deb.	4	4	74½	—	5 7 5
Electric Construction	7½	10	1 1/16	—	7 12 4
Gen. Elec. Pref.	6	6	10½	— ½	6 3 10
do. Ord.	10	10	28½	+1⅛	*3 10 0
Henley	25	25	2⅜	—	5 17 8
do. 4½ Pref.	4½	4½	3⅜	—	5 12 2
India-Rubber	10	10	16⅜	—	*6 4 0
Telegraph Con.	20	20	44½	+ ½	*5 7 8

*Dividends paid free of Income Tax.

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NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

B.T.H. Hand-Operated Rheostats.

We have received from the BRITISH THOMSON-HOUSTON CO., LTD., Rugby, their new descriptive list No. 5,100 on hand-operated starting rheostats for D.C. motors. The Form D rheostat is designed essentially for motors of low power and small armature current. The contact brush is of the "skate" type, pressed on to the contacts by means of a steel spring. In rheostats for motors from 5 to 7.5 H.P. renewable sparking contacts are fitted on the first live step. The line terminals are in the form of clamping pillars. A starting period of 30 seconds is allowed with normal full load current, without undue heating of the resistance coils.

The Form F rheostats are designed for motors of higher power. The contact brushes consist of a carbon portion, to reduce sparking, and a brass portion which carries the current; both these portions are self-aligning and independent of each other. In the larger type of rheostats carbon rollers and laminated short-circuiting brushes are fitted. On every step renewable contacts are fitted which can also be reversed to make use of the under side. Line and armature terminals of

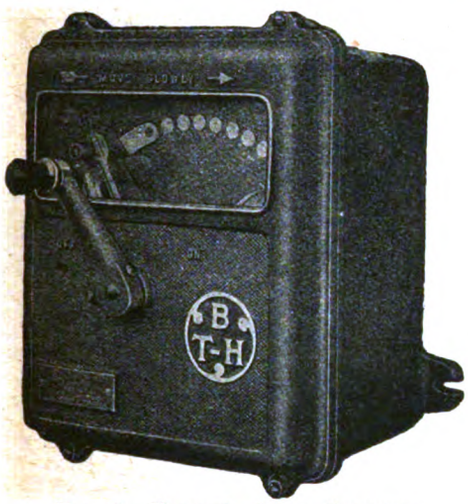

FIG. 1.—FORM D, 3-H.P. RHEOSTAT.

rheostats from 9 to 12 H.P. are in the form of clamping pillars, for larger capacities cable thimbles are provided. A starting period of 45 seconds is allowed. Both forms are constructed to give a wide and positive break in the off position, in which position the brush is thoroughly insulated and rests on a fire-proof slab.

The low voltage release coil is connected in series with the shunt field, except for series wound and variable speed shunt wound motors having a wide range of shunt field current, in which cases the coil is separately excited, and connected in series with an external resistance. The overload release is designed to short-circuit the low voltage coil, and can be set to operate at 100, 125, or 150 per cent. of full load rating. The resistance units can be easily renewed; they are fireproof, with porcelain insulators, and are wound with non-rusting wire.

An American Bosch Magneto with Impulse Starter.

The AMERICAN BOSCH MAGNETO CO., of New York and Plainfield, N.J., which has recently been taken over by the U.S.

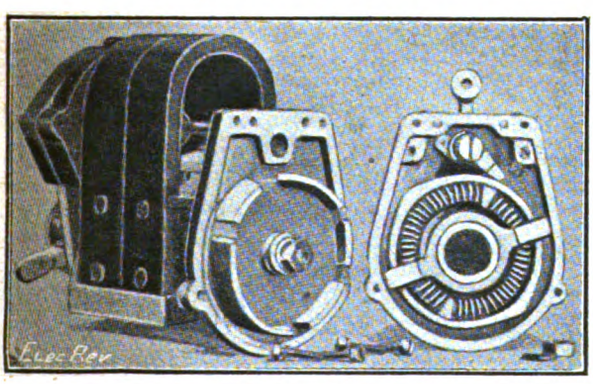

FIG. 2.—MAGNETO IMPULSE STARTER.

Government, has lately adapted an impulse starter to two models of the Bosch high-tension ignition magnetos. As will be seen from the accompanying illustration, fig. 2, it is located between the armature and the driving shaft. On starting up the engine, by the usual starting handle, the armature of the magneto is held stationary by means of a pawl while energy is being stored up by the compression of a series of coil springs. After the driving shaft has been turned through a certain angle the pawl is released by a cam allowing the springs to suddenly open out, the energy which has been stored up imparting a quick rotary movement to the armature resulting in the production of a hot spark sufficient to set the engine working. When the engine attains a speed of 120 R.P.M. the impulse starter is automatically disengaged, the springs then merely acting as a flexible drive to the armature. To set the starter a lever mounted on a spindle projecting from the coil-spring casing at the front has to be set in the operating position either directly or through a suitable linkage. The moving parts of the starter are of steel, the whole being enclosed in a dust-proof aluminium casing integral with the magneto. The heavier part of the starter is carried on its own sleeve bearing, it being consequently claimed that there is no additional strain on the magneto bearings.

The Drayson Petrol Engine and Generator.

We give herewith an illustration (fig. 3) of a new petrol engine and generator set which has recently been introduced by the COMMERCIAL AND MARINE ENGINE CO., LTD., Oak Works, Church Road, Hanwell. The engine, which is mounted on the same bed-plate as the generator, is one of the company's W.O. 45 four-cylinder type, having a bore and stroke of 5 in. × 5½ in., the

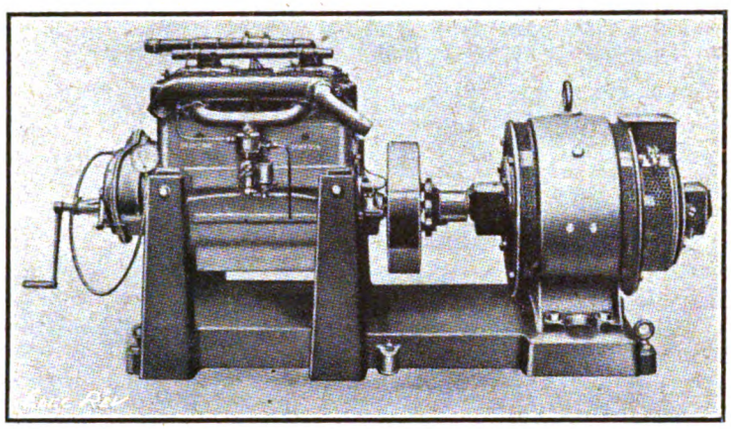

FIG. 3.—THE DRAYSON PETROL ENGINE AND GENERATOR.

engine being rated at 45 H.P. While primarily designed to use petrol as fuel, the engine can by the fitting of a vaporiser be readily adapted to run on paraffin. The details of the engine are all on up-to-date lines, the crankshaft having three large main bearings of chill-cast anti-friction metal. A half-compression device is provided for easy starting, while another feature is the provision of an automatic governor to regulate the speed of the engine. Ignition is by high-tension magneto, while the water circulation and lubrication systems are pump-controlled.

The generator is of the protected, shunt-wound type, having an output of 250 amperes at 110 volts when running at a speed of 1,100 R.P.M. As will be gathered from the picture, it is connected with the engine through a flexible coupling, and the bearings are fitted with end shields.

Electric Cooking and Water-Heating Devices.

In the *Elektrotechnische Rundschau* of March 13th a new cooking device is described in which the heating element is replaced by the water required to cook the food. The device consists of a flat porcelain dish with two electrodes of carbon passing through its base. The current passes from these through the water, which is heated and raised to boiling point. The steam produced rises through a perforated plate until it reaches the food upon which it condenses, after which it falls back into the well where it is again evaporated. This process continues until the food has reached the boiling point after which the water no longer condenses on the food but upon the inside of the lid, from which it flows back into a trough in the lid. When all the water has been evaporated from the well and has collected in the trough the current is automatically interrupted. In this manner the length of time during which the food is cooked can be controlled in advance by filling the well at the beginning with a suitable quantity of water.

The first water heating device described in the *Elektrotechnische Zeitschrift* of March 28th, was designed for use on three-phase circuits, and consists of three sheets of carbon 20×20cm. in area and placed at 10 to 15 mm. apart, and held together by insulating distance pieces. The plates are dipped into the liquid that is to be heated and are used without any series resistance. The apparatus is made suitable for any supply voltage by altering the size of the plates and their distance apart. The carbons have an unlimited life and so the cost of upkeep is very small. 300 lit. of water

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can be heated from 8 deg. C. to 40 deg. C. in about an hour. When the water is hot one plate can be disconnected so as to reduce the power taken to a value just sufficient to maintain the temperature of the water.

The second device described is a can through which the water is passed, being heated in its passage. This device works on the same principle as the previous one, but the flat carbon plates are replaced by three carbon cylinders at 5 to 6 mm. distance apart. The cold water is admitted inside the smallest cylinder and rises in the two annular spaces between the three cylinders and runs out hot at the top.

Indicator to Call a Deaf Clerk.—The inventor of this device, described in our last issue, was Mr. E. O. Catford, of the Edinburgh and District Tramways Co., Ltd.

WAR PRICES FOR ELECTRICAL ENERGY.

THE list of increases in the prices of electrical energy published in the ELECTRICAL REVIEW on October 5th, 1917, has been brought up to date so far as the information published in our "Lighting and Power Notes" will allow.

The figures given below are additive, except where otherwise stated. L = lighting, P = power, H = heating, C = cooking, T = tramways, RV = rateable value; where not otherwise specified, the increases are understood to apply to all supplies. In the case of complicated tariffs, only the main features are given. The names of months indicate approximately the quarter in which the increase took place (usually following the month named). Prices in pence are per unit.

ABERDEEN.—Oct., 1915, L. 10 p.c., P.H.C. 25 p.c.
ABERTILLERY.—March, 1916, L. ¼d.; Oct., 1916, L. 1d.
ABERYSTWYTH.—Dec., 1915, 10 p.c.; July, 1916, 10 p.c.
ACCRINGTON.—May, 1915, 20 p.c.; March, 1917, L. 0.2d., H. 0.1d., R.V. 0.1d., P. 10 p.c.; Sept., 1917, R.V. and H. 10 p.c., P. 10 p.c. Cont. rev. prices .06d. plus 10 p.c. Dec., 1917, L. 10 p.c.
ACTON.—May, 1915, 10 p.c.; Nov., 1915, min. per qr. 13s. 4d.
ALDERSHOT.—March, 1916, L. 10 p.c., P.H. rev. prices, 2d.—1½d.; Dec., 1916, rev. prices, L. 6d., P.H. 3d.—2¼d.
ALDRINGTON.—June, 1915, ½d.
ALTRINCHAM.—March, 1918, ¼d.
AMMANFORD.—June, 1918, 1d.
ASHTON-UNDER-LYNE.—March, 1916, L. 10 p.c., P.H. 25 p.c.; Dec., 1916, L. pre-war price plus 1d.; Dec., 1917, L. 15 p.c., D.C. P. 15 p.c., A.C. P. .06d.
ATHERTON.—Dec., 1915, P.H.C. 20—10 p.c.
AVLESBURY.—March, 1916, L. 10 p.c., P. ½d.; March, 1918, L. 7d. and 1½d.; shop L. 4d., P. 3d. to 1½d.
BACUP.—Dec., 1917, L. 10 p.c., P.H. 15 p.c.; June, 1918, L. 15 p.c.; P. and H. 18.3 p.c.
BANGOR.—June, 1915, L. inc. to 6d.
BARKING.—April, 1915, 10—5 p.c.; Aug., 1916, rev. price, P.H. 1¼d. plus 5 p.c., to 1d.
BARNSLEY.—June, 1916, L. ½d., P. 10 p.c.; Sept., 1917, L. ½d., P. 15 p.c.
BARNSTAPLE.—June, 1916, inc. to 6d.
BARROW.—Sept., 1915, L.P.H. 10 p.c.; Nov., 1917, L. 20 p.c.
BASINGSTOKE.—Sept., 1917, 15 p.c.
BATH.—Sept., 1915, 10 p.c.; Dec., 1916, 10 p.c.; Sept., 1917, L. ½d., H. 5 p.c.
BATLEY.—Sept., 1917, L. 7½ p.c., P. 2½ p.c.; Dec., 1917, rev. price, P. and H. 27½ p.c.; June, 1918, rev. price, L. 20 p.c., P. 40 p.c.
BECKENHAM.—June, 1915, 15 p.c.; June, 1916, L. inc. to 7d.; Dec., 1917, L. inc. to 8d., P. and H. ½d.
BEDFORD.—March, 1916, 5 p.c.; Sept., 1916, 5 p.c.; Dec., 1917, L. to 6d. plus 10 p.c., H. 1¼d., P. 2d. to 1½d.
BELFAST.—July, 1915, L. ½d., P. ½d.; July, 1917, ½d.; June, 1917, ½d.
BEXHILL.—Sept., 1915, 10 p.c.; July, 1916, 5 p.c.; March, 1918, 10 p.c.
BIRKENHEAD.—Dec., 1915, 7½ p.c.; March, 1916, rev. prices, L. 4d., P.H. 1½d. to 1d., plus 10 p.c.; March, 1917, L. 5 p.c.; March, 1918, L. 12½ p.c., P. 10 p.c.
BIRMINGHAM.—March, 1916, L. 15 p.c., P. 20 p.c.; Dec., 1916, L. 15 p.c., P. 10 p.c.; Sept., 1917, 15 p.c.; March, 1918, P. L.T. 15 p.c., H.T. and T. 10 p.c.; June, 1918, P. L.T. 5 p.c.
BISPHAM.—Jan., 1917, rev. price, P. 2d
BLACKBURN.—Oct., 1915, 15 p.c.; Dec., 1917, 10 p.c.
BLACKPOOL.—June, 1915, 10 p.c.; June, 1917, rev. prices, L. 4½d., or 7d. and 2d., P. 3½d. and 1d., H.C. 1d.—1½d.; March, 1918, 5 p.c.
BOGNOR.—Nov., 1916, 1d.
BOLTON.—May, 1915, L. ½d., P. 10 p.c.; Sept., 1917, L. and P. .1d., T. .04d.; June, 1918, .15d.
BOOTLE.—June, 1916, 12½ p.c.
BOURNEMOUTH.—Sept., 1917, 20 p.c.; Dec., 1917, 5 p.c.
BRADFORD.—March, 1918, 20 p.c., contracts and bulk supply, existing rates plus .015d. p.u. for every 6d. over 9s. cost of coal per ton.
BRAY (WICKLOW).—Sept., 1917, 10 p.c.
BRIDLINGTON.—April, 1916, rev. prices, L. 5½d.—4d., H. 2d.—1½d.; March, 1918, L. 1½d., H.C. ½d., P. 2½d.—2d.
BRIGHTON.—March, 1915, L. ½d., m.d. 6d. and 2d. raised to 6d. and 3d., public lighting, ½d., P. 0.1d.; Oct., 1915, L. ½d., P. 0.15d., T. 0.05d.; March, 1916, rev. prices, L. 6½d.—4d., P. 1½d.—1¼d.; June, 1917, 10 p.c. (T. 0.1d.); March, 1918, 15 p.c.
BRISTOL.—April, 1917, L. 22½ p.c., P. 45 p.c., contract 37 p.c.
BROADSTAIRS.—Sept., 1915, 10 p.c.
BROMLEY (KENT).—July, 1915, 10 p.c.; June, 1918, L. inc. to 8d., P. 4d.—2d.
BURNHAM (SOMERSET).—Dec., 1916, 1d.; Dec., 1917, L. inc. to 7d.
BURNLEY.—Aug., 1915, rev. prices, L. 3½d., H. 1½d., P. plus 5 p.c.; March, 1916, L.H.C., ½d., T. 0.05d., P. 5 p.c.; Sept., 1917, L. ½d., P.T. .12d.
BURTON-ON-TRENT.—March, 1916, 15 p.c.; Dec., 1917, 10 p.c.
BURY (LANCS.).—June, 1915, L. 10 p.c., P.H. 15 p.c.; June, 1916, L. 5 p.c., P.H. 10 p.c.; Sept., 1917, 5 p.c., making total L.H.T. 20 p.c., P. 30 p.c.; June, 1918, 10 p.c.
BUXTON.—Sept., 1917, 20 p.c.
CANTERBURY.—May, 1916, ½d.
CARDIFF.—March, 1917, 5 p.c.
CARLISLE.—Sept., 1917, 10 p.c.; Dec., 1917, 10 p.c.; March, 1918, 5 p.c.
CATERHAM.—July, 1916, rev. price, 7d.
CHATHAM.—March, 1915, 20 p.c.; March, 1916, 13½ p.c.; Sept., 1917, rev. prices, L. 6d., P. 1¾d., H. £1¼ p. qr., spl. rates 10 p.c.
CHELTENHAM.—June, 1917, 10 p.c.; Dec., 1917, 10 p.c.
CHESTER.—Dec., 1915, 15 p.c.
CHESTERFIELD.—Aug., 1915, 12½ p.c.; Nov., 1917, 12½ p.c.
CHICHESTER.—Dec., 1915, 1d.
CHISLEHURST.—July, 1915, 10 p.c.
CLONES.—Oct., 1915, 1d.
COLCHESTER.—July, 1915, ½d.; Dec., 1917, since L. 10 p.c.
COLNE.—June, 1915, P. ½d.; March, 1917, increase; Dec., 1917, L. ½d., P. ½d.
COLWYN BAY.—June, 1916, ½d.
CONISTON.—May, 1917, 2d.
CORK.—June, 1915, 10 p.c.
COVENTRY.—July, 1916, P. 2 to 16 p.c., according to price of coal.
CREWE.—June, 1916, 10 p.c.; June, 1917, 15 p.c.; June, 1918, 12½ p.c.
CROMER.—Dec., 1917, L. inc. to 4d.
CROYDON.—March, 1915, ½d.; June, 1916, 10 p.c.; Dec., 1916, rev. price, P. 2½d. to 600 units, 1d. over; Sept., 1917, 15 p.c.; March, 1918, L.H.P. 25 p.c., making 50 p.c.
DALKEITH.—July, 1915, rev. price, L. 3½d., P.H. 2d.; July, 1916, L. ½d., P. special charge.
DARLINGTON.—June, 1915, L. ½d., P. ½d.; Nov., 1917, P. 1.16d.
DARTFORD.—Sept., 1915, L. 1d. and ½d., P. ½d.; March, 1916, 20 p.c.; July, 1917, L. 10 p.c., P. 15 p.c.; Dec., 1917, L.P. 10 p.c.
DARWEN.—June, 1915, L. 10 p.c., P. 20 p.c.; June, 1916, P. 5 p.c.; June, 1917, 5 p.c.; Dec., 1917, 10 p.c.; March, 1918, 20 p.c.
DAWLISH.—Aug., 1916, L. 10 p.c.
DENNY.—Sept., 1916, L.P. ½d.
DERBY.—Nov., 1915, 10 p.c.; Nov., 1917, 10 p.c.
DEWSBURY.—June, 1915, L. 10 p.c., R.V. 12 p.c., P.H. 15 p.c.; June, 1917, L. and R.V. 2½ p.c., P.H. 10 p.c.
DONCASTER.—Dec., 1917, rev. prices, 25 p.c. inc.
DORKING.—Dec., 1917, rev. prices, 20 p.c. inc.
DOVER.—Sept., 1916, ½d.
DUBLIN.—March, 1915, L. ½d., P. ½d.; Dec., 1917, L. ½d., P. ½d.
DUDLEY.—Dec., 1917, 12½ p.c.
DUNDEE.—June, 1917, L. ½d., P. ½d.
DURHAM.—June, 1915, 0.02d. for every 6d. above 7s. cost of coal per ton.
EALING.—Aug., 1916, 33.3 p.c.; March, 1918, rev. prices, L. 8d., C.H. 1½d.
EASTBOURNE.—March, 1916, L. ½d.; Sept., 1916, L. ½d.
EAST HAM.—Dec., 1915, 10 p.c. (T. 5 p.c.); June, 1917, 10 p.c. (T. 5 p.c.); Dec., 1917, 13⅓ p.c. (T. 10 p.c.); June, 1918, L. 4d. plus 33.3, m.d. 5½d. and 2½d. plus 33.3, contractors 2d. plus 33.3, P. and H. 1½d. plus 33.3 to 1½d. plus 33.3, special rates inc. ½d. plus 33.3 p.c.; March, 1918, T. 1.0625d. plus 33.3 p.c.
ECCLES.—Sept., 1915, L. 10 p.c., P.H.C. 20 p.c.; Dec., 1916, L. 15 p.c., P.H.C. 5 p.c.
EDINBURGH.—July, 1915, L. ½d.; Aug., 1917, L. ½d., P. 5 p.c.; Nov., 1917, L. ½d.; May, 1918, rev. prices, L. 3½d., P. 1½d. plus 20 p.c.
ELGIN.—July, 1915, P. 12½ p.c.; Aug., 1916, L. ½d., P. 7½ p.c.
EPSOM.—March, 1916, 25 p.c.; March, 1916, rev. prices, L. 7d., P. 3½d., P.L., 4½d.
ERITH.—Sept., 1915, L. ½d., P. 10 p.c.
EXETER.—June, 1916, L. 1d.; June, 1918, L. 10 p.c., P.T. and Pub. L. 15 p.c.
FALKIRK.—April, 1915, 30 p.c.; Sept., 1917, L. ½d., P. .075d.; Feb., 1918, rev. prices, L. 6d.—4½d., P. 4½d. and special rates.
FARNHAM.—Dec., 1916, rev. prices, L. 8d., P.H.C. 4d. (restricted).
FAVERSHAM.—Oct., 1915, ½d.; Sept., 1917, ½d.; June, 1918, rev. prices, L. 6½d.—6d., P. 3d.
FINCHLEY.—June, 1916, L. 20 p.c., P. 10 p.c. and scale.
FLEETWOOD.—Sept., 1915, 10 p.c.; June, 1918, 25 p.c.
FRINTON-ON-SEA.—March, 1918, L. inc. to 9d.
GREAT YARMOUTH.—July, 1915, ½d.; Dec., 1915, ½d.
GILLINGHAM.—April, 1915, L. ½d.; Dec., 1915, H. ½d. plus 10 p.c.; Oct., 1916, 15 p.c.; Sept., 1917, 10 p.c.; Dec., 1917, L. 10 p.c., H.C.P. 20 p.c.
GLASGOW.—June, 1917, rev. prices, L. 5d. and 1½d. or 4½d., P. 2d. and 1d. and scale, H. 1½d. or 1d., KW. charge inc. 15 p.c.; Aug., 1917, .075d.; Nov., 1917, .10d., KW. charge inc. 15 p.c.
GLOUCESTER.—July, 1916, 20 p.c.; June, 1917, 13.3 p.c.
GODALMING.—June, 1918, L. to 8d., P. and H. 10 p.c.
GRANTHAM.—June, 1916, 20 p.c.; June, 1918, P. and H. 20 p.c.
GRAVESEND.—March, 1916, 25 p.c.
GRAYS.—June, 1915, 10 p.c.; June, 1916, 15 p.c.; July, 1917, 8.3 p.c.
GRIMSBY.—Oct., 1915, ½d.; Dec., 1917, 15 p.c.
GUILDFORD.—Sept., 1915, L. 10 p.c., P.H.C. 20 p.c.
HALIFAX.—Sept., 1916, P. 17½ p.c.; Dec., 1917, L.H. 12½ p.c., P. 20 p.c.
HAMPTON.—July, 1916, 20 p.c.
HARROGATE.—June, 1918, 25 p.c.
HASLINGDEN.—June, 1917, rev. prices, L. 4½d., P. and H. 15 p.c.; Dec., 1918, L. ½d., P.H. 10 p.c., T. flat rate 1½d.
HASTINGS.—Sept., 1915, L. 10 p.c.; Dec., 1915, 10 p.c.
HEBDEN BRIDGE.—Dec., 1916, L. 20 p.c., P. 25 p.c.; Dec., 1917, L. 8½ p.c., P. 20 p.c.
HECKMONDWIKE.—June, 1915, 10 p.c.; July, 1917, 33.3 p.c., making L. 6d., P. 2d. and 4d.
HEREFORD.—May, 1915, 10 p.c.; May, 1916, 25 p.c.; Dec., 1917, L. 10 p.c., P. 10 p.c.
HESTON AND ISLEWORTH.—March, 1917, 25 p.c.
HEXHAM.—June, 1915, L. 1d.; Sept., 1916, L. 1d., P. ½d.
HEYWOOD.—May, 1915, 10 p.c.; Dec., 1915, L. 5 p.c., P. 10 p.c.
HIGH WYCOMBE.—June, 1915, 10 p.c
HORNSEY.—March, 1916, 10 p.c.; Dec., 1917, rev. prices, 40 p.c. inc. on pre-war prices.
HORSHAM.—March, 1917, rev. prices, L. 6d., P.H. 2d.; Dec., 1917, price increased.
HOVE.—Sept., 1915, 20 p.c., P. 10 p.c. or flat rate 2d.
HUDDERSFIELD.—June, 1915, 12½ p.c.; Sept., 1916, 12½ p.c.; March, 1918, 12½ p.c.
HULL.—Dec., 1915, L. ½d., P.H. 15 p.c.; Dec., 1917, L. ½d., P.H. 17½ p.c.
ILFORD.—March, 1916, 12½ p.c.; June, 1918, L. 6d. or 8d. and 3d. and 4½d. and 2d., R.V. plus 1½d. plus 50 p.c., P. 4d. to 2½d., H. 2½d., special rates 25 p.c.
ILKESTON.—March, 1916, rev. prices, L. 4d., P. 2½d.—1¾d., H. 1¾d.
IPSWICH.—June, 1915, L. ½d., P.H.C. and R.V. 10 p.c.; March, 1916, L. ½d., P.H.C. 15 p.c.; Dec., 1917, rev. prices, L. 6d., R.V., H.C. inc. 50 p.c. on pre-war prices.
ISLE OF WIGHT.—June, 1918, rev. prices, L. 8d., P.H. 10 p.c.
LYMINGTON.—June, 1918, L. inc. to 8d.
KEIGHLEY.—Sept., 1915, ½d.
KENDAL.—June, 1915, L. 1d., P. ½d.
KESWICK.—June, 1916, L. 10 p.c.
KETTERING.—June, 1915, P. 10 p.c.
KINGSTON-ON-THAMES.—April, 1915, rev. prices, L. 5d. or 7½d. and 3½d., P.H.C. 1.65d.; April, 1916, rev. prices, L. 6½d.—4½d., P.H.C. 1¾d.—1d.; Dec., 1917, P. 1½d.
KING'S LYNN.—July, 1915, L. ½d., P. 5 p.c.; Jan., 1916, P. 5 p.c.; Dec., 1917, L. ½d., P.H. 7½ p.c.
KIRKALDY.—Nov., 1917, L.P. 50 p.c. on pre-war prices.
LANCASTER.—April, 1916, ½d.; April, 1917, L.P. 22 p.c., T. 12½ p.c.; Dec., 1917, 25 p.c.
LEEDS.—March, 1918, 10 p.c.
LEEK.—June, 1915, 10 p.c.; June, 1918, rev. prices, L. 5d. plus 40 p.c., P. 2d.—1½d. plus 50 p.c., or KW. charge plus ½d. plus 50 p.c.
LEICESTER.—July, 1915, L. ½d., P. 20 p.c.; March, 1917, L. 1d., P. 15 p.c.
LEIGH (LANCS.).—June, 1917, L. 15 p.c.
LEITH.—Sept., 1917, L. ½d., P. ½d.
LEYTON.—March, 1916, L.P.H. 15 p.c., T. 5 p.c.; Dec., 1917, rev. prices, L.P. 33⅓ p.c. over pre-war prices, T. 10 p.c.
LINCOLN.—Dec., 1916, L.P. 20 p.c.; Sept., 1917, L.P. 10 p.c., contract 5 p.c.
LIVERPOOL.—Dec., 1915, 12½ p.c.; March, 1918, 17½ p.c.
LLANDRINDOD WELLS.—July, 1916, 1d.
LLANDUDNO.—Aug., 1915, ½d.
LONDON COMPANIES.—
Brompton & Kensington.—Sept., 1917, total inc. 20 p.c., ckg. 1d.
Charing Cross, West End & City.—June, 1916, rev. prices, 5d., 4d. & 2d.; June, 1918, rev. prices, 6d.
City of London.—March, 1915, P. 10 p.c.; March, 1916, 10 p.c.; June, 1917, public lighting 15 p.c.; Dec., 1917, L.H. 10 p.c., P. 10 p.c.; June, 1918, rev. prices, all charges 50 p.c. increase on pre-war rates.

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Kensington & Knightsbridge.—Dec., 1916, rev. price 5½d.; June, 1918, L. 10 p.c.
London Electric Supply Corporation.—Sept., 1917, total increase from 20 to 30 p.c.
Metropolitan Electric Supply Co.—Sept., 1917, total inc. 20 p.c.
Notting Hill Electric Supply Co.—March, 1915, ½d.; Sept., 1916, ½d.; total inc. 20 p.c.
South London Electric Supply Corp.—Dec., 1915, 9 p.c.; Dec., 1917, P. 11 p.c.
South Metropolitan.—March, 1915, 10 p.c.; June, 1918, rev. prices, 6d. plus 10 p.c.

LONDON BOROUGH COUNCILS.—
Battersea.—Sept., 1915, 10 p.c.
Bermondsey.—June, 1917, L. 40 p.c., P. 50 p.c.
Bethnal Green.—Sept., 1917, 33.3 p.c.
Fulham.—March, 1915, 5 p.c.; Dec., 1915, rev. prices, L. 4d., P. 1½d.; March, 1917, 5 p.c.; May, 1917, kw. system, plus 0.0075d. p.u. for each 6d. over 13s. cost of coal per ton; March, 1918, rev. prices, all charges increased 50 p.c. as compared with 1914.
Hammersmith.—Sept., 1917, L.P. 12½ p.c.
Hampstead.—Sept., 1916, 10 p.c.; Dec., 1916, 23.3 p.c.; Sept., 1918, 16.7 p.c.
Islington.—Dec., 1916, 25 p.c.; March, 1918, rev. prices, 1d. p.u. and under 50 p.c. inc. on 1914 prices, above 1d. p.u. 33.3 inc., public lighting, 1.75d.
Poplar.—March, 1916, P. and public lighting 10 p.c.; Sept., 1917, 10 p.c.; Dec., 1917, P. and public lighting 15 p.c., L.H.C. 10 p.c.
St. Marylebone.—Sept., 1915, 10 p.c.
St. Pancras.—June, 1915, 10 p.c.; Sept., 1917, reduced to 2½ p.c.
Shoreditch.—March, 1917, L.P.H. 25 p.c.
Southwark.—Jan., 1917, total increase equal L. 30 p.c., P. 50 p.c.; Sept., 1917, rev. prices, L. 6d.—3d., two rate L.P. 8d. and 2d.; March, 1918, P.L.H. 20 p.c., contracts, 33.3 p.c., limit of coal clause to be 15s. per ton instead of 20s.
Stepney.—Sept., 1917, 50 p.c.; March, 1918, special rate ¾d. plus 50 p.c.
Woolwich.—March, 1915, ½d.; Nov., 1917, L. (except factory) 1½d., P. ¼d.—¾d.

LONG EATON.—June, 1915, rev. prices, L. 4d., factory 3½d. and 2½d., P. 1½d. and 0.85d., H. 1d.
LOUGHBOROUGH.—Sept., 1915, 12½ p.c.; Dec., 1916, 12½ p.c.; June, 1917, factory L. 1d., kinemas 1½d.; Dec., 1917, P. 10 p.c.
LOWESTOFT.—March, 1916, L.H. 10 p.c.; May, 1917, L. ½d., P.H. 10 p.c.
LYNN.—Dec., 1917, L. ½d., P.H. 7½ p.c.
MAIDENHEAD.—Sept., 1915, L. ½d., P. 10 p.c.; April, 1916, L. ½d., P. 10 p.c.; July, 1917, L. 1d., P. 10 p.c.
MAIDSTONE.—Dec., 1914, P. ½d.; April, 1915, L.H., ½d.; Dec., 1915, L. ½d.; March, 1916, H. reduced to 1d.; June, 1916, rev. prices equal 25 p.c. inc. on original prices; Aug., 1917, L. ½d., T. ½d., other 10 p.c.
MALTON.—March, 1916, 20 p.c.
MALVERN.—May, 1915, 1d.
MANCHESTER.—May, 1915, L. 10 p.c., P. 15 p.c., R.V. from 12 to 15 p.c.; Dec., 1917, L.P.H., 20 p.c.
MANSFIELD.—June, 1918, 25 p.c.
MERTHYR TYDFIL.—June, 1915, rev. price, 4½d.
MEXBOROUGH.—July, 1916, rev. price, L. 4d.
MIDDLETON.—June, 1915, L. ½d., P. 12½ p.c.; March, 1916, L. ½d., P.H. 12½ p.c.; Dec., 1917, L.P. 12½ p.c.
MIRFIELD.—May, 1915, P. and public lighting, 10 p.c.
MORECAMBE.—June, 1917, rev. price, P. 5d.; March, 1918, L.P. ½d.
MUSSELBURGH.—May, 1918, 2d.
NELSON.—Dec., 1917, L. ½d., P. ½d.; March, 1918, L.P. ½d.
NEWCASTLE-UNDER-LYNE.—May, 1916, L. 5 p.c., P. 16.7 p.c., P. 20 and 10 p.c.; Oct., 1916, rev. price, L. 7½d.
NEWPORT (MON.).—June, 1915, 20 p.c.; June, 1917, 10 p.c.; Dec., 1917, 15 p.c. (except contracts).
NEWQUAY.—Dec., 1915, rev. price, 7d.; March, 1918, 3d.
NEWTON ABBOTT.—July, 1915, 16 p.c.
NORTHAMPTON.—Sept., 1915, L. 10 p.c., P. 7½ p.c.; Sept., 1916, L.H. 10 p.c., P. 12½ p.c.; June, 1917, 10 p.c.; Dec., 1917, 10 p.c.
NORTHWICH.—June, 1916, 10 p.c.; June, 1917, rev. prices, 7d. and 4½d., flat rate 6d.
NORWICH.—Dec., 1917, L.H. 5 p.c., P. 10 p.c.
NOTTINGHAM.—Nov., 1917, 7½ p.c.
NUNEATON.—June, 1917, 20 p.c. (P. 10 p.c.); Sept., 1917, total inc. 33.3 p.c.
ORAN.—Sept., 1917, L. 1d., P. ½d., H. ½d.
OLDHAM.—Dec., 1917, L. (except flat rate) 15 p.c., H.C. (except cotton mills), 15 p.c.
ORMSKIRK.—Nov., 1915, L. 10 p.c.; March, 1918, L.H.P. 10 p.c.
OXFORD.—June, 1916, 20 p.c.; March, 1918, rev. prices, L. 8d.—1d.
PEMBROKE (DUBLIN).—March, 1915, L. 5 p.c.; June, 1918, L. ½d., P.H.C. ½d.
PERTH.—Aug., 1916, L. 12½ p.c., P. 5 p.c.; Aug., 1917, 40 p.c.
PETERBOROUGH.—Sept., 1915, P. ½d.; Oct., 1915, 10 p.c.; Sept., 1917, total increase 20 p.c.
PONTYPRIDD.—June, 1918, 10 p.c.
PORTSMOUTH.—Dec., 1917, total increase will equal L. 30 p.c., P.H. 45 p.c.
PLYMOUTH.—Sept., 1915, L. ½d.
PRESTON.—June, 1915, L. ½d.
QUEENBOROUGH.—Dec., 1915, 15 p.c.
RADCLIFFE.—Sept., 1915, L. 10 p.c., P.H. 15 p.c.; July, 1916, L. 5 p.c., P.H. 10 p.c.
RAMSGATE.—Sept., 1918, rev. prices, L. 8d., P. 4d.—2d. plus 20 p.c.
RATHMINES.—June, 1916, L. ½d., P.H. ½d.
RAWTENSTALL.—June, 1916, P. 5 p.c.; Dec., 1917, L. 25 p.c., H. 30 p.c., P. 33.3 p.c., also coal clause, public lighting £5 kw. installed plus 2d.—½d.
REDRUTH.—March, 1918, rev. price 8d.
REIGATE.—March, 1916, L.P. 15 p.c., H. ½d. plus 15 p.c.; April, 1917, 18.5 p.c.
RICHMOND (SURREY).—April, 1915, 10 p.c.; Nov., 1916, rev. price, 4½d.
ROCHDALE.—June, 1915, L. 10 p.c., P.T. 15 p.c.; May, 1917, L. 10 p.c., P. 30, instead of 15 p.c. Also coal clause, Nov., 1917, L. 13.3 p.c., P. 1d., T. .25d.; May, 1918, L. 17.6 p.c., P. 4d.
ROTHERHAM.—July, 1915, L. ½d.; Sept., 1917, P.H. 20 p.c.; March, 1918, P. 13.3 p.c.
ROWLEY REGIS.—Aug., 1916, 20 p.c.
ST. ANNES-ON-SEA.—June, 1915, L. ½d., P.H. 10 p.c.; April, 1917, inc.
ST. HELENS.—June, 1915, L. 10 p.c.; July, 1916, 10 p.c.; Dec., 1916, 10 p.c.; April, 1917, 10 p.c.; Sept., 1917, 10 p.c.
SALFORD.—June, 1915, L.P. 7½ p.c.; March, 1916, L. 2½ p.c., P. 7½ p.c.; Nov., 1917, L. 10 p.c., P. 10 p.c.
SCARBOROUGH.—June, 1915, L. 10 p.c.; Dec., 1917, rev. price, L. 7d., P. 2½d., H.C. 1½d.
SHEFFIELD.—July, 1916, prices over 2d., 10 p.c.; under 2d., 20 p.c.; Dec., 1917, prices under 2d., 5 p.c.
SHIPLEY.—June, 1915, rev. prices, L. 4½d., P. 10 p.c.; March, 1916, P. 10 p.c.; Dec., 1917, L. ½d., P. flat rate ½d., sliding scale 25 p.c.; June, 1918, L. 1d.
SHREWSBURY.—March, 1916, 20 p.c.; June, 1917, 13.3 p.c.
SEAFORD.—March, 1917, L. ½d., P. ½d.; June, 1918, ½d.
SOUTHAMPTON.—June, 1916, 10 p.c.; Sept., 1916, 10 p.c.; Dec., 1917, 20 p.c.
SOUTHEND-ON-SEA.—June, 1917, L. ½d., P. ½d.
SOUTHPORT.—June, 1915, 10 p.c.; June, 1917, 5 p.c.; Dec., 1917, 5 p.c.
SOUTHWOLD.—March, 1916, 20 p.c.
SPENBOROUGH.—June, 1915, rev. prices, L. 4½d., P.H. 2½d. and 1½d.; April, 1917, rev. prices, L. 5½d., P. 2½d.; March, 1918, L. ½d. plus 10 p.c., P. ½d.—½d. plus 10 p.c., special rates 50 p.c.
STAFFORD.—June, 1916, P. ½d.; Sept., 1916, rev. prices, L. 7½d.; Dec., 1917, L.P. ½d.
STALYBRIDGE.—June, 1916, P. (on prices less than 1d.) 0.1d.; Dec., 1917, rev. prices, L. 4½d.—3d., heating 1½d., theatres and kinemas ½d., cotton mills 5 p.c., P. coal clause increased to 2d.; June, 1918, L. ½d., P. .35d., H.C. ½d.
STAMFORD.—July, 1915, 10 p.c.; June, 1918, P. and H. 10 p.c.
STIRLING.—Nov., 1917, L. ½d.
STOCKPORT.—June, 1915, rev. prices, L. 5d., H. 1½d. (above 25 units, existing rates plus 10 p.c.), P. coal clause.
STOKE-ON-TRENT.—June, 1917, 25 p.c.; Sept., 1917, 8.3 p.c.; Dec., 1917, 6.6 p.c.; March, 1918, 20 p.c.
STOURBRIDGE.—June, 1918, 50 p.c. on pre-war prices.
STOWMARKET.—April, 1917, price inc. from 8d. to 10d.
STRATFORD-ON-AVON.—April, 1916, 1d.; August, 1917, ½d.; Dec., 1917, rev. price 6½d.
STRETFORD.—Aug., 1915, L. 10 p.c., P. 15 p.c.; Oct., 1915, 15 p.c.
SUNDERLAND.—March, 1916, ½d.; March, 1918, H.P. contracts, 15 p.c.
SURBITON.—March, 1916, 1d.; March, 1917, 1d.
SUTTON.—July, 1916, ½d., P.H. ½d.; June, 1918, rev. prices, L. 6d. plus 10 p.c., P.H. ½d.
SWANAGE.—March, 1918, price raised to 10d.
SWANSEA.—Sept., 1915, hours of m.d. inc. from 91 to 137 in winter qr., meter rent adopted; March, 1918, 12½ p.c.
SWINDON.—Sept., 1915, L. 12½ p.c. or ½d., P. 12½ p.c., public lighting and T. 10 p.c., H.C. ½d.; Sept., 1916, L. ½d.; March, 1918, public lighting, 20 p.c., P. 3d.—1.8d., H. 1½d., T. 1.8d.
SWINTON AND PENDLEBURY.—Dec., 1917, 5 p.c.
TAUNTON.—Sept., 1915, 15 p.c.; June, 1916, 10 p.c.; March, 1917, 8.3 p.c.; June, 1918, 16.6 p.c.
TEDDINGTON.—June, 1916, 20 p.c.
THIRSK.—April, 1916, 20 p.c.
TODMORDEN.—Nov., 1917, rev. price, L. 5d., P.H.C. 10 p.c.
TORQUAY.—Sept., 1916, L. ½d.; June, 1917, ½d.; March, 1918, L. 1d., P.H.C. ½d.
TOTNES.—June, 1918, rev. price.
TROWBRIDGE.—Aug., 1916, 10 p.c.
TUNBRIDGE WELLS.—Sept., 1917, L. 10 p.c., P.H. 25 p.c.
WAKEFIELD.—Sept., 1915, L.P. 12½ p.c.; April, 1916, P. 12 p.c.; Dec., 1917, P. 25 p.c., L. 12½ p.c.; June, 1918, P. 1½ p.c. inc. for each 6d. increase per ton of coal, ½ p.c. inc. for each 1s. per week inc. to workmen.
WALLASEY.—July, 1915, rev. prices, L. 4d.—3½d., P. 2½d., H.C. 1½d.
WALTHAMSTOW.—June, 1915, 15 p.c.; Nov., 1916, L. 5 p.c., P.H. 10 p.c.; Sept., 1917, L. 5 p.c., P.H. 8.3 p.c.
WALTON-ON-THAMES.—Sept., 1916, rev. price, 7d.
WARRINGTON.—July, 1915, L.T. 10 p.c., H.P. 15 p.c.; July, 1916, 5 p.c.; June, 1917, 10 p.c.; June, 1918 (except tramways), 10 p.c.
WATFORD.—June, 1915, L. 12½ p.c., P. 10 p.c.; Sept., 1916, rev. price, L. 5½d.
WEDNESBURY.—Dec., 1914, 15 p.c.
WEST BROMWICH.—June, 1915, 20 p.c.; Dec., 1915, P. 15 p.c.
WEST HAM.—Sept., 1916, 10 p.c.; Sept., 1917, further 10 p.c.
WEST HARTLEPOOL.—Sept., 1917, 15 p.c.
WESTON-SUPER-MARE.—Dec., 1917, L. ½d., P.H. ½d.; June, 1918, L. 1d., P.H. ½d.
WEYBRIDGE.—June, 1918, P.H. 10 p.c.
WEYMOUTH.—April, 1916, L. 15 p.c., P.H.C. 20 p.c.; Sept., 1916, rev. price, L. 6d.; Dec., 1917, ½d.; Sept. 30th, L. 7d.—2d., military 5d.; fixed price, L. 20 p.c.
WHITEHAVEN.—Dec., 1917, L.P. 20 p.c.
WIGAN.—March, 1917, rev. prices, L. 5½d. to 3½d.; Sept., 1917, rev. prices, P. 2d.—1d., plus 25 p.c.
WIMBLEDON.—March, 1916, 10 p.c.; Sept., 1916, 15 p.c.; Sept., 1917, rev. prices, L. 6d., P.H.C. 2d.
WINCHESTER.—Sept., 1916, 15 p.c.; Dec., 1916, 10 p.c.
WINDERMERE.—June, 1916, 10 p.c.
WINDSOR.—Dec., 1917, price inc. to 8d.
WISBECH.—June, 1916, inc. to 6½d.
WOLVERHAMPTON.—March, 1916, 10 p.c.; Sept., 1917, 10 p.c.; Oct., 1917, P. (1d. p.u. and under) 10 p.c.; Dec., 1917, P. (1d. p.u. and under) 20 p.c., (over 1d.) 30 p.c.; June, 1918, P. (1d. p.u. and under) 10 p.c.
WORCESTER.—Oct., 1915, L.P.H. 10 p.c.; Sept., 1917, 10 p.c.; March, 1918, contracts ½d.
WORKSOP.—Sept., 1915, L. ½d., P. ½d.; May, 1917, ½d.
WORMIT.—March, 1918, L. inc. to 7d., contracts 17 p.c.
WORTHING.—Oct., 1915, L. 10 p.c. or total 5½d.; Jan., 1917, 20 p.c.
WREXHAM.—Dec., 1916, 10 p.c.; Sept., 1917, L.H. 15 p.c., P. 6.7 p.c.
YORK.—March, 1917, L.P. 10 p.c.

NOTES FROM CANADA.

(FROM OUR SPECIAL CORRESPONDENT.)

IN a recent issue of the *Canadian Engineer* there appeared an article on the Chippewa-Queenston power development of the Hydroelectric Power Commission of Ontario which is now in progress. A few extracts showing the salient features of this scheme will, no doubt, be of interest. The actual difference in level between Lakes Erie and Ontario is 330 ft., but only about half of this occurs at Niagara Falls where all the existing power plants are located.

By making a canal from Chippewa, some distance above the Falls, to convey the water, at the higher level, to Queenston, which lies beyond the Rapids, a gross head of 316 ft. will be obtained, and a net head of 205 ft. after deducting friction and other losses; some of the present power houses at the Falls are said to be working under net heads of less than 135 ft. The length of this canal will be 12¾ miles, of which there is a river section (the Welland River) of 4¼ miles, and an excavated section of 8½ miles. The river section will have to be deepened and widened and the flow of the Welland River will be reversed in this section. At the Queenston end of the canal the cliffs forming the Niagara river banks are nearly vertical, so that short penstocks can be utilised; this results in comparatively small cost and little loss of head in the penstocks, and does away with the need of surge tanks.

The canal is designed for a nominal rate of flow of 10,000 cu. ft. per second at minimum low water. The greater portion of the excavation will be in rock, but where earth is encountered it will be lined. The rock section will be 48 ft. wide at the bottom with perpendicular sides; the average wetted section will be 35 ft. deep. The velocity of the water in this portion of the canal will be about 6 ft. per second, maximum; in the earth section the velocity will be less, and the sides will have a considerable slope. The Commission has bought a wide strip of land as a right of way, and, if necessary, two more canals could be constructed on it in the future.

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The ultimate capacity of the plant to be installed under the present scheme will be 300,000 H.P., and two-thirds of that amount is being arranged for now; there will finally be six turbines, each of 50,000 H.P. capacity, four of these to be installed at the start. These turbines are larger than any water turbines yet in existence, but it is possible that the first extension from 200,000 H.P. to 300,000 H.P. will be made with a single unit as the Commission has designs for a 100,000 H.P. turbine set already.

The generator voltage will be 12,000 to be stepped up probably to 110,000 volts. The excavating equipment includes two five cubic-yard electrically-driven "Buegous" shovels of 735 H.P. nominal rating each. The weight of each of these shovels is over 400 tons, each has a capacity of 3,000 cubic yards a day when handling earth, and they can load cars standing on tracks 62 feet above the level of the tracks on which the shovels rest. The quantity of earth excavation is estimated to be 11,000,000 cubic yards, and of rock excavation 4,000,000 cubic yards.

The construction railway is double track 12½ miles long, and is electrically operated. A large jaw crusher which will have a capacity of 20,000 cubic yards of stone per day will be installed. Four railway bridges, besides a number of highway and foot bridges will span the canal at various points. The Commission is carrying out the whole of the work, no contractors being engaged. The estimated total cost is $25,000,000, and it is expected that the plant will be in operation in 1921.

The Commission of Conservation reports that at Sudbury, in Northern Ontario, the British American Nickel Corporation is erecting a new smelter and refinery, so that nickel will in future be treated in Canada instead of in other countries. Some 2,500 tons of ore per day will be handled, and there will be an annual production of nickel of about 10,000 tons. The entire plant will be operated by electric power, which will be supplied by the Hydro-Electric Power Commission of Ontario.

At Port Colborne, Ontario, the International Nickel Co. is also constructing a nickel refinery. This plant, which it is expected will soon be in operation, will turn out 7,500 tons of nickel a year, but future extensions will probably bring this up to 20,000 or 30,000 tons. The tons referred to are "short" tons of 2,000 lb. each.

At Shawinigan Falls an electrolytic plant has been erected for recovering metallic magnesium from magnesite; this metal is used for the manufacture of star shells and flares, and as an alloy with aluminium for aeroplane parts.

There are now in Canada 32 Héroult electric furnaces and 22 of other types, having a capacity of 173,000 tons of iron and steel, 50,000 tons of ferro-silicon, and 8,000 tons of other ferro-alloys per annum.

WATER-POWER IN ITALY.

BY "ULYSSES."

ONE of the effects of the war has been to reveal the present dependence of some countries upon imported coal for the maintenance of their industrial efficiency. France—with her northern provinces in enemy occupation—Holland, Denmark, and Argentina, all have to import coal, and of no country is this truer than Italy, which, according to the British Board of Trade, imported coal from the United Kingdom to the value of £5,234,285 in 1915, and of over £7,800,000 in 1916.

So great has been the shortage of coal in the Peninsula, that we hear of £4 and £5 a ton being cheerfully paid by manufacturers, and the Government has been compelled to forbid the cutting down of olive trees, which fetched a heavy price for firewood in factories. But a remedy close at hand has presented itself in the form of electricity generated by water-power from the numerous streams which flow from the Alps to the sea. The possibility of producing up to 40 million H.P. has been estimated by some enthusiasts in Italy, but, at any rate, 5 to 6 million H.P. is at present virtually assured, given the required capital and machinery, and to-day over 1,000,000 H.P. is actually in use.

A comparison of the water-powers of different countries shows that Germany and Switzerland are leading the world in the use of this power, while Italy, the U.S.A., France, Norway, and Sweden have all developed percentages—up to 17 per cent. in the case of Italy—of their possible water-power output.

In Italy the aspiration is very strong to become independent of coal by the development of their "white coal," and an extensive development of electrical power generated by water has been undertaken by a company called "Società Elettrica Riviera di Ponente," of which Signor Rinaldo Negri is the active managing director.

In 1917 the company increased its capital from lire 20,000,000 to lire 50,000,000 (= about £1,500,000 to-day), and has continued to pay a dividend of 12 per cent. since 1907. It has erected considerable generating stations on the Roja, Argentina, and Maira Rivers, and distributes electric power from the French frontier River Roja right away to Genoa (over 100 miles), and from the Maira River, in the Province of Cuneo, about the same distance to Novi and back to Genoa. The railway line has been electrified between Genoa and Savona (a distance of 30 miles), and it is proposed shortly to do the same for the line from Savona to Ventimiglia, another 50 miles. Travellers along the Riviera, where the endless tunnels, hitherto full of foul smoke, have so spoilt the journey, will welcome this purifying change.

In England we ought to welcome this industrial development in Italy by means of her water-power. The policy of exporting coal—our industrial life-blood—is very questionable; and the more Italy and other countries can develop their own resources, the better purchasers they will be for our manufactures and machinery. But in the meantime, we can learn much from the practical application of electricity to railways and factories, which is making such progress in Italy.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

11,177. "Gas generator for mercury interruptors for X-ray, &c., purposes." A. E. DEAN. July 8th.
11,180. "Electrical connector arrangements." R. A. R. BOLTON & J. W. BRIGGS. July 8th.
11,181. "Electric batteries." A. MOND & L. RABINOVITCH. July 8th.
11,197. "Accumulator grids." S. J. WILLIAMS. July 8th.
11,208. "Method of submarine electric lighting or illumination." W. M. MITCHELL. July 9th.
11,219. "Sparking plugs for internal-combustion engines." J. W. T. CADETT & M. E. DIXON. July 9th.
11,231. "Instrument for teaching the Morse alphabet and for transmitting wireless, &c., messages automatically by Morse code." H. H. AYSCOUGH. July 9th.
11,232. "Electric generator." H. H. HAVE, P. RAVEN & F. WEATHERILL. July 9th.
11,252. "Telegraphing apparatus." E. H. KNOWLES. July 9th.
11,279. "Couplings for electrical conductors." H. SIMON, LTD., & H. WILLIAMS. July 10th.
11,296. "Electrical control of gun movements." SOC. ANON. ITALIANA G. ANSALDO & Co. July 10th. (Italy, July 18th, 1917.)
11,301. "Electrical searchlight, &c., projectors." C. A. HUGHES, LONDON ELECTRIC FIRM & W. M. MORDEY. July 10th.
11,304. "Cone heating elements for electric heating apparatus." H. J. C. FORRESTER (Burgess). July 10th.
11,317. "Means for operating magneto in reversible internal-combustion engines." G. M. BLACKSTONE, E. CARTER & F. CARTER. July 10th.
11,336. "Electric lamp flashers." E. C. LEACHMAN. July 10th.
11,340. "Electric motor-starters." C. C. GARRARD, A. H. RAILING & W. WILSON. July 11th.
11,342/3/4. "Sparking plugs for internal-combustion engines." A. T. ELLIS & H. A. HANDS. July 11th.
11,370. "High-tension adjustable jump-spark conductor." F. H. NORRIS AND J. A. G. OGILVIE. July 11th.
11,409. "True-bearing magnetic compass." R. GILLESPIE. July 12th.
11,444. "Electric locomotives or cars." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.) July 12th.
11,459. "Instrument whereby short ends of carbon may be held securely in electric arc lights." W. A. GITSHAM. July 12th.
11,474. "Timing mechanism for ignition systems." BOSCH MAGNETO Co. July 12th. (U.S.A., September 26th, 1917.)
11,476. "Impulse starting mechanism." BOSCH MAGNETO Co. July 12th. (U.S.A., September 21st, 1917.)
11,478. "Process for insulation of electric installations." ELEKTRO-MATERIAL GES. July 12th. (Germany, April 11th.)
11,483. "Fixing and supporting devices for tubes, electric wires, &c." G. S. BOOTHROYD AND CALLENDER'S CABLE & CONSTRUCTION Co. July 12th.
11,484. "Leading-in conductors for electric lamp bulbs, &c." NIHON DANKI KOGYO KABUSHIKI KRISHA & T. YANAI. July 12th.
11,485. "Leading-in wires for incandescent electric lamps, &c." K. OHTANI. July 12th.
11,486. "Junction boxes, &c., for electric wiring installations." G. S. BOOTHROYD AND CALLENDER'S CABLE & CONSTRUCTION Co. July 12th.
11,500. "Electrical burglar alarms." G. KIRK. July 13th.
11,515. "Centrifuge electric speed-governor." T. N. C. KORESSOIS. July 13th.
11,525. "Sparking plugs." I. KNASTER. July 13th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

7,009. ELECTRIC SWITCHES. F. C. Stockel and Fyfe, Wilson & Co. May 16th, 1917. (116,734.)
8,638. ELECTRIC CONTROLLERS. Edison Accumulators, Ltd., J. F. Monnot and E. W. Lewis. June 15th, 1917. (116,747.)
8,722. REMOVABLE ELECTRICAL FUSE CARRIERS OR CONNECTING DEVICES. British Insulated & Helsby Cables, Ltd., and R. W. Blades. June 18th, 1917. (116,752.)
9,086. TERMINAL SOCKETS FOR ELECTRICAL CONDUCTORS. St. Helens Cable and Rubber Co. & J. C. White. June 25th, 1917. (116,764.)
9,587. ELECTRIC CONDENSERS. F. R. Simms & Simms Motor Units. July 3rd, 1917. (116,780.)
9,594. PRODUCTION FOR COLOUR MUSIC AND APPARATUS THEREFOR. A. B. Hector. July 3rd, 1916. (107,767.)
10,160. ELECTRIC WELDING MACHINES. T. E. Murray. October 23rd, 1916. (111,089.)
10,472. LIFTING MAGNETS. A. West & Co. and L. Satchwell. July 20th, 1917. (116,791.)
12,105. SUPPORTS FOR DEVICES SUCH AS ELECTRIC FANS. F. C. W. Thompson. August 23rd, 1917. (116,805.)
15,541. ELECTRICAL ACCUMULATORS. E. A. Cotte. October 25th, 1916. (111,107.)
18,501. TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. December 15th, 1916. (112,026.)
18,595. AUTOMATIC TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. & C. F. Tomlins (Automatic Electric Co. in part). December 14th, 1917. (116,849.)

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3,304. AUTOMATIC TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. March 19th, 1917. (114,422.)

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THE ELECTRICAL REVIEW.

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In view of the Order recently issued by the Paper Controller, readers are urged to place a definite order with their newsagents for regular supply of the ELECTRICAL REVIEW weekly. In the event of difficulty arising in so doing, a subscription rate order should be forwarded direct to these offices, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4

MOTOR PROBLEMS.

IN spite of the excellent progress that has been made in the design and construction of electric motors and controllers, there is much to be done before we can claim to be able to cope with all reasonable conditions of working. Not least of the difficulties that still await a complete solution is that of the variable-speed A.C. motor, and this question is constantly increasing in importance as the three-phase system comes more and more into vogue. It cannot be doubted that the future of electricity supply in this country—and, indeed, everywhere—is closely associated with polyphase currents; the proposition does not require demonstration—the facts speak for themselves. For constant-speed driving the induction motor, were it not for its heavy starting current under load and its deficiency as regards power factor, would be almost ideal; and, indeed, it is already so good that its improvement is not a matter of great urgency. But for variable-speed driving the problem is much further from an adequate solution. Granted that there are several extremely ingenious and highly efficient variable-speed A.C. motors on the market, we do not think it is claimed that any of these can successfully compare or compete with its D.C. rival without sacrificing one or other of the qualities of cheapness, efficiency, convenience, high power factor, constant-speed characteristic, or uniformity of speed variation. So long as the change of speed takes place by jumps, or, to avoid this drawback, a commutator is employed, the D.C. motor will retain material advantages for certain fields of application, and it is often considered preferable to convert part of the A.C. supply to D.C. rather than to install the A.C. machine. In saying this we do not wish to cast a slur upon the latter; we are merely stating facts that are well known to the practical men who are engaged in such work.

But, on the other hand, the D.C. motor is not faultless. Perhaps its most tender spot is its inevitable possession of a commutator. We have just pointed out its superiority over the A.C. motor for variable-speed work, but let us take the case of a D.C. shunt-wound machine with a combined controller and regulator, and having a speed range of 4 : 1. When this motor is running at its top speed on a 460-volt circuit, and an emergency arises requiring it to be stopped at once, the user throws back the controller handle, which action first cuts out the field regulating resistance, and if the machinery possesses considerable inertia, the motor will be driven by it for an appreciable period as a dynamo, generating at a pressure which may easily, under certain conditions, exceed 2,000 volts. Naturally, a flash-over is to be expected, but even if this does not happen, it is not fair to the motor to apply three or four times its normal voltage to the windings, perhaps many times a day. Moreover, the armature would be returning a heavy current to the mains at the moment when the circuit was opened, tending to burn the contacts of the starter.

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Of course, a circuit-breaker can be used, but then up goes the cost; and some interlocking device is necessary to ensure the return of the controller handle to the starting position before the circuit is closed again, further adding to the cost and complication. Here is a nice little problem, which we commend to our inventive readers; it is not a hypothetical case, but an actual difficulty in present-day practice. Delaying-devices to prevent the quick throwing-off of the handle do not meet the requirements; a *quick* stop must be provided. And the solution must be mistake-proof, for the apparatus is handled by unskilled operators.

If the regulating rheostat is separate from the starting rheostat, it is not difficult to fulfil the desired conditions; apparatus is, in fact, available for the purpose. Our remarks apply only to the combined starter and regulator with a single operating handle, which from the practical point of view is desirable on the score of simplicity and cheapness—two considerations of the first importance.

The Skilled Labour Strike Ended.

Another most deplorable war-time dispute is ended, and the men have returned to their posts on the understanding that the Ministry of Munitions Committee of Inquiry will investigate immediately the matter of the embargo on skilled labour. The determination of the Government to withdraw protection certificates from men who remained on strike on Monday brought them to their senses. That the Government had behind it the support of the great body of the nation in its decision to deal with the matter firmly, is beyond all doubt. In critical days such as these, when our brave forces are in a position to deal more effectively with the Enemy "over there," and when in consequence a blow is being struck at the moral of the German people, it is impossible to tolerate traitorous conduct at the bench any more than in the trench. We deplore the existence of the spirit which permitted such a strike, yet we cannot altogether regret that the dispute has occurred, for it has revealed to the nation just where we stand in relation to certain industrial questions. We have cherished hopes of some measure of success attending the various efforts to secure Industrial Peace after the war, but these periodical strikes while we are at deadly grips with the tyrant foe do not encourage us in that connection. If men cannot submit to some limitation of their occupational liberties, while millions of others are risking their lives, in the interests of larger and permanent liberty, what will happen when there is Peace between nations? There is unquestionably a need for a strong Government with the nation behind it, and if a Parliamentary Election is going to secure such for us, the sooner it takes place, the better. If there is a loose rein after the war, or if there are blunders due to vacillation, the way to ruin will be short and steep. Sectional demands must never be permitted to imperil the interests of the nation as a whole.

Electric Traction and Freight Haulage.

In the minds of the public and the Government, the electric railway is associated only with the transportation of passengers. This is unfortunate, since it means that many miles of track are being used only for a fraction of their capacity, instead of fully sharing the burden of the great freight movement of the present time. An immediate step of the first importance in the relief of traffic congestion is the elimination of needless duplication of service of steam and electric lines. An article by Mr. A. B. Cole, who has recently made an extended personal study of the freight-carrying facilities of electric railways, in the *Electric Railway Journal*, dealing with seventeen typical cases taken from data secured from the War Board of the American Electric Railway Association, indicates the prevalence of this condition in the United States.

It has been said that steam railroads are best fitted for long hauls, but an investigation of the existing electric railways discloses some surprisingly long hauls, and shows what could be done by the addition of a few miles of track here and there, the increase of motive power and car equipment, terminal facilities, &c., to relieve the steam railroads of burdensome local passenger and freight service, particularly the latter.

Many interurban electric railways gave little or no attention to the movement of freight, especially those built during the early development of this class of transportation. Those constructed in more recent years have been devoting more attention to the development of this service. Fortunately, enough instances exist to prove that not only can electric railways do great things to relieve freight congestion, but also that they can do it in the fullest co-operation with the steam roads. Where there is duplication between steam and electric lines, the facilities of the latter should be used to their maximum capacity to relieve the steam line of the short-haul traffic. The general equipment, motive power, and cars which would thus be saved could be released for long-haul through freight and passenger service on the steam lines.

The undeveloped facilities of the electric railways that already exist are of such magnitude, and can be made available in the present crisis at such a comparatively small cost, that it would seem extravagant and wasteful were the Government to countenance any other means of transportation before the freight-carrying power of the electric roads had been fully developed.

The above observations apply mainly to conditions prevailing in the U.S.A., but they also apply in a less degree to this country. It is noticeable that while the electrified lines which already exist in this country cater for passenger traffic only, the goods traffic at night over the same railways is hauled entirely by steam locomotives. The reason for this inconsistency is not apparent, and we fail to see why such electrified railways as we already possess should not share in the haulage of goods as well as passenger traffic.

The amount of relief which the electric railways could afford the steam lines is not to be measured merely by the tonnage handled, but by the increase in the physical capacity of the steam railroads, through the elimination of long waiting at freight terminals, thus conserving fuel and labour by a reduction of standing time.

Trade with Italy.

The British Chamber of Commerce for Italy is working hard to increase its membership between now and September. It is justifiably eager that the coming of Peace shall find its organisation in a state of full efficiency, in readiness for encouraging and developing British-Italian reciprocal trade and economic relations in the future, and for preventing present enemies from resuming their former "overpowering position" in the Italian market. The membership of the Chamber which for 1917 was 845 has now grown to 950, and the present desire is to pass the 1,000 by September. The headquarters are at Genoa, while there are branches at Rome, Naples, Milan, and in Tuscany; one for Sicily is under consideration.

Many of our electrical firms are, no doubt, considering the needs of the Italian market and their own schemes, either individually or through associated action; but we have pleasure in drawing their attention to the work of the British Chamber which, as our pages have shown, has performed a very useful service almost from the beginning of the war in circulating information in this country concerning business opportunities in Italy that have been open to British manufacturers. The London offices are at Oxford Court, Cannon Street, E.C.

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PRACTICAL POINTS CONCERNING INTERPOLES.

[COMMUNICATED.]

It is very convenient when testing interpole motors or dynamos to have some method of making the polarity of the interpoles right. Of course, if the machines are started up with the interpoles having the wrong polarity, sparking is sure to occur, and then the interpoles have to be altered.

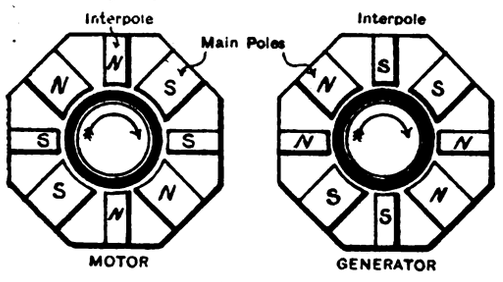

Fig. 1.

As the armature and interpoles are connected in series with each other, and a permanent connection is generally made of one armature lead to one end of the interpoles, it necessarily follows that if the interpoles are wrong the armature leads must be changed over, in order that the polarity of the interpoles with respect to the armature may be correct. When the interpoles are made correct in this manner, it is necessary to keep the armature and interpoles always connected permanently, and when it is necessary to reverse the direction of rotation, it must not be done by changing over the armature leads, but by reversing the shunt connections; if it is a shunt motor or dynamo, as a machine intended for a dynamo must be excited, it is run as a motor first, and the interpoles are made right in the same way; if it is a series-wound motor, the series field connection must be changed over. In the case of a compound-wound machine the series winding will also have to be changed over in order to keep it from opposing the shunt or weakening it. One of the best methods of finding out if the interpoles are correct has been found by the writer to be as follows:—

1. Move the brushes to the left or right of the neutral position.

2. Pass a current through the interpole coils and armature connected in series. The armature will then rotate

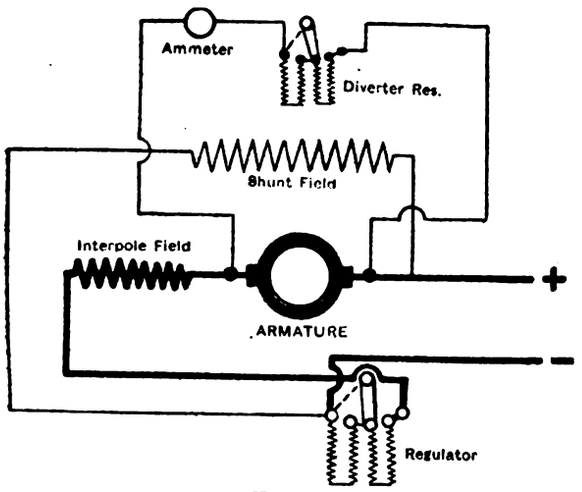

Fig. 2.

in one direction or the other when sufficient current is passing. If it rotates in the same direction as the brushes are moved, the interpoles are correct.

When it is found by the rotation of the armature that the interpoles are wrong, it is necessary to change over the two armature leads, or when it is not convenient, owing to the number of brush spindles, each armature lead should be moved to the next spindle of a different brush polarity.

If the interpoles are weak, it is possible for the armature to rotate in a direction contrary to the above rule, but this occurs very seldom, and would soon be discovered.

Another method is to start the machine up in the usual way and with load on. In most cases it would be improbable that much load could be got without severe sparking if the interpoles were wrong. If any doubt exists regarding the connections of the interpoles, it is possible to try round the yoke outside with a compass, but this is doubtful with a small load on the machine. If the inter-

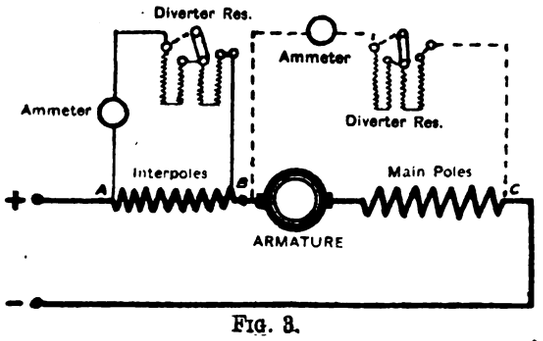

Fig. 3.

pole preceding a main pole with respect to the direction of rotation is of the same polarity, it is then correct in the case of motors, and otherwise for dynamos (see fig. 1).

There should be no sparking at all with interpole machines, and if the interpoles have correct polarity, and the machine is found to spark, there may be something wrong with the strength of them. If it is known what the resistance of the interpoles should be, the volts-drop can be taken when the machine is running, and if the resistance is low, it suggests that the interpoles are too weak. In the case of a shunt-wound motor, the current must then be diverted from the armature whilst the motor is running at full load, by means of a resistance connected in parallel with the armature, and having a regulating switch and suitable ammeter in circuit. The amperes should be diverted gradually, until the sparking ceases. This test is arranged as shown in fig. 2. Having got a sparkless position, the reading on the ammeter will then show how many more ampere-turns are required to be put on the interpole in order to make a permanent correction for sparking.

The interpole resistance being too high would suggest that too many ampere-turns were on the interpoles. and that they were too strong; this being the case, some current

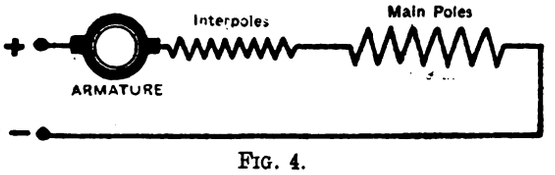

Fig. 4.

must be diverted from the interpoles, and a similar calculation from the ammeter reading, when sparking stops, will show how many ampere-turns require to be taken off the interpole coils.

When sparking takes place at all brushes equally, the fault will most probably be caused by the interpoles being either too weak or too strong, and measuring their actual resistance when the correct resistance is known will indicate in most cases whether they are strong or weak.

If the sparking took place at one set of brushes, and not at the others, this would show that one of the interpole coils was less effective than the others. To correct this, it would be necessary to take the resistance of each coil separately, when it would probably be found that some part of one coil was shorted. This fault may easily occur when copper-tape coils made up to carry large currents are placed in sections on top of each other without adequate insulation, or carelessly put together, and in some cases with ordinary wire coils also, the number of turns being incorrect. If one interpole were connected so as to have the wrong

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polarity, it would cause worse sparking than a short circuit, as previously stated.

In temporarily strengthening or weakening the interpoles of a series motor when running, the connections should be made as in fig. 3, as, in the case of strengthening the interpoles, current would have to be diverted from *a* and *b*, and in the case of weakening the interpoles this arrangement allows convenient diversion from *b* to *c*. If the connections are made as in fig. 4, it is not convenient to divert current from the armature and series winding, leaving the interpoles only strengthened, therefore the connections in fig. 3 are best for the purpose.

Sparking may take place owing to bad design, such as too few sections in the commutator, which is a bad fault, but where the interpoles are faulty it can generally be remedied. If the interpole iron is too large in section, the tendency in most cases is for the motor to surge. By reducing the section, so that at a suitable load the density would become increased, surging may be prevented.

Surging takes place mostly on variable-speed machines which have the speed increased by weakening the main field. If the brush rocker is behind the neutral position with respect to the direction of rotation, the motor tends to surge, but by moving the rocker forward in the direction of rotation, the tendency to surge is reduced. The distance moved should be decided by the sparking and running conditions. Of course, the correct position of the brushes should be actually the neutral position, but in some cases it is necessary to keep the rocker slightly forward.

When the correct resistance of the interpoles is not known, and there is a doubt as to whether they are too strong or too weak, a very good method of finding out which is the case is given in an article in the Electrical Review, August 24th, 1917, by Frederik Murgatroyd, B.Sc., which uses the drop of volts between brush and commutator throughout the brush thickness. Test curves, made as explained in the article named, show exactly whether to strengthen or weaken the interpoles to cure sparking and to get ideal commutation.

If it is not desired to go to this trouble to get curves, it is practicable first to try weakening the interpoles, and if sparking increases try strengthening them.

PACKING MACHINERY FOR TRANSPORT.*

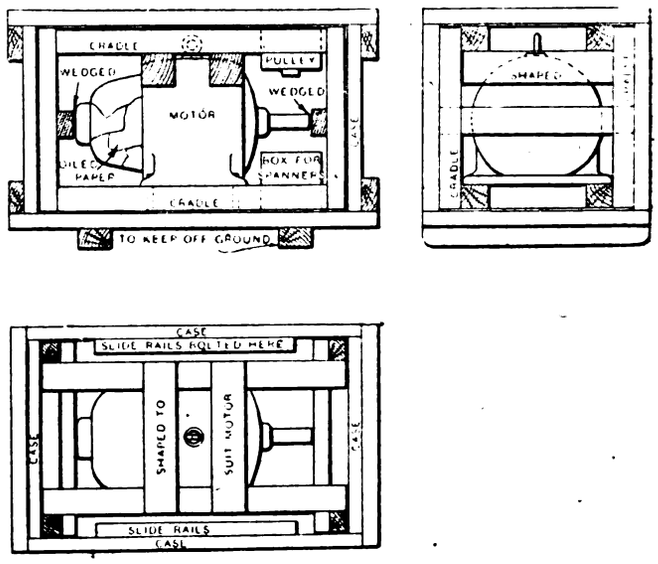
By J. F. SHIPLEY.

Both in Great Britain and still more in the United States packing is badly done. It should receive the attention of an engineer who has had experience at the receiving end. The usual method of first-class firms in this country is to build a case slightly larger than the piece of machinery to be packed. The machinery is then bolted down to one side and usually left unwedged. Auxiliaries such as tools, Lewis bolts, pulleys and rails are tied to the machine in a package by rope or string.

What happens to such a case during transit? It gets tumbled down on end; the machinery inside not being supported all round breaks away from the case and continues the journey loose. Every further tumble does more damage. The case arrives disabled, lugs and projecting pieces are knocked off the machine, paint is chipped, and dents occur everywhere. The new machine must at least go to the repair shop, involving loss of time, expense and exasperation to the customer. The manufacturer suffers a certain loss of credit, not much perhaps, because most manufacturers are alike. Often with, for example, an electric motor, the first tumble on the end allows the armature and shaft to move independently of the carcase. This results in the bending or shearing through of the oil rings, or of the detent screw of the bearing sleeves; or in either one or both end bearing shields being broken. Many machines so damaged have come to my notice.

The illustration shows a type of packing that has been proved as nearly perfect as possible. It costs about 30 per cent. more than ordinary packing. During 12 years about 10,000 such cases averaging 400 kg. per case came through my hands. The maximum expenditure in any one year for repair of damage to contents during transit was £20. The corresponding value of the goods was about £30,000. Insurance for breakage, usually costing 1 per cent. on declared values, is thereby unnecessary. Eight hundred such cases, containing hydroelectric machinery of all sorts complete with switchboards and instruments, were sent, with two transhipments and journey by rail, and then a 100 miles journey over mountain tracks by mule to the top of the Andes in South America. There were no breakages at all.

On the Pacific coast of South America, for instance, vessels at most ports have to lie out in open sea, and tranship their cargo into lighters for the port. The Pacific rollers are very heavy. The rise and fall of the lighter alongside of the ship is often 6 to 7 metres. If the crane operator does not gently drop the case of machinery when the lighter is at its topmost



Packing Case for Foreign Shipment.

position, a heavy fall occurs, the packing case may be smashed, and the machinery thereby damaged. Sometimes the goods go through the bottom of the lighter, and the lighter is lost as well. United States machinery suffers most under such circumstances.

Note that the material in the case is contained in and entirely supported by a strong but simple cradle. The cradle is entirely independent of but closely fits a strong packing case. Should the case be dropped on its end or in any position, the cradle will take the whole of the shock, transmitting it to the other end of the case, and it shields the contents from any injury at all.

In the event of such packing cases having to be stored, battens to keep the cases off the ground are bolted to the bottom, and the cases are lined, if not all round at least at the top and from a few inches down on each side, with tarred waterproof paper. Machines kept in storage for two years in a climate such as that of this country keep very satisfactorily.

A Skidding Test.—Some time ago the Bay State Railway, Boston, Mass., conducted a skidding test on Davis (American Steel Foundries) one-wear, cast-steel, manganese-tread wheels. It was desired to determine to what extent a skid of very unusual length would flatten these wheels, and to that end a stretch of level tangent track 110 ft. in length was prepared for the test, and was divided into three parts. The first section, 30 ft. in length, had both rails greased with heavy oil; the next 30-ft. section had both rails greased and sanded, and the remaining 50-ft. section had both rails covered with dry sand. The test was made with a 30-ton double-truck car with 33-in. wheels, and consisted in starting the car and attaining a speed of 35 m.p.h. at the moment of entering upon the 30-ft. greased section of track. An emergency application of the air brakes readily locked all eight wheels, and they were permitted to skid until the car came to rest, with the forward pair of wheels just clear of the farther end of the 50-ft. dry-sanded section. The forward pair of wheels skidded the full 80 ft., while the rear pair skidded some 25 ft. less. The wheels remained fixed, thus confining the entire abrasive action to the eight points of contact with the rails, which points were prick-punched for identification before moving the car. A careful visual examination of the wheel treads disclosed a brightly polished elliptical spot of about ⅜-in. major axis and ¼-in. minor axis. That the manganese treads are somewhat ductile was evidenced by the slight flowing of the steel to the trailing side of the contact ellipse, where it was deposited in a very thin ridge about $\frac{1}{64}$-in. in height. After the test was completed the test car was again put back on the line, and the wheels rendered satisfactory daily service for 15 months, at the end of which time they were removed as worn out.

* From the *American Machinist*.

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ELECTRICAL RECONSTRUCTION IN BELGIUM.

The Programme of the Comité d'Etudes pour la mise en commun des Productions d'Electricité en Belgique.

The "Committee of Investigation for the pooling of the production of electricity in Belgium" was constituted in London in January, 1917, after Mr. Joseph Carlier had proved by an extended study of the question, that it was imperatively necessary for the future welfare of Belgium after the war to pool the production of electricity. The committee is presided over by Mr. Maurice de Smet de Noeyer, chairman of the "Société des Docks, Force et Lumière," of Ghent. His secretary is Baron F. Chazal, Secretary of the Enquête Economique du Gouvernement Belge.

A report of all the work done up to July of this year is about to be published; but a most interesting report, over the signature of Mr. J. Carlier, vice-chairman of the "Comité d'Etudes pour la Mise en Commun," and Assistant Professor of Railways at Liége University, was placed before the London Committee of the "Enquête Economique" of the Belgian Government on February 8th last, which shows precisely on what lines electrical reconstruction in Belgium should proceed.

The accompanying map shows that as many as 26 important power stations were in existence in Belgium before the war. In addition to these, there were a good many small power stations, which need not be taken into consideration.

After the necessary developments in connection with the electrification of the railways and the reconstruction of the ruined industries of the country have been carried out, the generation of electricity should be concentrated at the ports of Ostend, Ghent and Antwerp, and at the coal pits of Mons, Charleroi, Liége, and Limburg.

Super power houses should be erected at these places, as indicated by the letters A, B, C, D, E, F, and G, and these should be linked together by mains at a pressure of something like 80,000 to 100,000 volts. The 26 existing stations would be supplied with energy in bulk by these super stations as shown on the map, which embodies the leading features of the J. Carlier system.

It will be of interest to consider some figures in connection with the scheme thus briefly outlined.

Mr. Carlier has calculated that if the railway network were completely electrified, the maximum demand for power would not exceed 250,000 kw. If all the industries were supplied with electrical energy for motive power, something like 500,000 kw. would be required. These figures are taken from official statistics.

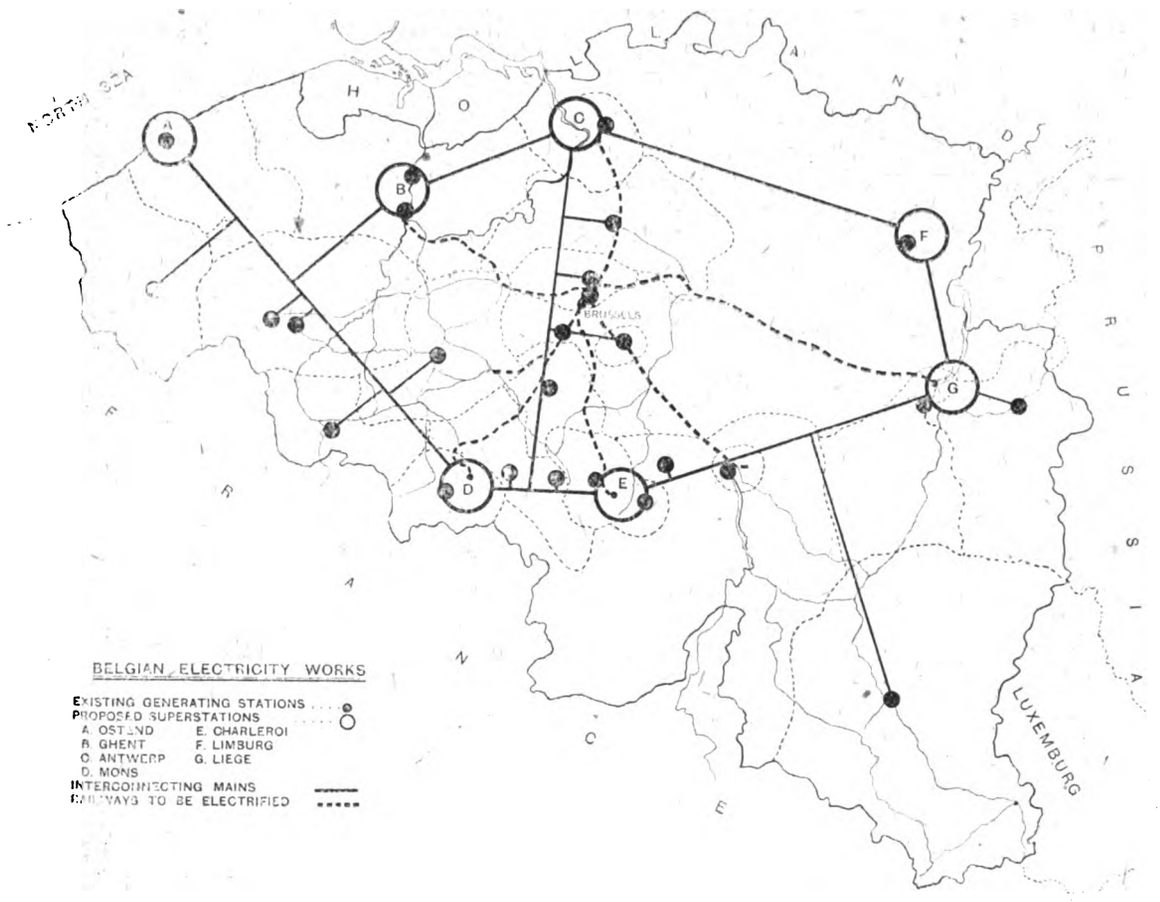
Thus, on the whole, something like 1,000,000 kw. of power would be required, and if provision were made for the demand that would be experienced five to ten years hence, about 1,250,000 kw. ought to be provided for in the super station system.

Next let us consider the saving of coal that may be expected to result from the adoption of the scheme. During the year 1912 the Belgian collieries extracted 22,972,140 metric tons of coal, valued at 380,444,300 francs; the average selling price was 16 francs 58 per metric ton, and the average cost price 16 francs 22 per metric ton.

By the general electrification of the railways, a yearly saving of about 1,000,000 metric tons is quite possible; and by the application of electric power to industries, something like 3,900,000 metric tons can be saved. Roughly, therefore, 5,000,000 metric tons could be saved annually.

This represents, on the basis of the figures given above, a saving of 22 per cent. of the annual output of the Belgian collieries, having a value of about 83,000,000 francs. But that is not all, as a great many other factors of the utmost interest should result from the general electrification of the country.

To develop the use of electricity is, as we know from many instances, of great benefit to the wealth of a country. For example, in the United States the energy used per inhabitant is more than 56 per cent. over the figure for the United Kingdom, and we know that the town of Stalybridge (26,513 inhabitants) in 1915-1916 held the record in the United Kingdom for the use of electrical motive power, with the figure of 250 kw.-hours per year and per inhabitant. The more motive power is used, the greater is the earning power of any worker, say the people who are versed in social economics.



The solution of the worker's problem, and also that of the employer, is one and the same. It consists in the use of electrical energy for industrial purposes to the utmost possible extent.

Now, the Comité advocates the linking-up of the Belgian power stations which are still in existence, whilst keeping in view the construction of super power stations, so as to supply electrical energy in bulk to the 26 centres, which take the place of the old power stations.

From the document of January 18th, 1918, which was discussed at the sitting of the Belgian "Enquête Economique" in London of February 8th, we gather that the super power stations of about 100,000 kw. to 300,000 kw. should be erected at Ostend, Ghent, and Antwerp, and in the coal districts of Mons, Charleroi, Liége, and Limburg (Genck).

But as the gas coal exists for the most part in the districts to the south of Mons, and of Limburg (Genck), it seems likely that a very large system of big power stations should be erected to the south of Mons, since the conversion of the coal into gas is the most economical method of utilising the fuel.

Hence, the power stations at the ports of Ostend, Ghent,

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and Antwerp should be of something like 60,000 to 80,000 or perhaps 100,000 KW. capacity, as they would be supplied with British gas coal for the most part, and the four coal districts should have power houses with outputs of 150,000 to 300,000 KW. or even more.

It must be borne in mind that this does not necessarily mean that only *one* big power house of 100,000 to 300,000 KW. should be erected in each of the industrial districts, but that many big power stations, using surplus heat from blast-furnaces and all kinds of plants, should be, as far as possible, linked up in the industrial area, so as to concentrate in the one system of the said industrial district all the supplies of electrical energy that are available.

How is an understanding to be arrived at between the actual power station owners, the industrials, the State, the railways, and the municipalities?

The only possibility appears to lie in the formation of a combine under a co-operative scheme, which should be called, for instance, the *Société Nationale d'Electricité*. In this company the large power consumers should participate as well as the producers of electricity, the State, and the municipalities.

In such a way the most effective co-operation between the industrials, the producers, and the public services should be attained, and the capital required to enable the Société Nationale d'Electricité to build the super-power stations, and to erect the mains for the delivery of the energy, should be subscribed by the consumers, who would be at the same time shareholders of the company.

Such an amalgamation of interests should practically give satisfaction to everyone concerned, and the combine of consumers and producers would in all probability lead to the best results with regard to the cheapening of electricity.

THE DEVELOPMENT OF ELECTRIC CAST-STEEL ANCHOR CHAIN.

RARELY has the solution of a war emergency problem been obtained with such promptness and unexpected success as in the development of an economical method for greatly increasing the production of stud link anchor chain, as described by Mr. W. L. Merrill in the *General Electric Review* of June, 1918. Any process for making chains which would make a real deduction in over-all labour had to be a radical change from the conventional hand-forging methods, particularly eliminating the preparation of the material for the chain, which the hand method required.

In 1911 the Marion Steam Shovel Co. built some chain, the links being 36 in. long, and the wire 7.5 in. in diameter, by casting one link at a time with the moulds interlocked. Samples made in the Schenectady Works of the G.E.C. proved that successful chain could be made by this process. The first attempt was made by die-casting the links, and afterwards placing the studs in position, the same as in hand-welded chain. This method was found to be not feasible for a large production since there is a very critical time at which the moulds should be opened to prevent shrinkage cracks, and if opened too soon, the metal would not be congealed. Therefore dry sand moulds were resorted to, and successful chain was made by this method.

The Classification Society's requirements for two-inch chain are: breaking test, 225,792 lb.; proof test, 161,280 lb., there being no requirements for elongation or reduction in area. No reliable data on wrought chain being available, the question of corrosion was dismissed, it being felt that the life of electric steel chain in comparison would at least last during the present emergency.

ELECTRIC CAST-STEEL CHAIN AFTER STUDS HAVE BEEN FITTED.

Comparative tests were made by subjecting single links to a blow under a drop hammer, which somewhat approximates the action of abnormal conditions to which practically all anchor chain failures are due. Neither the electric steel nor the wrought iron showed failure under this test, but the former showed less deformation than the latter. Further investigation was carried on, and processes worked up for moulding chain in sections complete with the studs cast as a part of the link, and successful chain was made by this process in several foundries. Then chain was made in various sizes from 1⅞ in. to 2¼ in., the former sized link apparently being the smallest that it is at present practicable to mould. Tests were then carried out with various samples of chain in comparison with hand-wrought chain and Navy chain from the Charlestown Navy Yard. These tests consisted of tensile tests and shock tests in a standard M.C.B. machine. In all cases the electric steel chain showed greater tensile strength and stood more punishment in the drop test than the wrought chain. Further tests were made to get comparative data and specifications on a shock bending test.

As a result of this work, the American Bureau of Shipping, and the American and English Lloyds have approved and issued specifications permitting the use of electric steel anchor chain on shipboard, these specifications differing mainly from those for wrought chain in the following points: The original breaking test of wrought chain is now specified for the proof test with proportional increase in tests for sample links above this of 40 per cent. For example, the original proof tests of 2 in. chain, 16,128 lb.; for electric steel, 225,972 lb. The original breaking test for wrought chain, 225,792 lb.; for cast steel, 316,109 lb. To this is added a shock bending test for sample links.

Electric Melting Furnace.—According to *Electric Traction*, the Bureau of Mines has announced the perfecting of a type of electric melting furnace that may be revolutionary in the making of brass. Patents on this furnace, known as the Rocking electric furnace, have been taken out by the Bureau and have been assigned to Secretary of the Interior Lane as trustee. Free licences to operate these furnaces under the patents, it is understood, can be obtained by making application through Van H. Manning, director of the Bureau of Mines.

The new furnace, which it is claimed will reduce the important losses in brass melting, is the result of five years' experimentation by H. W. Gillett, chemist of the Bureau of Mines, in co-operation with the laboratory of Cornell University, the American Institute of Metals, and a number of manufacturers of brass.

Up to the present most brass has been made in costly crucibles of imported clay and graphite. Since the war it has been impossible to obtain the imported materials for crucibles, and manufacturers have had to put up with crucibles of much poorer quality, and at a cost many times the pre-war price. With the huge tonnage of brass needed for war purposes, such as shells for cartridges, manufacturers have been anxious for a solution of the crucible problem. The Bureau states that it is inevitable that the next few years will see electric furnaces largely replacing crucible furnaces, and that there will be a development comparable to that seen in the steel industry in the last few years. The electric furnace, it is also declared, will greatly decrease the loss of zinc, which, together with copper, makes brass. Zinc boils at a much lower temperature than copper, and there have consequently been large losses in the open crucible furnace through volatilisation of the zinc. The electric furnace is closed, and these losses are avoided. It is estimated that the unnecessary losses in brass-making are more than $3,000,000 a year in normal times and perhaps $10,000,000 a year in war time. Another claim for the electric furnace is that it gives more healthful working conditions for the men.

Conservation of Engineers.—According to the *Electrical Review* of Chicago, engineers of every branch of the profession who are taking part in the war activities of the U.S. Army and Navy are alarmed at the unfortunate waste of technical training caused by the drafting and enlisting of engineers for regular service with little or no regard for their technical attainments. These technically educated and experienced men are essential to the successful conduct of the war and cannot be replaced. There is continuing evidence that America is repeating in some measure England's mistake of sending technical men into the ranks when they should be carefully conserved for special duties in the fighting forces or on the technical staffs of the Army, the Navy, and the essential war industries.

These facts have been forced upon the attention of engineers who have been co-operating with the Government through the Naval Consulting Board, the National Research Council and the Engineering Council. Upon these organisations requests have constantly been made for engineers, chemists and other technical men for a great variety of military services. Thousands of names have thus been furnished to the Government departments and bureaus. The Engineering Council especially has devoted attention to this personnel work through its committee, known as the American Engineering Service, which has available classified lists of approximately 25,000 engineers and besides unclassified lists of many more. It is from these lists, directly or indirectly, that most of the names have been selected for war service. Engineers do not seek to avoid fighting, but earnestly desire to be given opportunities for fighting and other services in which they can be most effective and which cannot be performed by others. In the opinion of the Engineering Council technically trained men of all ages should be enrolled and conserved for technical duties, and special efforts should be made immediately by the War and Navy Departments to find and record such men among drafted and enlisted forces, and to assign them to places in which their special qualifications are needed.

A later issue of our contemporary states that the Government has established a Division of Engineering to supervise the employment of technical men.

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NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Austin Portable Electric Lighting Set.

In the *Advocate* for April (Vol. VII, No. 6), which is the house organ of the Austin Motor Co., Ltd., Longbridge

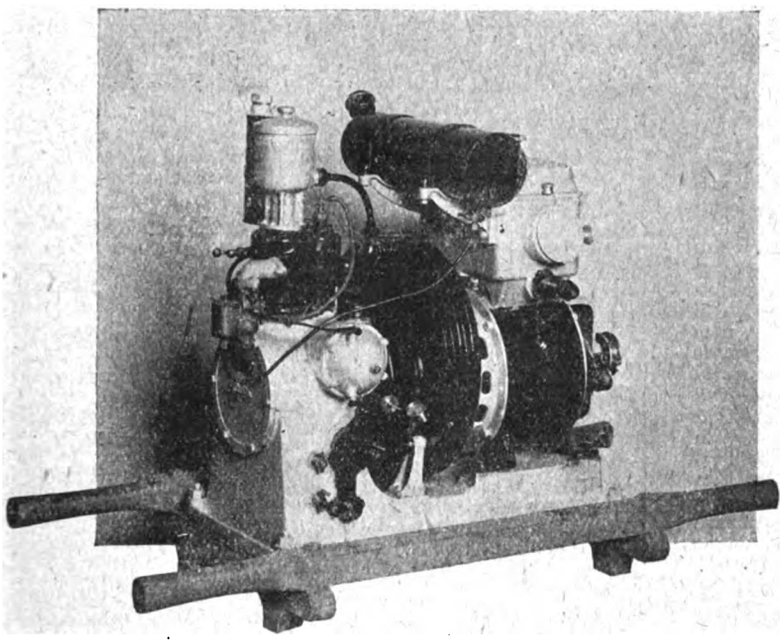


Fig. 1.—The Austin Miniature Portable Electric Lighting Set.

Works, Northfield, Birmingham, there appears a description of their small portable petrol-electric set for lighting and X-ray work, the chief objects aimed at in the design being lightness, compactness, and reliability. The set comprises a single-cylinder petrol engine, giving 1½ B.H.P. at a speed of about 1,300 revs. per minute, when using petrol as fuel, direct coupled to a reverse compound-wound charging dynamo having an output of 20 amps. at 35 volts. The engine is water cooled, being provided with a film-type fan-cooled radiator. A special drum-type controller is arranged to regulate the voltage from 4 to 35 volts, and the current according to requirements up to 20 amps. The engine and generator are mounted on a common aluminium base-plate supported on a wooden frame by means of which it can readily be transported.

A Pilot Transformer Lamp.

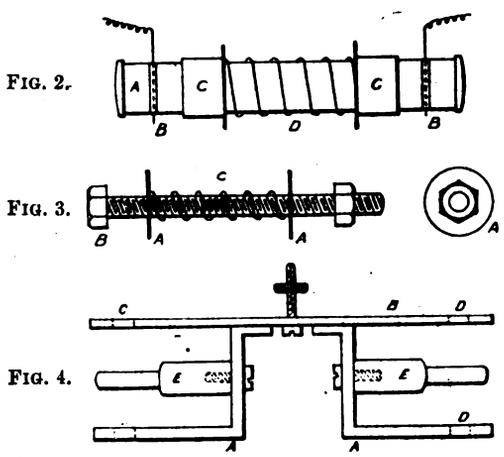
A small transformer called the Ferrix pilot transformer is described in the *Revue Générale d'Electricité*; it is used in conjunction with a small low-voltage lamp, and takes the place of a current transformer and ammeter in connection with any A.C. circuit. When a current is flowing in the cable to which the device is attached, the lamp glows more or less brightly, according to the strength of the current, giving a rough idea as to the load on the circuit. For example, the instrument, which is very inexpensive, can be fixed on a cable supplying a motor, and will give warning when the machine is overloaded; in three-phase installations it shows approximately whether the phases are balanced, and in lighting circuits it indicates whether the lamps are in use or not. The primary absorbs only a fraction of a volt, the power consumption being from 1 to 5 watts, and in case of a short-circuit on the line the magnetic leakage of the transformer comes into play, and limits the secondary current, thus avoiding the destruction of the lamp.

Three Useful Terminals.

The terminals illustrated herewith can be made quite easily from odds and ends of workshop material and should be useful to electrical students and experimenters. Figs. 2 and 3 refer to terminals intended for connecting to wires quickly or when it is inconvenient to twist their ends together. In fig. 2, A is a piece of round brass rod of any convenient size that happens to be handy, with a hole B near each end. Sliding easily along the rod are two short brass collars C C, with flanges soldered to the ends that face one another, separated by a spiral spring D. After assembling the parts the ends of the rod should be spread slightly by hammering to prevent the tubes falling off. The ends of the wires to be joined are passed through the holes B B, while the flanged collars are pressed together. Upon releasing the latter they are pressed tightly against the wire by the tension of the spring.

A simpler arrangement directed to the same end is shown in fig. 3. Two washers A A, of stout brass are dropped over a short brass bolt B, with a spiral spring C, between them. Screwing on the nut completes the terminal and keeps all the parts together. The wires to be joined are looped round the ends of the bolt and held by the pressure exerted by the spring.

The terminal shown in fig. 4 is intended for gripping very thick wires, and while of no use to the electrical instrument maker, is often handy for general experimental work. In addition to joining two thick wires a thinner one can be connected simultaneously, as a shunt. Two strips of thick sheet brass, ¾ in. wide, are bent twice at right angles as shown at A A, and soldered to a straight piece of the same material, B. Holes are made exactly opposite one another at C C, and D D, about $\frac{3}{16}$ in. in diameter or a little less. The thick wires to be connected are passed through these holes, and gripped by the spring studs E E, taken from an old electric lampholder. A



Figs. 2, 3, and 4.—Useful Terminals.

thinner wire can be connected if desired by looping the end round the small brass bolt, and screwing down the nut.—H. J. Gray.

A New Electric Tractor.

The Couple Gear Freight Wheel Co., of Grand Rapids, Mich., U.S.A., which has for some years been making a four-wheel electric motor tractor, has recently introduced a new model—a three-wheel tractor, designed for the purpose of converting ordinary types of horse-drawn wagons into motor vehicles, by simply substituting the tractor for the horses. As will be seen from the accompanying illustration, fig. 5, the new machine has a single-driving wheel of an improved type, mounted on springs at the front, the feature being that the armatures of the motors are mounted on ball bearings, while in addition Timken roller bearings are provided to carry the load and to take the thrust, enabling the end thrust bearing formerly used to be dispensed with. The outside diameter of the wheel band has also been reduced in order to permit the use of standard sizes of tyres; the new wheel is rivetless, the discs being cast from steel. The clearance within the

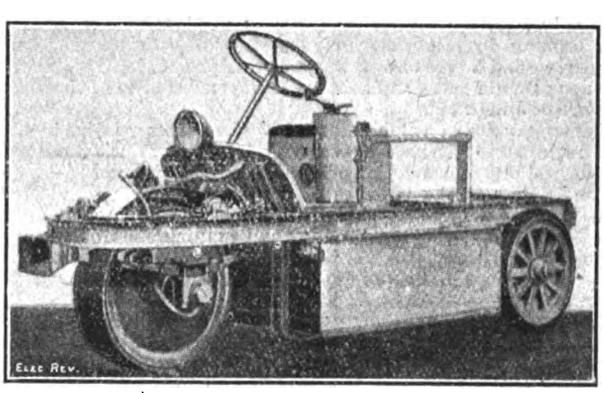


Fig. 5.—A Couple Gear Three-wheel Electric Tractor.

wheel has been increased materially over that provided for in previous models, and the motors are designed for a maximum pressure of 250 volts, and to give ordinary speeds at a pressure of 88 volts. The current is provided by a battery, mounted in a special cradle under the frame between the wheels, and the controller is located at the left of the driver's seat. The flexible cable connecting the battery to the motors in the driving wheel is pivotted to the centre of a guard placed longitudinally over the driving wheel tyre. It is claimed that the tractor is approximately no longer than the length of the horses it displaces, and that it and the wagon to which it is attached can be turned in the same radius as a horse-drawn wagon.

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CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Electric Propulsion of Ships.

I note Mr. Stanley Cook's reply to my remarks concerning Mr. Eskil Berg's claim for extremely high propulsive efficiency, and I really do not see what more I can add; pending Mr. Berg's own reply, which will surely come, there may be some reason for this higher efficiency of which I am not aware of, but I do know that on the *Jupiter* the American Navy officers carried out some very scientific tests before deciding on the electrical propulsion of their larger and more powerful vessels.

It is true that I said that it is not "economically" possible to provide a very high gear ratio in the "mechanical geared" method in this transmission, and my experience guides me; but, I am surprised that Mr. Cook makes claim to only 1 per cent. loss in such, in single gear, and 2 per cent. in double train. I can assure him that if he has been successful in bringing about such small losses which will stand up to the test of time under full duty, that he has done more than all the other gear makers I have approached, not only in this country but also in many parts of the Continent of Europe. He, however, is wrong in his statement that the induction motors in my "Paragon" system control the speed reduction in each case, because of large diameter; he will be interested to note that recent experiments which I have made in my laboratory have proved that future cargo boats will be fitted with, say, steam turbines running at 3,000 R.P.M. and propellers driven at full power at 100 R.P.M., and this without the use of gearing in either the case of the turbine or the motor. This 30 to 1 reduction in speed is made possible in the new "Paragon" variable speed short-circuited polyphase alternating-current motor, and I may add that a continuous range of speed can be obtained (without steps) from zero to full revolutions, with full torque. At the same time, I have cut down switchgear to the very minimum, consisting of the simplest and most robust nature. Transmission efficiency, as Mr. Cook is well aware, is not the only thing to be considered in connection with the design of the propulsion plant of large ships; there are many other features of engineering operation to be considered, and in all cases which I have struck, the electrical ship shows up best, and that is the opinion also of the finest brains in the United States Navy.

I realise also that there are few gentlemen in this country who have had more practical experience of "geared turbine" driven ships than Mr. Cook, and it would indeed be in the interest of the nation if the Government were to allow us to fit two sister ships—he to fit his ship with his 1 per cent. gears and I to fit my ship with my latest inventions; let these two ships steam side by side, carrying exactly the same naval equipment as regards guns and armour. Let them proceed at "full power" for 60 hours, and then at "cruising speed" for a further 100 hours, and then return to port and weigh the amount of fuel left, after taking the same amount aboard when starting. Personally, I have no fear which ship would be the more efficient. As I said before, it is not the maximum transmission efficiency that matters; there are other things besides, and I am certain that Mr. Cook can give a very shrewd guess what they are.

William P. Durtnall.

London, S.W., *July 28th*, 1918.

Heating and Cooking by Electricity.

Our attention has been called to your leading article on heating and cooking by electricity in your issue of July 12th. Upon inquiry, we find a typed letter was sent to a few of our Irish clients from our Dublin office, and this letter was referred to in the *Irish Builder* of June 22nd.

The appearance in a Dublin paper of the figures relative to the fuel required to generate electricity led to our pointing out the loss of heat due to conversion of coal into electrical heat.

The letter was the outcome of a proposition which had been made to heat a large assembly hall by electric radiators. Upon investigation as to the capital outlay and running costs of heating the hall by electricity, gas, and hot water respectively, it was finally decided to adopt a hot-water apparatus, this being the most economical.

The question of cooking by electricity had not arisen, and, therefore, cooking should not have been mentioned in the letter in connection with the heating problem.

We are entirely in agreement with Mr. H. C. Hopkin's remarks on electric cooking, in the same leading article—viz., that when intelligently managed, it is highly efficient for the reasons he named, but for the heating of water in quantity it is more economical to use steam where the latter is available.

G. N. Haden & Sons.

Trowbridge, *July 26th*, 1918.

Trade Unions: Past, Present, and Future.

If there is really a movement towards forming a new Trade Union, will you please forward my name as one who is eager to become a member? There is no time like the present, when so many who have been non-unionists all their lives, on principle, are wondering if they are doing the best thing by standing outside.

The present Unions are so over-run by the weeds of politics and ignorance that it is useless to hope for reforms by the entrance of new members.

Amongst the recommendations of the Whitley Report was the suggestion that all labour should be organised. But how can any man with a spark of patriotism and of average intelligence attach himself to any of the present Labour organisations?

What is wanted is a movement which aims at lifting, as well as helping, the *British* working man. Some of the present Labour movements seem to be out to assist the alien against the British, especially should he be of the enemy variety. We want to wipe out the slur now hanging on that word *worker*, so suggestive just now of shirker.

A fair day's pay for a fair day's work should be the new call, instead of as much as possible for as little as possible.

A Labour movement on broad common-sense lines would attract not only non-union, but also all the best of the union members.

Electrical Fitter.

July 21st, 1918.

Instruments for Central-station Switchboards.

In this controversy Mr. Fawssett has the advantage over me in so far that he writes with full knowledge of the results of the tests he made, whereas I only know that portion of them which he chooses to disclose. To illustrate my meaning, I need only point to the reference in my previous letter regarding accuracy under varying pressures; this was quite a random shot, and has drawn the interesting information that the "Aron" meter wins in this respect.

It is true that Mr. Fawssett's figures show the motor meter, though a bad second, to have no great error when the pressure is reduced by 10 per cent; but why does he say nothing as to the effect of increasing the pressure by a similar amount? This is another random shot!

Apart from this, I am afraid Mr. Fawssett's attitude in this matter has not been altogether above suspicion. After refusing to let me have his complete results because, forsooth, our competitors objected, he sent to them that portion purporting to show the "Aron" meter in an unfavourable light, without waiting for our permission. At the time I did not question his attitude, because I understood the results were to be treated as being private and confidential; but when the letter from the "A.M.I.E.E." appeared in your journal, I again asked for the complete results, with no further success.

Clearly "a very complete and careful series of tests" must have comprised very much more than has been disclosed, and I, for one, would like to know how the competing meters behaved on starting current, low loads, and overloads, and on short-circuits. What was the effect of stray fields (a point upon which Mr. Fawssett laid great stress in his original specification), and were the motor meters tested for hysteresis errors?

I think I have written enough to show that it is absurd for Mr. Fawssett to ask your readers to judge the merits of the competing types from the one or two results he chooses to pick out from his series of tests. After all, the best criterion in a question of this kind is the test of experience under practical working conditions, and it was presumably the result of this test which prompted Mr. Fawssett to write that he "quite expected it (the Aron meter) to beat the other."

Mr. Fawssett states that I was to send along to him our latest pattern shunted meter; but, as he informed us that he would not change while the war was on, *even if he got satisfactory results*, I could not be expected to set aside Class A war work to make up meters for him.

Aron Electricity Meter, Ltd.
(F. A. NIELD.)

London, N.W., *July 29th*, 1918.

Women in Central Stations.

I have read "E. H. H.'s" letter in the "Correspondence" columns of the current issue of the REVIEW, and I sincerely hope that the opinions expressed therein are not those of the majority of station engineers and managers in this country.

Whilst undoubtedly great difficulties have had to be faced by engineers and managers since the outbreak of hostilities, still one cannot help thinking that "E. H. H." (from the tone of his letter) is one of those individuals who cannot (or will not) patriotically adapt themselves to the changed circumstances of the times, even after four years of the greatest war in history.

Referring to the question of the employment of women in electrical stations, perhaps "E. H. H." is not aware that as far back as the summer of 1915, women switchboard attendants were employed on all the shifts in a large and important municipal generating station with E.H.T. three-phase and also D.C. plant, and although they had to be trained for the duties on the job itself and had no previous training, they did wonderfully well, and patriotically carried on in the absence of the men.

Further on in his letter "E. H. H." says:—"No one objects to give a man who has served his country in the Army or Navy, especially if he has been one of those in uniform who actually fight the enemy or the elements, a chance," &c., &c. "E. H. H.", perhaps, requires gently reminding of the fact that if it were not for the courage and self-sacrifice of thousands of his fellow men, he might not be sitting securely in his presumably pre-war berth (and grousing, too, at the circumstances!) at the present moment.

One is proud to think, however, that hundreds of electrical station engineers nobly responded to the call of their King and Country, and have done splendid work in H.M. Forces, and among

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the lists of those on service will be found the names of not a few chief engineers and managers too.

Possibly a good many of those engineers who have made such sacrifices will never be quite so fit again for their former duties, and the least that those at home can do to help the men who fought for them, is to see that they obtain suitable positions once again, and that their former berths are not retained by the men who have secured promotion through their more patriotic brother's absence on naval or military service. It is to be hoped that the E.P.E. Association will see that the latter point, at least, is not overlooked.

Turning to the question of the training of ex-service men for positions such as switchboard attendants, &c., if "E. H. H." had had experience in both home and colonial generating stations, he would know that "a good general and technical education and three years' training" is not nowadays considered an essential preliminary, and the writer has seen native boys of 15 or 16 years of age, with no previous training, and unable even to speak English, trained in a few months as switchboard attendants in a H.T.-A.C. station of 1,000 KW. capacity! The employment of women and also ex-service men in an increasing ratio in electrical stations is very probable, and, perhaps, by the cessation of hostilities, even "E. H. H." will have modified his somewhat conservative and unpatriotic attitude!

July 28th, 1918. **Staff-Sergeant R.E. (T.)**

LEGAL.

ISAACS *v.* HOBHOUSE.

(*Concluded from page* 82.)

ON Wednesday, last week, Sir Henry Norman gave evidence, and corroborated that of Sir Chas. Hobhouse. He denied that he had invited von Lepel to form an English company or promised to procure for him financial assistance; neither had he told the Telefunken Co. that they could rely on Government support. Mr. Reginald McKenna was next called, and gave evidence with regard to the decision of the Cabinet to withdraw the repudiation of the Marconi contract. Sir John Simon then addressed the jury for the defendant. He said it was impossible to reconcile the two stories; "one of the two people here is a liar." During his address Mr. Hird was recalled, as a matter of urgency, and stated that he had discovered a letter dated July 21st, 1914, from the same directors of the Telefunken Co., who had written to Mr. Isaacs. The letter said that von Lepel would probably endeavour to make a start in England, with the support of Sir H. Norman, and asked Mr. Hird to communicate with the Marconi Co. with a view to opposing the attempt to start a new company. There was no reference to Sir Chas. Hobhouse or the Imperial Wireless Chain.

Sir John Simon then concluded his address to the jury, and the hearing was adjourned. On the following day Mr. Leslie Scott, K.C., took occasion to complain of his Lordship's references to the forgery of documents, remarking that it had been apparent that he was taking a strong view in favour of the defendant.

MR. JUSTICE DARLING said, in summing up, that the letters complained of, which did constitute an actionable libel, were the culmination of a long dispute between Sir Chas. Hobhouse and Mr. Isaacs, or the Government and Mr. Isaacs. It was said that it was a dishonest, wicked invention that the defendant had palmed off on the House of Commons, and that the memorandum prepared in order that he might make the speech was a false document. His Lordship, referring to the letter of the Telefunken director, asked the jury which they believed—Von Bredow and Solff, or Sir Chas. Hobhouse and Sir Henry Norman, and whether they believed Mr. Isaacs's denial that there were two letters. The jury, he said, had to look at the case broadly, and decide whether the document prepared on the night of February 5th, 1915, was a forged document.

The jury, after deliberating for over an hour, returned a verdict for the defendant.

Judgment was accordingly entered, with costs, which his Lordship, on the application of Mr. Leslie Scott, agreed should be taxed and paid over on the usual undertaking in the event of a successful appeal.

A.E.G. ELECTRIC CO., LTD.

IN the Chancery Division, Mr. Justice Younger had again before him the petition of the Board of Trade to wind up this company under the Trading with the Enemy (Amendment) Act, 1916.

MR. AUSTEN-CARTMELL, for the Board of Trade, said the petition had been standing over to see what progress was made with the case before the Official Receiver in connection with the arbitration with the Rio Tinto Co., in which there was a large claim and counter-claim. That matter was not yet completed, and the company took the view that it might be embarrassed in those proceedings if a winding-up order were made at this stage. The Board had no desire to embarrass the company in connection with the arbitration proceedings, and was willing that this motion stand over until after the Long Vacation.

MR. CONWAY, for the company, said his clients felt that they might be prejudiced in the other matter if an order to wind up the company were made at this stage.

HIS LORDSHIP said the petition could stand over until the first petition day of next sittings, but should anything occur to make it desirable, the Board of Trade could renew its application for an order during the Long Vacation. His Lordship added that it might be necessary to have some sittings of that Court during the Vacation.

WAR ITEMS.

The Imperial War Conference and Demobilisation.—The Imperial War Conference held on July 22nd discussed at the instance of the Government of Canada various problems respecting demobilisation, particularly connected with transportation. Ultimately, on the suggestion of the War Office representatives, a resolution was passed agreeing that an advisory and executive committee, to be known as the Military Demobilisation Committee of the British Empire, should be set up forthwith. This committee will consist of representatives of the military authorities, Dominions and Colonies, and representatives of the War Office, India Office, and Ministry of Shipping of the United Kingdom, under the chairmanship of the Secretary for War or a deputy appointed by him. The committee will consider all military questions of demobilisation affecting the various Governments concerned; will arrange for the fullest interchange of information regarding plans for demobilisation; and will submit questions of principle arising from time to time to the Governments concerned. The committee will sit prior to general demobilisation, at such times as the chairman may consider necessary, and during demobilisation as frequently as may be necessary to secure complete co-ordination of the demobilisation procedure of the Governments concerned.

Trading with the Enemy.—The *London Gazette* for July 26th contains further lists of persons or bodies in the following countries with whom trading is prohibited:—Argentina, Paraguay and Uruguay; Brazil; Chile; Costa Rica; Cuba; Ecuador; Guatemala; Netherlands; Netherlands East Indies; Panama; Peru; Spain; and Sweden.

Exemption Applications.—Before the West Kent Appeal Court, exemption was sought by C. F. Mounsdon (34, Grade 1), electrical engineer, of the Sundridge Electrical Works, Sevenoaks. It was asked that time should be given until August 31 to allow another man to take his place. The appeal was dismissed, with 42 days grace.

At Southampton, the Corporation Tramway Department applied for exemption for eleven employés. Three months were allowed, the volunteer condition being waived.

The Malvern Tribunal granted temporary exemption until December 28th to C. H. Clemens (36, Grade 2), electrician, with Messrs. Sparkes & Houlton.

At Rochdale, on the recommendation of the Advisory Committee, exemption until November 30th was granted to T. Kenworthy (31, Grade 3), electrician, appealed for by Messrs. Kelsall & Kemp, Ltd.

At St. Albans, Messrs. Nicholsons, Ltd., appealed for the retention of J. W. Allen (45, Grade 2), electrical fitter, in charge of the motor and lighting plant. Three months were conceded with a view to substitution.

At Canterbury, there was a review of the case of A. Johnson (27, Grade 2), electrician, with Messrs. Court Bros. The conditional exemption was cancelled, and two months' substituted.

At Oxford, the Electric Tramways Co. appealed for D. Campbell (38, Grade 2), traffic superintendent, and three months' temporary exemption, without the volunteer condition, was granted.

At Ryde, there was a review of the case of H. F. Jolliffe (28, Grade 1), wireman and joiner with the Isle of Wight Electrical Co. The manager (Mr. Braithwaite) claimed that he was in a certified occupation, and the National Service Representative (Mr. Colenutt) said that left it open for the Tribunal to say whether the man should be in the Army or not. Mr. Braithwaite contended that Jolliffe was doing work of national importance. If a breakdown occurred he was the only man they had to do the repairs. Mr. Colenutt submitted that an older man should be found to do the work, and he would consent to an adjournment to see what could be done. Mr. Braithwaite said that the Order stated that a young man was not to be prejudiced if in a certified occupation; they could not get old men for this work. The Tribunal cancelled conditional exemption, and substituted three months, the mayor saying that they hoped that in the meantime a substitute would be found.

Electric Baking Ovens.—Bread can be baked electrically by much lower expenditure of heat than is needed in steam-heated ovens. Cases are cited (*Elektrotechnik und Maschinenbau*) in which, other factors being as nearly as possible identical, steam ovens used 0·19 to 0·21 kg. of coal per kg. of bread (*i.e.*, 955 to 1,060 calories), whilst electric ovens used 0·39 to 0·42 KW.-hour per kg. of bread (*i.e.*, 322 to 359 calories). The power consumption of the electric ovens was 90 KW. and 50 KW. respectively. During a short test the energy consumed for the initial heating is a large proportion of the whole energy consumption. The average consumption of the 50-KW. electric bake oven, excluding the consumption for initial heating, is about 0·35 per KW.-hour per kg. of bread. Indirect electric heating with heat accumulation is not inferior to the direct system with heating elements in the oven. In both cases the average consumption is 0·35 KW.-hour (300 calories) per kg. of bread, as compared with 0·2 kg. of coal (1,000 calories) per kg. of bread baked in steam ovens.

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REVIEWS.

Engineering Mathematics. By C. P. Steinmetz. Third Edition, revised and enlarged. London: Hill Publishing Co. Pp. xix + 321. Price 12s. 6d. net.

This volume is not a text-book on mathematics, but is designed to fill a rather special and definite gap which is often found to exist in the mathematical equipment of an electrical engineer. There are, for instance, many men who possess a fair knowledge of the phenomena of electrical engineering on the one hand, and of the ordinary branches of mathematics on the other hand, but who lack familiarity with the somewhat specialised methods of mathematical statement and calculation which would enable them to obtain the full advantage from their knowledge in both directions when it comes to the point of carrying out actual concrete calculations and obtaining practical results. In short, they have not learnt the most appropriate methods of dealing with the special and peculiar problems which arise in connection with the various types of electrical engineering problems. It is just here that Dr. Steinmetz offers his help in this book, which is mainly directed towards illustrating the methods by which electrical problems may best be handled in mathematical terms. It is to the electrical engineer that the author chiefly makes his appeal—and in a special degree to the student of his own works on alternating-current phenomena, &c.—though he has also included a number of problems drawn from other branches of engineering, notably those arising in connection with the problems of the steam turbine.

As already stated, it is not one of the aims of the book to be a text-book of mathematics, and, indeed, we can well imagine the ordinary teacher of mathematics (or, perhaps, we should have said, the teacher of ordinary mathematics) holding up his hands in righteous protest against some of the unorthodox methods adopted in it, and lamenting, not without some measure of justification, what appear to be wilful evasions of strict mathematical reasoning.

For the electrical engineer who has had a good grounding in the usual elements of a mathematical course, and whose main object is to use his knowledge of mathematics as a tool, and as a means to an end, rather than as an end in itself, for such a man, this book should prove most suggestive and inspiring, and of real value when he is confronted with some of the more complex calculations arising in his work.

Coming to a more detailed examination of the contents of the book, the first chapter is devoted to the subject of the general number, which includes the algebra of the complex number containing real and imaginary elements. We are here introduced to the rules for the addition, subtraction, multiplication, and division of complex numbers expressed in both rectangular and polar co-ordinates. It is by means of simple examples or illustrations, rather than by mathematical proofs, that the author proceeds from one step to another. His tacit assumption that symbols and conclusions may be applied indiscriminately, and without any apparent distinction to positions of points, the definition of finite lines, vectors, pure numbers, and even physical quantities, such as currents and voltages, is at times rather bewildering, and may sometimes prove to be a stumbling block to the student until he has made further progress and has become more familiar with the writer's methods. As an example of the author's lack of precision in these matters, we may refer to page 30, where we read: "The distance of the point which represents the general number A from the co-ordinate centre is called the *absolute value*, radius, or scalar of the general number or complex quantity. It is the vector a in the polar representation of the general number: $A = a (\cos \theta + j \sin \theta)$." The inexperienced student, who has been taught to distinguish carefully between a scalar and a vector, may be excused if he protests that this sentence leaves him in doubt as to the category to which he should assign the symbol a. This example is, however, a matter of verbal ambiguity, rather than a lack of clearness in expression of ideas. It is in connection with the representation of the vector quantities of current and voltage, and the scalar quantities of impedance and admittance a few pages later that the reviewer regards the failure to draw a clear distinction between the characteristics of these quantities as being a serious omission, and a probable cause of a good deal of obscurity to the student.

Another distinction which the reviewer thinks should have been drawn, and which is entirely overlooked by the author, is that which exists between the dual *rôle* played by the symbol j ($\sqrt{-1}$). Sometimes j represents what the author calls the "quadrature unit," *i.e.*, it represents "unit vector in quadrature with the main vector axis." In other connections, j is an operator, and has the effect of producing a rotation of a vector through 90 deg. when that vector is multiplied by j. If this distinction had been clearly drawn, it would have been easy to indicate the essential difference between multiplying a current $I = i_1 + j i_2$ by a voltage $E = e_1 + j e_2$, in which j is a unit quadrature vector, and multiplying the current by an impedance $Z = r + jx$, where j is an operator producing rotation of the original vector.

Chapter II is a useful discussion of the use of expansion into series, and of exponential functions in respect of their utility for the practical purposes of engineering calculation. It includes a very clear treatment of the application of differential equations to the numerical solution of problems, with examples designed to show in what cases they may be made to give the required solution.

Chapter III is entitled "Trigonometric Series." The first part of this chapter forms a summary of the usual formulæ, giving the relations between the ordinary trigonometric functions. The second part is of special interest and importance, since it deals with the composition of curves representing both periodic and transient phenomena. We have here a most instructive and helpful treatment of the subject of the curves, which mean so much to the electrical engineer. Dr. Steinmetz is specially helpful in connection with this subject, because he approaches it with such a wide experience gained by dealing with these curves from a practical point of view, and with the purpose of gaining definite information from them. His discussion is consequently in marked contrast to that usually found in mathematical treatises, while his mastery of the mathematical aspects of the subjects enables him to adopt many simplifications with confidence. Typical curves of various kinds are given, and the evaluation of their various harmonic components is illustrated in full detail. After working carefully through this section, the student should find himself well equipped for analysing or interpreting any form of curve which may arise in his experimental work.

Chapter IV is another extremely interesting and practical one; it deals with the maxima and minima of functions. It consists mainly of a wide selection of engineering problems in which some variable quantity is plotted as a curve, and its maximum or minimum value is ascertained graphically or by differentiation. Incidentally, many interesting points are brought out, both on the practical engineering side and in connection with the mathematical handling of the problems.

The next chapter deals with methods of approximation, and is also illustrated by some practical problems in electrical engineering, though it is necessarily more mathematical than the preceding one, dealing, as it does, very largely with the expansion of expressions into series.

The last two chapters, dealing respectively with empirical curves and numerical calculations, contain many valuable aids in plotting the results of observations, and in subsequently classifying or analysing them by mathematical methods. As examples of the curves discussed, we may mention core-loss curves, hysteresis curves, alternator voltage curves, volt-ampere characteristic of the tungsten lamp, &c. The choice of scales for plotting, the use of logarithmic paper, the proper tabulation and checking of results, are some of the practical points included, and are dealt with in a way which is clear proof of the author's wide experience and careful attention to detail.

It would take too long to enumerate all the useful mathematical devices which the author has included in this book, and we must conclude this rather cursory survey by saying that it is the work of an eminent electrical engineer who has employed mathematics as a tool in his own practice, and has here set down valuable hints gained in the course of his experience for the assistance of his younger colleagues. For a book of this kind—unconventional and, possibly, incomplete as a mathematical guide though it may be—we owe Dr. Steinmetz a debt of gratitude.

Electrical Measurements. By Frank A. Laws, S.B. London: Hill Publishing Co., Ltd. Pp. xiii + 719. Price 21s. net.

This is a well printed and well got-up book of over 700 pages by the Professor of Electrical Engineering, Massachusetts Institute of Technology, and Harvard University. It is intended as a general treatment of the subject of electrical measurements, but particularly it is written to be of service rather to the student of electrical science engaged in the laboratory or the testing shop than to the full-fledged engineer, though, for the matter of that, there is much within its pages which the latter will find useful. As it is primarily designed for the student, the fundamental processes with regard to electrical measurements have been treated in detail, and it is assumed that users of the book have had courses in physics, the theory of electricity, and in mathematics such as are given to third-year students in technical schools of the first rank. With regard to laboratory work, the author makes the useful suggestion that interest and discussion are stimulated if such work is so arranged that the various members of the class while engaged upon the same general topic carry out the experimental work by alternative methods.

The work is divided into 15 chapters, and at the end there are a couple of pages on the legal definition of the electrical units in the United States. The first 13 chapters deal with such subjects as the measurement of current, the ballistic galvanometer, resistance devices, measurement of resistance, potential difference and electromotive force, power measurement, inductance and capacity, induction instruments, electricity meters, phase meters, power-factor indicators, synchroscopes and frequency meters, instrument transformers, the calibration of instruments, &c.

Chapter XIV, on the determination of wave form, is very good, and is plentifully supplied with diagrams and photographs of apparatus. The final chapter is on cable-testing, and contains much interesting and instructive matter.

At the end of each chapter there are references to certain

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important papers connected with the subject matter, so that the specialist may obtain a more detailed discussion of the various methods. The figures and diagrams, of which there are nearly 450, are well drawn, and very clearly and accurately reproduced.

The Theory of Electricity. By G. H. Livens, M.A. Cambridge: University Press. Pp. vi + 717. Price 30s. net.

This is a volume of some 700 pages. There is little in it that appeals to the practical man, and it will probably be found of service only to those who have the time and inclination to delve into the more abstruse parts of electrical science. But regarded with the eyes of the theorist, it is really a monumental work, being an attempt to present a general text-book on the mathematical aspects of modern electrical theory.

The method of treatment adopted by the author is chiefly based on the original Faraday-Maxwell theory, generalised and extended to the case of moving systems by Sir Joseph Larmor; for he holds that this form of the theory, in spite of being abandoned in recent accounts of the subject, remains the only one which appears to be completely satisfactory from the point of view of mathematical and physical consistency.

The book opens with a general mathematical introduction. Then follows the main treatment, which is divided into two parts, (1) statics and kinetics, and (2) dynamics. The former includes the consideration of the production and characteristic properties of the electric field, the electrical and mechanical relations of a system of conductors, the Faraday-Maxwell theory of electrostatic action, the theory of polarised media, magnetostatics, electric currents in metallic conductors, and electric currents in liquid and gaseous conductors; the latter includes the electromagnetic field and some special electromagnetic fields, electrodynamics of linear currents, electromagnetic oscillations and waves, and the electrodynamics of moving media.

At the end there is an appendix containing 339 questions to be solved by the student, and an index of names.

Electricity Meters. Second Edition. By C. H. W. Gerhardi, A.M.I.E.E. Pp. xx + 504. London: Benn Bros., Ltd. Price 15s. net.

The small number of books dealing with the subject of electricity meters and their testing and maintenance has more than once been remarked, and, in view of the importance of this subject, this circumstance is not a little curious. The appearance of the second edition of Mr. Gerhardi's work will, therefore, be particularly welcome to engineers in charge of central-station test rooms. In preparing the new edition of the book the author has not only brought it up to date by the addition of descriptions of the latest types of meters, European and American, now on the market, but has also rectified a noteworthy defect of the earlier work by adding an entirely new chapter on the measurement of polyphase power and the testing of polyphase meters. Included in the work are descriptions of all types of meters in common use in this country, notwithstanding many of such types being superseded by more modern designs, and being no longer manufactured.

The chapter on polyphase meters above-mentioned deals briefly with the theory of the measurement of three-phase power. The author rightly deprecates the use of a single meter for so-called balanced three-phase circuits, and strongly urges the use of more scientific methods if anything like accuracy is required. Diagrams of connections for these meters are, however, included, as this method is still sometimes used. The author prefers the single polyphase meter to the use of two single-phase meters for the measurement of energy in polyphase circuits. His objections to the latter method do not seem very forcible; the contingency of a negative reading on one meter is not a very likely one, and by the use of two meters a rough mutual check is obtained. The author recommends the adjustment of polyphase meters to secure independence of phase rotation. This seems rather a counsel of perfection. The descriptions of polyphase meters are accompanied by diagrams of internal connections of the meters.

The second part of the book deals with the testing and repair of electricity meters, and with the arrangement and equipment of testing departments. The author's description of his own test rooms is interesting, but the work would have been more valuable if some suggestions for the equipment of test rooms for small stations had been embodied. In many such works it is exceedingly difficult to obtain even the barest necessities, and many of the refinements and conveniences described by the author are utterly out of the question. One or two suggested schemes on very simple and elementary lines would therefore doubtless have been specially welcome to test-room superintendents in the smaller undertakings.

In the chapter on instruments and apparatus, useful descriptions of the Kelvin balance, the Drysdale double wattmeter, and the potentiometer are given, together with an explanation of the degree of accuracy requisite in the various instruments in use. The author lays considerable stress on the provision of a standard of time. This seems, however, hardly on the same footing as the provision of accurate watt, ampere, and volt standards, in that time indicating instruments can so frequently and easily be checked. The errors of stop-watch readings, moreover, are almost entirely composed of personal errors of stopping and starting, and jump errors when the centre-seconds train is thrown into gear, the errors of calibration of the watch being remarkably small as a rule. When it is remembered that a watch losing five minutes per week has an error of 1 in 2,000, or about 0.05 per cent., the necessity for a standard chronometer in any but the largest and most important test rooms is not apparent. The notes on adjustable resistances, choking coils, secondary cells, and other apparatus will be found more useful.

A chapter on meter-testing follows. The author appears to favour the adjustment of the speed of the meter to suit the counter train rather than the reverse process of adjusting the train by means of a change-wheel to suit the observed speed, and urges as an objection to the latter method the necessity of a dial test. The dial test is, however, one that should always be taken, particularly after the meter has been taken down for repair. The use of a change-wheel is specially convenient, in that it enables the required adjustment to be made with certainty. The description of the testing of polyphase meters is excellent, and the diagrams of connections are most valuable. Diagrams are given for testing both on single-phase and three-phase circuits, and these diagrams will doubtless be found exceedingly useful to those who, by reason of their having to test these meters but infrequently, are not quite as well acquainted with the subject as they might be.

The chapter on meter testing *in situ* includes a description of portable testing meters. There are chapters on meter fixing, meter reading, and meter repairs, together with a suggested system of meter records. This system will probably be found altogether too elaborate for any but the larger undertakings, and one or two alternative schemes on a much smaller scale would have been very useful. There is a table of meters approved by the Board of Trade, and a complete index. A further table collecting the information given earlier in the book regarding the shunt losses, full-load torque, testing constants, and other data would have been very desirable. The book, in its present form, is a most valuable and complete work, covering the most up-to-date practice, and dealing with every branch of the subject of electricity meters. It can be thoroughly recommended to all engineers who are concerned with or interested in this subject.—G. W. S.

BUSINESS NOTES.

Italian Cable Manufacturers' Association.—*Il Sole* (Milan) announces the formation, on July 3rd, of an Association of Manufacturers of Rubber, Cables, Electric Conductors, &c., between 14 Italian firms, which employ about 20,000 workpeople, and have an output of goods valued at several hundred millions of lire per annum. (Lira = 9½d. at par.) The President of the Association is Senator G. B. Pirelli, and the Vice-Presidents Comm. Ing. V. Tedeschi, of the S. A. Ing. B. Tedeschi, of Turin, and Ing. Romola Pola, of the Societa Piedmontese Industria Gomma e Affini, of Moncalieri. The object of the Association is the development of the rubber and electric conductor industries in Italy by the study of all questions affecting their expansion in Italy and abroad.—*Board of Trade Journal.*

Patents and Alien Enemies.—Applications have been made to the Board of Trade by Messrs. J. Musgrave & Son (1913), Ltd., Messrs. Daniel Adamson & Co., Ltd., and Messrs. Willans and Robinson, Ltd., to avoid or suspend nine patents granted to Müller for steam condensing plant.

Book Notices.—"Magnetic Measurements and Experiments." By A. Risden Palmer. Pp. 124; 24 figs. London: T. Murby & Co. Price 1s. 6d. net.

"Electrical Experiments." By A. R. Palmer. Pages xii + 115; 49 figs. London: Thomas Murby & Co. Price 1s. 6d. net.

"Selwyn's Metric Conversion Tables." By W. E. Dommett. Pp. 49. London: James Selwyn & Co., Ltd. Price 2s. 6d. net.

"A Bibliography of Municipal Utility Regulation and Municipal Ownership" By Don Lorenzo Stevens. Pp. vi + 410. London: Oxford University Press. Price 17s. net.

"Additions to the Formulas for the Calculation of Mutual and Self-Inductance." By F. W. Grover. (Scientific Papers of the Bureau of Standards. No. 320). Washington: Government Printing Office. Price 10 cents.—This paper furnishes a list of formulæ for the calculation of mutual and self-inductance which have appeared since the publication of the earlier paper dealing with the same subject (Scientific Paper, 169). Some of the formulæ here given, notably those for eccentrically-placed circles, provide solutions for cases where none has been previously available. Copies may be obtained from the Bureau.

"*The B.E.A.M.A. Journal.*" July, 1918. London: King's House, Kingsway, W.C. 1s. net.

Liquidations.—British Autogenous Welding Co., Ltd.—Meeting August 30th, at 268, South Lambeth Road, London, S.W. 8. to hear an account of the winding up from the liquidator, Mr. L. M. Fox.

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Holidays.—The office and works of The Crypto Electrical Co., Ltd., Willesden, will be closed from Saturday, August 3rd, until Monday morning, August 12th.

The works of the New Switchgear Construction Co., Sutton, will be closed from Saturday, August 3rd, until Monday, August 12th.

The works of Messrs. Connolly Bros., Ltd., Blackley, will be closed from to-night until Monday, August 12th.

Catalogues and Lists.—Messrs. Jenson & Nicholson, Ltd., Goswell Works, Stratford, London, E. 15.—Sixteen-page pamphlet giving particulars of their varnishes, japans, enamels and paints to meet engineering and industrial requirements.

Messrs. Boilerine, Ltd., 885A, Old Kent Road, London, S.E. 15.—Circular respecting their radiator tablets for prevention of rust, corrosion or deposits.

Non-Ferrous Metal Industry Act.—The *London Gazette* for July 30th contains a further list of licences granted under this Act.

Electric Vehicles at Chester.—Referring to the satisfactory results obtained from the working of the electric vehicles used by the Corporation for refuse collection, which we recently recorded, we understand that the handling of this equipment throughout, and the financing on a deferred payment system, were carried out by the vehicle department of Messrs. Drake & Gorham, Ltd., who are sole agents for Edison Accumulators, Ltd., in the district.

Canadian Electrical Inquiry.—The High Commissioner for Canada (19, Victoria Street, S.W. 1) has received an inquiry from a Canadian electrical firm which wishes to enter into negotiations, for post-war trade, with United Kingdom importers of brass and porcelain sockets, cut-out receptacles, rosettes, attachment plugs, current taps, tumbler and snap switches, shade-holders, lampholders, and door bolts.—*Board of Trade Journal.*

Cast-iron Pipes.—The Stanton Ironworks Co., Ltd., Nottingham, have sent us a neat momento of their c.-i. pipes in the form of a glass desk tray.

LIGHTING AND POWER NOTES.

Bath.—Year's Working.—The accounts of the Corporation electricity undertaking for the past year show a profit of £593, compared with a deficit of £1,782 in the previous year. The gross income was £31,031, against £26,507, and the expenditure was £17,638, against £14,987. Capital charges amounted to £12,186.

Birkdale.—Price Increase.—The Electric Supply Co. has increased its charges as follows:—Lighting, 5d. per unit., plus 20 per cent.; power, heating, and cooking, 1½d., plus 20 per cent. The minimum charge will be 7s. 6d. per quarter.

Bolton.—Year's Working.—According to the annual accounts of the Corporation electricity department for the year ended March 31st last, the revenue amounted to £109,230, compared with £91,140 in 1917, and the working expenses to £61,938, against £48,157. Of the gross profit of £47,292, interest, income-tax, and depreciation absorbed £40,387, and, after meeting other charges, there was a surplus of £3,375, against £2,708 in the previous year. The works cost per unit was ·417d., against ·374d., and the total cost amounted to ·513d., against ·479d.; 24,654,804 units were sold during the year, against 20,616,535, including lighting, 1,580,770, against 1,523085; tramways, 4,740,802, against 4,576,352; and power, 16,864,944, against 13,493,857.

Braintree.—Prov. Order.—As the Crittall Manufacturing Co. has notified its intention to apply for an Electric Lighting Prov. Order, the U.D.C. has instructed the E.L. Committee to renew the Council's application.

Brighton.—Year's Working.—There was a surplus of £2,887 on the past year's working of the Corporation electricity department, against £5,140 in the preceding year. The total income amounted to £119,003, compared with £109,059, and the expenditure to £76,026, against £61,994. Capital charges absorbed £40,140, against £42,060. The works cost per unit was 1·4d., against 1·15d., and the total cost, including loan charges, was 2·66d., against 2·5d. Units sold numbered 10,242,007, against 9,771,615.

Bristol.—Year's Working.—According to the annual accounts of the Corporation electricity department, the revenue for the year ended March 31st last amounted to £177,339, and the expenditure to £105,351. After deducting interest (£20,596), loan redemption (£32,330), and other items, £5,156 was carried forward. Units sold during the year numbered 26,839,580, compared with 23,579,139 in the previous year. The works cost per unit was ·752d., against ·813d., and the total cost was ·920d., against ·989d. Coal consumption per unit was reduced by 18 per cent.

Burnley.—Wages.—The employés at the Corporation electricity works have refused the 25s. weekly bonus offered to them, and the matter will be the subject of arbitration by the Committee on Production. The War Wages Committee has recommended that 25s. per week bonus be paid to the men engaged on ramway relaying work.

Carlisle.—Year's Working.—There was a net profit of £1,295 on the past year's working of the Corporation electricity undertaking, against a deficit of £196 in the previous year. The revenue amounted to £34,987, against £27,287, and the expenditure to £23,171, against £17,384. Interest and redemption charges absorbed £10,520. The units sold totalled 5,879,532 (compared with 4,750,591), including power and public lighting, 5,092,916; private lighting 532,142, and traction, 256,000. Works costs amounted to ·56d. per unit, against ·5d., and the total cost per unit to 1·37d., against 1·39d.

China.—Recent Extensions in Power Plant.—The normal growth of Canton as a leading centre, and its prospects for the future, have led the Kwangtung Electric Supply Co. to decide to increase the capacity of its plant. A contract was signed recently for the purchase of two American high-pressure non-condensing turbo-alternators, rated at 2,500 kw., three-phase, 60 cycles, 2,300 volts; one American high-pressure non-condensing turbo-generator, 350 kw., 125 volts, direct current; switchboards, pumps and other accessories. The contract also calls for four 750-h.p. Babcock and Wilcox boilers. The extension of the plant under this contract will be made with the object not only of supplying the city and its environs more extensively with light, but also of furnishing electric power for the various industries that have developed during the past few years. When the additional machinery and supplies are installed, the Canton plant will be the largest in China, except that at Shanghai.

In addition to Canton, electric power plants have been installed in many other cities and towns of that Province and of the neighbouring Province of Kwangsi. The present enhanced price of kerosene is greatly adding to the number of electric light patrons, and ensures good prospects for these ventures. The electrical equipment of the installations was purchased for the most part in the United States, while the engines came from England.

The subject of future power development in all parts of China is a question of vital interest to the future growth of the Republic. Native coal fields are known to exist in many sections of China, but the prolific water powers of the great interior possess such untold possibilities for future development, that other sources of power generation fade into insignificance in comparison.—*Journal of Electricity.*

Clogheen (Co. Tipperary).—Fire.—The electric lighting plant installed for the supply to the town has been destroyed by fire.

Continental.—Spain.—Application has been made by a Vigo syndicate for a concession to utilise the water power of the River Alberchi, near El Tiemble, for the generation of electricity.

Cork.—Lease Renewal.—A Special Committee of the Corporation has secured a reduction in the number of years to be embraced in the new lease sought by the Cork Electric Tramways and Lighting Co., with an appeal to the B. of T., should reasonable provision not be made as regards the extent of supply and price of electricity, or at any time the Corporation should be of opinion that the charges of the company are unreasonable A clause has also been included to the effect that, in the event of the company at any time failing to give a reasonable service of tramway-cars on the existing routes, the Corporation shall be at liberty to take over the undertaking on six months' notice, on terms of purchase set forth in the deed of transfer.

Croydon.—Year's Working.—The accounts of the Corporation electricity department show a deficiency for the year ended March 31st last of £2,651, though there was a net increase of income of £11,411. The deficiency has been carried forward, and the charges for electricity increased by a further 25 per cent., making a total war increase of 75 per cent. It was explained, at a meeting of the Corporation, that coal alone would cost a further £5,500, so that there was a deficiency for the present year of £9,000 or £10,000 to be made good, which the increased charges would just about meet.

Edinburgh.—Price Increase.—The E.L. Committee recommends that the charge for electricity for lighting be raised from 3½d. to 3¾d. per unit, and for power from 1¼d., plus 25 per cent., to 1½d., plus 25 per cent.

Erith.—Bulk Supply.—The U.D.C. has given a Sub-Committee full powers to conclude negotiations with the West Kent Electric Co. for a supply of electricity in bulk to the Council, and also to Vickers, Ltd. A loan for the materials and apparatus needed is to be applied for.

Glasgow.—Year's Working.—The accounts of the Corporation electricity department for the year ending May 31st show a revenue of £789,002, an increase of £208,568 over the previous year, while the working costs were £542,717, an increase of £138,312. Depreciation amounted to £60,134, and capital charges to £179,005, leaving a net profit of £7,145. The electrical engineer states that the price of energy to all consumers will have to be increased by not less than ¾d. per unit.

Halifax.—Price Increase.—Subject to the approval of the T.C., the charges for electricity are to be further advanced by 12½ per cent. all round.

Hastings.—Year's Working.—The accounts of the Corporation electricity department for the year ended March 31st last, show that the income was £20,941, an increase of £1,854 compared with the preceding year. The expenditure was £14,404, compared with £13,056. Interest and sinking fund charges amounted to £11,114, compared with £11,126. An adverse balance of £4,628 transferred from the net revenue account was met out

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of the general district rate account. During the year the number of private consumers increased from 1,982 to 2,114. The total cost per unit sold was 3·28d., compared with 3·60d.

Leeds.—Price Increase.—The Electricity Committee has decided to increase the price of electricity to all consumers by 40 per cent. from October 1st, in place of the present increase of 20 per cent.

Lincoln.—Loan for Extensions.—The T.C. has decided to apply to the L.G.B. for sanction to borrow £250,000 for the acquisition and extension of Messrs. Clayton & Shuttleworth's power station, and the supply therefrom to the works of Ruston, Proctor & Co., as recommended by Sir John Snell.

Llandudno.—Price Increase.—The T.C. has decided to increase the price, of electricity by 1½d. per unit, making a flat rate of 7½d. per unit.

London.—Westminster.—Public Lighting.—With a view to decreasing the public lighting of its area, the City Council has provisionally agreed with the Charing Cross, West End, and City E.S. Co. for the replacement of the arc lamps at present in use by 100-watt incandescent lamps of the half-watt type. The cost is to be reduced by £5 per lamp per annum.

Lambeth.—Public Lighting Charges.—The B.C. has rejected a recommendation of the General Purposes Committee that the Electric Supply Corporation be allowed to increase the price of electricity for public lighting from 6d to 7d. per unit.

The B.C. has come to the conclusion that it would be inadvisable to reduce the street lighting in the inner part of its borough to more than 30 per cent. of the pre-war lighting, owing to the wide spaces between the lamps and the density of population, but in the outer area every effort is to be made to further reduce the lighting 50 per cent.

Street Lighting.—The Chief Commissioner of Police has addressed a letter to the Metropolitan Borough Councils stating that, with a view to securing further economy in the consumption of coal, the competent authorities have agreed that street lighting in inner London may be reduced to 50 per cent. of the pre-war lighting, provided that the reduction is spread equally over both main and side streets. The lighting of street lamps might be commenced later, and the extinction earlier than at present, provided that the majority of the lamps in the more important streets are lighted between one hour after sunset and two hours before sunrise during the summer period. This measure must be regarded as subject to revision, should the reduced lighting lead to any increase of crime or danger to traffic, or seriously handicap the supervision of the streets by the police. In any event, the matter would have to be re-considered at the expiration of the summer time. It was not desirable that any lamps now lighted should be dismantled. As special importance was attached by the military authorities to a uniform lighting effect, it might be necessary to make local alterations in the street lighting, to treat lamps of high power specially, and to increase lighting in places where the prevailing conditions demand this course.

Mansfield.—Year's Working.—There was a net loss of £162 on the past year's working of the T.C. electricity undertaking, compared with a net profit of £1,664 in the preceding year.

Meltham.—Prov. Order.—The U.D.C. has deferred consideration of an application from the Electrical Distribution of Yorkshire, Ltd., asking for the Council's support to the intended application to the B. of T. for a prov. order for the supply of electricity in the district.

Nelson.—Price Increase.—The Electricity Committee has decided to increase the charges for electricity by ½d. per unit for lighting and ¼d. for power.

Newquay.—Prov. Order.—The Bill confirming a provisional order of the B. of T. relative to the amendment of the Newquay E.L. Order has been passed by the Select Committee of the House of Lords on Unopposed Bills.

Rochdale.—Price Increase.—The Electricity Committee has recommended the following increases in the charges for electricity :—$\frac{1}{10}$ of 1d. per unit on power supplies under 15 kw. demand, and 5 per cent. for lighting, making a total of 55 per cent. over pre-war rates. The maximum charge will be 8d. per unit.

Scarborough.—Public Lighting.—The Corporation has deferred consideration of the question of public lighting by electricity, and has instructed the town clerk and engineer to interview the E.L. Co. and report further on the matter.

Stalybridge.—Loan Sanction.—The Joint Tramways and Electricity Board has received sanction of the L.G.B. to the borrowing of £8,000, for the laying of a main from the generating station to Hyde.

Stoke-on-Trent.—Price Increase.—The Council has approved the recommendation of the Electricity Committe for a further advance of 15 per cent. on all electricity charges, making 75 per cent. in all.

United States.—The World's Largest Power Systems.—In view of the interconnections that have taken place during recent months, it is interesting to note that the West has again established a world's record in power service. Hitherto the Commonwealth Edison Co. of Chicago had surpassed any other system of power distribution when steam-generated power in addition to hydro-electric power was taken into consideration. To-day, however, the combined system in Central California, under one management, now overtops all other systems in the world.

Thus the combined output of the Pacific Gas and Electric Co., the Great Western Power Co., and the Sierra and San Francisco Power Co., now under one management, shows a total during 1917 of 1,500,408,765 kw.-hours, while the total output of the Commonwealth Edison Co. amounted to but 1,488,080,000 kw.-hours. The next largest systems in America are, in the order named, the Niagara Falls Power Co., the Southern California Edison Co. and its interconnections, the Ontario Power Co., and the Montana Power Co., with respective yearly outputs of 1,188,221,770 kw.-hours, 1,150,000,000 kw.-hours, 990,086,100 kw.-hours, 954,913,584 kw.-hours, and 947,732,014 kw.-hours.

To have reached the vast total of a billion and a half in kw.-hours consumption is indeed a record to be proud of, when we contemplate the vast industrial and agricultural activity that is as a consequence brought to life in one giant network of interconnection. And, finally, when we consider that the major portion of this work is derived from indestructible water powers in the mountains, once again the potential possibilities of the West when fully developed, representing 10 times the present development, are seen to be so great as to almost stagger the imagination.

While this vast region west of the Rocky Mountains has but one-sixteenth the population of the United States, already within its confines there has been developed one-third of the total hydro-electric power now in operation in the United States. Nearly a billion dollars is represented in invested capital. The average *per capita* consumption of electrical energy is five times that of the remaining portion of the country.

Great optimism is felt in the future power possibilities of the West, for within its confines is located over 70 per cent. of the possible water-power of the nation.—*Journal of Electricity.*

Willesden.—Bulk Supply.—The North Metropolitan E.P.S. Co. has returned to the Council the draft of the agreement for the supply of electricity in bulk, with amendments to which the Council is unable to agree. A Sub-Committee has now been formed to meet representatives of the company.

Year's Working.—The annual accounts of the U.D.C. electricity undertaking for the year ended March 31st, 1918, show a surplus of £1,201.

York.—B. of T. Order.—The Electricity and Tramways Committee is applying to the B. of T. for an Order extending for a further period of one year the time within which the Corporation is to lay mains for the purpose of electricity supply under the York E.L. (Extension) Order, 1914, and to purchase land under the York Corporation Act, 1914.

TRAMWAY AND RAILWAY NOTES.

Canada.—Strike.—3,500 employés of the Montreal Tramways Co., by a practically unanimous vote, have decided to strike for increased wages.—*The Times.*

Colne.—Fare Revision.—The Corporation has increased the 1d. tramway fares to 1½d., and all other fares by ½d. The 1½d. tickets will be issued in packets of six for 7½d., or twelve for 1s. 3d.

Continental.—Sweden.—Mr. A. Groothoff, in a lecture recently delivered before the Royal Institute of Engineers, Holland, gave an interesting description of the electrified railway line from the Kiruna iron mines in Sweden to the "Empire boundary." The line is 93 miles long. Single-phase current at 80,000 volts is transmitted from Porjus Falls to four transformer stations, of which the first is 87 miles and the last 160 miles distant from Porjus. The voltage is stepped down to 15,000, at which pressure power is supplied to the contactors. The freight locomotives weigh about 100 tons and the passenger locomotives 70 tons each. A normal freight train consists of two electric locomotives and 40 ore cars of 46 tons each, the total weight being from 2,000 to 2,100 tons. Normal speed for freight is 18½ miles per hour, the maximum speed being 31 miles per hour. The maximum speed for passenger trains is 62½ miles per hour. In the first year this road transported 1,104,000 tons of ore, which is barely one-third of its normal capacity. Despite this low traffic, it showed a saving over steam operation, due partly to the high price of coal. The continuation of the road southward to Svarton, on the Baltic coast, has been decided upon, and the cost of the extension, 143 miles long, has been estimated at about £1,760,000. With an annual ore transport of 3,000,000 tons, electric traction can compare favourably with steam traction when coal is about 28s. a ton. The power for the whole road is to come from Porjus.—*Railway Gazette.*

Germany.—In an article on "Improvements in the Permanent Way of Tramways," in the *Organ für die Fortschritte des Eisenbahnwesens* of March 15th, the author discusses the best methods of rendering the tramrails stiffer, and remarks that welding the joints renders the metal softer. The new type of fish-plate made by the Georgs-Marien Mining Co., of Osnabrück, is illustrated and described. It consists of a pair of very long plates with eight bolts and a packing piece to support the joint itself, but even this is not so strong as the rail itself. The "Ibeco" type has plates which pass round the bottom of the rail as well as up the sides. He then discusses the corrugation of the rails caused by rapid traffic, but states that the cause is still doubtful. A recent type of

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construction consists of a very shallow rail bedded on asphalt and resting upon reinforced concrete. One tram-rail is figured in which the web has longitudinal corrugations intended to give elasticity. Other illustrations, which are fully described, show the concrete foundation below the rail joint strongly reinforced.

Croydon.—Year's Working.—There was a surplus on the past year's working of the B.C. tramway undertaking of £11,220, compared with a deficiency of £1,634 in the previous year. Traffic receipts increased by £20,947, and the total was £109,543. Working expenses amounted to £78,626.

The petition of the tramway employés that the £1 war bonus award of the Committee on Production to all licensed vehicle workers should be granted them, has been refused.

It is stated that season tickets are in contemplation for the tramways.

Edge Hill.—Proposed Light Railway.—The Light Railway Commissioners have submitted to the B. of T. for confirmation, an order for the construction of light railways in the Edge Hill district.

Ilford.—Women Drivers.—It was stated at the Council last week that licences for women tramcar drivers would not be granted if discharged soldiers were available.

Lanarkshire.—Strike.—Women employed by the tramway company left work on Monday because they did not get an advance of 5s. weekly with the men.

London.—An experiment is being made on some L.C.C. tramcars with bags for the collection of old tickets. Some cars are being converted into goods trucks.

L.C.C.—Extensions.—For some time past the Highways Committee has been in negotiation with the M.E.T., Ltd., with a view to the institution of through-running arrangements between the Council's tramways and those of the company at Stamford Hill. Owing to the difficulties of equipment and maintenance the company is unable at present to undertake the operation of additional through-running services, *via* Stamford Hill, but an arrangement has been provisionally agreed to on the basis of the extension of certain of the Council's services beyond Stamford Hill to Seven Sisters' Corner. An extension of the service to Waltham Cross, or intermediate points, is to be arranged as soon as the necessary cars are available.

L.U.T. Bill.—This Bill, which has now been passed by a Select Committee of the House of Commons, authorises the company as from six months after the termination of the war, to charge fares not exceeding 1d. per mile for ordinary passengers, and workmen's fares not exceeding 1d. for the first 3 miles and ½d. per mile beyond. It also contains a clause prescribing that the powers of compulsory purchase by local authorities shall be exercisable within six months after January 1st, 1950, and within six months of the expiration of every subsequent seven years.

Middlesbrough.—Arbitration.—The Bradford Corporation has given permission to its tramway manager to act on behalf of the Middlesbrough Corporation in an arbitration for the acquisition of the tramways in its area.

Preston.—Fare Revision.—The Corporation has increased the tramway fares, as from August 1st, by ½d. on all tickets, excluding workmen's.

Rochdale.—Price Increase.—The Electricity Committee has recommended that the charges to the Tramway Committee be increased by a tenth of a penny per unit, making 1·45d. per unit. The price of energy in future is to be subject to the coal clause.

TELEGRAPH AND TELEPHONE NOTES.

A Telegraphic "Jubilee."—Fifty years ago (July 31st, 1868) the telegraph system in this country was taken over by the General Post Office, and since the transfer telegraphy, with the sister science of telephony, has become an inherent part of our business life. By a curious coincidence, the past month has also seen the transfer of the American telephone and telegraph systems to State control; whether the transfer will become permanent or not remains for the future to decide. During the past decade the progress of wireless telegraphy has been one of the most striking features of the scientific world, the range of transmission having extended from short distances to many thousands of miles. After the war further developments may be expected.

Argentina.—The Siemens-Schuckert Co., representing Telefunken, of Berlin, has applied for a concession to erect a high-power Telefunken station for international and commercial messages. Detailed plans are to be presented 12 months after the concession has been signed, *force majeure* due to the war excepted. The construction is to be commenced one month, and the station completed in two years, after the plans are approved, failing which the deposit of $10,000 in paper currency is to be forfeited.—*The Times.*

Proposed New Cable.—At a luncheon given in New York in honour of a party of Australian editors, the establishment of a new direct cable between Australia and the United States was urged by a special committee of prominent business and professional men.—*The Times.*

The Telephone Service.—The P.M.G. is appealing for girls to enter the telephone service, pointing out its advantages as affording a permanent appointment on Civil Service lines without a competitive examination, and good prospects of advancement. A girl aged 19 receives 30s. 6d. a week to commence with.

Wireless Telephony.—Wireless telephone trials with Spanish apparatus were recently carried out, says the report of the British Chamber of Commerce in Spain, between the steamships *Raimundo Lulio*, at Barcelona, and the *Rey Jaime I*, during the voyage of the latter between Barcelona and Palma, Majorca, a few hours after she left Barcelona. The voices of the captain and an officer of the *Rey Jaime I* were heard on board the *Raimundo Lulio* and at land stations in Barcelona, as well as on board the cruiser *Princesa de Asturias.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—September 4th. Victorian Railway Commissioners. 800 lighting transformers for signal system. A copy of the specification may be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence) in London.

Belfast.—August 16th. Corporation. Two 6,000-kw. turbo-alternators, &c.; one 500-kw. turbo-alternator, &c.; one 30-kw. balancer-booster; four 48,000-lb. per hour water-tube boilers; four fuel economisers, &c.; two steel chimneys, with fans, &c.; two electrically-driven boiler feed pumps, &c.; accumulators; three 500-kw., and five 1,000-kw. rotary converters, with transformers, &c.; two 250-k.v.a., two 350-k.v.a., and six 1,250-k.v.a. transformers. See "Official Notices" July 19th.

Leeds.—August 10th. Electricity Department. Extension to feeder switchgear; alteration of generator switchgear; one 6,000-kw. turbo-alternator and jet condensing plant; two water-tube boilers, stokers, economisers, &c.; coal and ash conveying plant; pipes, centrifugal pump, &c. See "Official Notices" July 19th.

Spain.—Tenders have recently been invited by the municipal authorities of Medina de Rioseco (Province of Valladolid) for the concession for the electric lighting of the town during a period of 12 years.

CLOSED.

Barrow.—T.C. In connection with the new extensions:—

Foundations.—Hydraulic Mining Cartridge Co., £280.
Steam and circulating water-pipes.—Babcock & Wilcox, Ltd., £881.
Hand-rails for foundations.—Babcock & Wilcox, Ltd., £22.
Ironwork for foundations.—Joseph Webb & Sons, Ltd., £110.
Air duct for alternator.—Jas. Howden & Co., Ltd., £52.
Feed pump.—Jas. Howden & Co., Ltd., £250.

Bradford.—Tramways Committee.

Gear wheel castings.—Edgar Allen & Co., Ltd., and Cammell, Laird and Co., Ltd.

Hammersmith.—Electricity Committee. Annual contracts:—

Engine oil.—Dick & Co., Ltd.; 4s. 6d. per gallon.
Coal.—Cory Bros. & Co., Ltd.; Aberclwyd coal, 25s. 9½d. per ton.

Ilford.—U.D.C. Mossay & Co., Ltd., at £1,122, for a 3½-ton Orwell electric vehicle. The amount mentioned is exclusive of unloading gear, which is to be fitted.

Lancaster.—The tender of Messrs. Bennis & Co., Ltd., for the supply of two sets of machine stokers (£360) has been accepted by the Council.

London.—L.C.C.—The Highways Committee has purchased about 2,800 tons of coal and 3,400 tons of coke, for use at Greenwich power station, at a cost of about £58,000, during the quarter ended June 30th, 1918.

Main Drainage Committee. Accepted tender:—Electric ventilating fan and motor (£64), Allday & Onions.

Redditch.—U.D.C.

One 2,000-kw., 3,000-k.v.a., turbo-alternator and condensing plant complete.—C. A. Parsons & Co., Ltd.
E.H.T. switchgear.—Ferguson, Pailin & Co.
Cooling tower.—Lancashire Water Cooler Co., Ltd.
Boiler, stoker, Green economiser, and induced-draught fan.—Babcock and Wilcox, Ltd.

South Africa.—Johannesburg.—T.C.:—

Hubert Davies & Co.—10,000 electric lamps, £1,167; Griffin Engineering Co.—3,000 traction lamps, £300.

Stepney.—Electricity Committee:—

E. Foster & Co.—3,000 tons Howley Park D.S. nuts at 88s. 6d. per ton.

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Tasmania.—Launceston City Council. Messrs. Hinman, Wright & Manser, at £12,167, for the construction of a flume along the South Esk river from the intake dam to the electric power station.—*Tenders.*

Walthamstow.—U.D.C. Vaughan Crane Co., Ltd. Electric hoist, at £116, for the electricity department.

Wolverhampton.—Electricity Committee. Expanded metal partitions to enclose E.H.T. apparatus, &c., £57, Messrs. Halls, Ltd. The Committee agreed to the additional payment of £77 to the Rees Roturbo Manufacturing Co., Ltd. (owing to the revision in labour rates) in respect of their contract for two motor-driven pumps for a cooling tower, and of £66 to the General Electric Co., Ltd., in respect of additional wages paid in connection with the contract for a 900-KW. rotary converter.

NOTES.

The A.I.E.E. Convention.—The thirty-fourth annual convention of the American Institute of Electrical Engineers was held in June in Atlantic City, this being the second annual convention held by the Institute since the advent of the U.S. in the war. Judging by the ambitious programme, and the keen attendance, the Institute has lost nothing of its ability to contribute to electrical science and progress, although more than 10 per cent. of its members are in national service. While it was not a war convention in the strict sense, the effect of the war made itself apparent in the programme of papers, and it is easy to understand why the efficient utilisation of power and materials, the use of automatic instead of manual methods of control, and so on, have been the themes of the majority of the papers. President E. W. Rice's address was a masterly review of the electrical engineering progress of the time, and he sounded the keynote of the situation when he stated that the engineer was the hope of the nation, not only now, when they were at war, but even more so in the future—in the days of reconstruction following peace.

The meeting was devoted largely to a discussion of the engineering problems confronting the central-station industry, since it is upon the solution of these problems that the adequate and continuous supply of power depends. The convention included six technical sessions, an informal reception and dance on the evening of the first day, and conferences of Institute officers and section and branch delegates.

British Scientific Products Exhibition.—As we have already announced, this exhibition, organised by the British Science Guild, will be open from August 12th to September 7th, 1918. It will show how, by the combination of science and industry, we have not only supplied ourselves with the materials which before the war were imported from enemy countries, but have in many cases far surpassed the German products, and have established many new manufactures on a firm and enduring basis in this country. Over 250 manufacturers will take part in the exhibition, and the Air Ministry and the Food Production Department will also make large displays. The chief purpose of the exhibition is to educate the public mind to the realisation of the *necessity* of scientific research to progress in industry, and to demonstrate the remarkable results which have been achieved by this means since the outbreak of war; once the lesson is learnt, we hope it will never be forgotten. One section will be devoted to electrical and electromagnetic appliances, and in the "Physical Appliances" section a variety of electrical heating and welding apparatus will be shown; other sections relate to chemical products and processes, optical apparatus, refractories and porcelain, and measuring instruments. The exhibition will be held at King's College, Strand, London, and will include short lectures and addresses. Similar exhibitions have been held in France and the United States with successful results. The organising secretary is Mr. F. S. Spiers, 82, Victoria Street, S.W. 1.

The Inch v. the Metric System.—According to the *Journal of Electricity*, the American Consul at Geneva reports that a Swiss purchaser of iron sheets desiring to purchase sheets 3, 5, and 7 mm. in thickness, was informed by a British manufacturer that it would be impossible to furnish sheets of the thickness given in millimetres, as these sheets were made according to fractions of an inch. Manufacturers will do well to take note of this item.

Appointments Vacant.—Assistant mains engineer (£6) for the St. Marylebone B.C. Electricity Supply Department; junior assistant engineers-in-charge (32s. 6d. + 20s. + 12½ per cent.) for the West Ham Corporation Electric Supply; shift engineer for the Urban Electric Supply Co.'s Works, Stamford; charge engineer (58s. + 12½ per cent.) for the City of Gloucester Electricity Works; junior switchboard attendant (29s. 6d. + 9s. + 12½ per cent.) for the Rhondda U.D.C. Electricity Department; charge engineer (52s. + 12½ per cent.) for Merborough Electricity Department. See our advertisement pages to-day.

For Sale.—Wallasey Corporation electricity department invites offers for the following surplus plant:—One 500-KW. direct-coupled, triple-expansion generating set, two wooden water-cooling towers, three sets of condensing plant, and one Green economiser. See our advertisement pages to-day.

Imperial Mineral Resources Bureau.—At the Imperial War Conference last year it was agreed that it was desirable to take steps to set up an Imperial Mineral Resources Bureau, which should be charged with the duties of collecting information from the appropriate departments of the Governments concerned and from other sources, regarding the mineral resources and metal requirements of the Empire; and of advising from time to time what action, if any, might appear to be desirable to enable such resources to be developed and made available to meet the metal requirements of the Empire. Accordingly a Special Committee under the chairmanship of Sir Jas. Stevenson, Bart., was appointed to examine this proposal, and to report upon the duties and administrative responsibilities of the proposed Bureau. The Committee defined the duties of the Bureau as follows:—

(*a*) To collect, co-ordinate, and disseminate information as to resources, production, treatment, consumption, and requirements of every mineral and metal of economic value.
(*b*) To ascertain the scope of the existing agencies, with a view ultimately to avoid any unnecessary overlapping that may prevail.
(*c*) To devise means whereby existing agencies can, if necessary, be assisted and improved in the accomplishment of their respective tasks.
(*d*) To supplement those agencies, if necessary, in order to obtain any information not now collected which may be required for the purposes of the Bureau.
(*e*) To advise on the development of the mineral resources of the Empire or of particular parts thereof, in order that such resources may be made available for the purposes of Imperial defence or industry.

After consideration of the report of this Committee, the Government instructed the Minister of Reconstruction, in consultation with the Secretaries of State for the Colonies and India, to take the necessary action to give effect to the recommendations of the Imperial Conference and the findings of the Committee. Detailed proposals were accordingly submitted to the Dominion and Indian Governments, who nominated their representatives on the governing body of the Bureau, and the general scheme of the Bureau has now been finally ratified by the Imperial Conference. The Bureau will be incorporated by Royal Charter, and the governing body, which will be under the presidency of the Lord President of the Council, will consist of the following gentlemen:—

Sir Richard Redmayne, K.C.B. (chairman)
Nominated by the Canadian Government.—Dr. Willet G. Miller.
Nominated by the Government of the Commonwealth of Australia.—Mr W. S. Robinson.
Nominated by the Government of New Zealand.—Mr. T. H. Hamer, of the High Commissioner's Office.
Nominated by the Union of South Africa.—Right Hon. W. P. Schreiner, C.M.G.
Nominated by the Government of Newfoundland.—Right Hon. Lord Morris, K.C.M.G.
Nominated by the Government of India.—Mr. R. D. Oldham, F.R.S.
Nominated by the Secretary of State for the Colonies.—Mr. J. W. Evans, D.Sc., LL.B.
Nominated by the Minister of Reconstruction (in consultation with the Institute of Mining and Metallurgy, the Institute of Metals, the Iron and Steel Institute, and the Institution of Mining Engineers).—Mr. W. Forster Brown, Mineral Adviser to H.M. Woods and Forests.
Prof. H. C. H. Carpenter, President of the Institute of Metals.
Dr. F. H. Hatch, Member of Mineral Resources Advisory Committee of the Imperial Institute.
Sir Lionel Phillips, Bart., lately Director of Mineral Resources Development Department, Ministry of Munitions.
Mr. Edgar Taylor, ex-President of the Institute of Mining and Metallurgy.
Mr. Wallace Thorneycroft, President of the Institution of Mining Engineers.

Mr. Arnold D. McNair has been appointed secretary, and all communications regarding the Bureau should be addressed to the Secretary, Imperial Mineral Resources Bureau, Holborn Viaduct Hotel, E.C.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Corps Orders No. 81, by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Saturday, August 3rd, to Sunday, August 11th.—Annual Camp at Esher, Surrey. Parade at Waterloo Station, opposite No. 10 Platform, at 2 p.m., on Saturday, August 3rd. Dress: F.M.O. Billets are provided at Sandown Park (Fire Station Entrance).

C. Higgins, *Capt.* R.E., *Adjutant.*

Welded Ships.—A special meeting of the Technical Committee of Lloyd's Register of Shipping has been held to consider the application of electric welding to shipbuilding to the extent of eliminating by this method the use of rivets for important structural connections. The Committee of Lloyd's has recently carried out a series of carefully devised experiments to determine, as far as can be done by means of tests and analysis, the general trustworthiness of structural connections effected by electric welding and their capacity to stand the strains to which they would be subjected in practice. The Technical Committee had before it a report from the society's chief ship surveyor on the results of these experiments, and to assist it in its deliberations, a demonstration was given at the society's offices. After careful consideration, the Technical Committee decided to recommend to the General Committee for approval certain recommendations put forward by the chief ship surveyor as to the conditions on which, as a tentative measure, welding might be adopted, instead of riveting in the construction of vessels intended for classification in Lloyd's Register Book.—*The Times.*

Electric Cooking and Heating.—From a letter which appears in our "Correspondence" columns it will be noted that Messrs. G. N. Haden & Sons repudiate that part of their Dublin circular which related to electric cooking, and express their entire agreement with the remarks of Mr. Hopkins, which we quoted, regarding the efficiency of electric cooking. We gladly welcome this statement of their views, and may add that we have reason to believe that the firm will shortly give a practical demonstration of their faith in the future of cooking by electricity. It may be of interest to add that the company was established over 100 years ago, and has, therefore, acquired a ripe experience in heating engineering.

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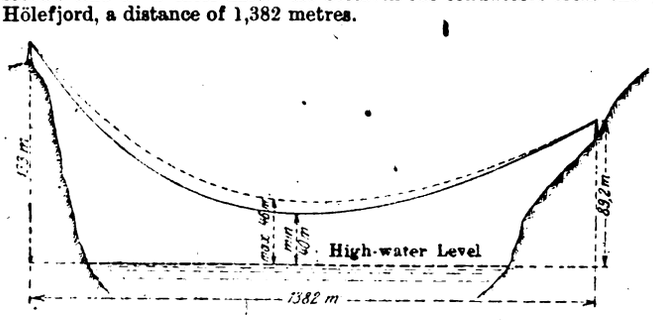
The Flörli-Oltesvik Transmission Line in Norway.—According to the *Elektrotechnische Zeitschrift*, the city of Stavanger, Norway, has purchased various water-powers so as to assure its supply of electricity in the future. The total capacity of the water-powers held by the city will ultimately be about 200,000 KW., corresponding to 6 KW. per inhabitant. The city now owns one undertaking at Oltedal, near Hölefjord, and a second undertaking is in course of construction at Dorge, in Sirdalen. Great difficulties have been experienced in obtaining materials and machinery, and the scheme will, therefore, take longer to complete than was anticipated.

Under these circumstances the city of Stavanger has made an agreement whereby in the meantime about 4,000 K.V.A. will be purchased from the Flörli electro-smelting works at Lgsefjord. Later this supply will be increased to 11,000 K.V.A.

The energy will be carried from Flörli to Oltesvik along a transmission line 26·5 km. long, which is built for a pressure of 55,000 volts, but which will at first only be worked at 32,000 volts. For a distance of about 15 km. the transmission line traverses mountainous country (770 metres being the greatest height above sea level). It consists of a pole line carrying three copper conductors each of 50 sq. mm. cross-section, provision being made for a second line at a later date. At Oltesvik the conductors cross the Hölefjord, a distance of 1,382 metres.



NORWEGIAN TRANSMISSION LINE CROSSING THE HÖLEFJORD.

Twin wooden masts are used, the angle posts being made up of four wooden masts placed together. The lowest conductor is 7·5 metres above the ground, and the average length of span 131 metres. With the exception of the span which crosses the fjord, the length of the longest span is 250 metres. The conductors have a safety factor of 2·5, the wooden masts 7, and the iron masts 3.

The conductors which cross the fjord have a minimum height of 40 metres above high water, and ships with masts about 80 metres in height have sailed under the span on the Oltesvik side. These conductors spanning the fjord consist of 19-strand steel cable (with a fatigue rupture of 140 kg. /mm.²) and with an outer cross-section of 16 mm. Each cable is carried on iron towers placed at distances of 15 metres apart, the conductors being 7 metres high. The safety factor of the steel conductors is 3, and that of the iron towers 4.

At Oltesvik the new transmission line will be linked up with the 30,000-volt line from Oltedal, and from that point onwards the existing Stavanger line will be made use of.

Development of the Electrical Industry in Italy.—The possibilities and impossibilities of industry in general in Italy have, says *Energia Elettrica*, been carefully worked out. Ten million tons of coal are needed for Italian industries to-day; to-morrow they will need other figures. Coal supplies will have to wait on imports; in other words, industrial activity will be at the mercy of the liberty of the seas and of the price of fuel. To overcome the difficulty resort is to be had to electricity. The lakes and rivers of the north and the midlands may give, it is estimated, about six million horse-power. Italian engineers think they may be able to yield more, and take their measures accordingly. Industrial and financial groups watch their operations attentively. It has been decided to electrify the Italian railway system, place electrical energy at the disposal of husbandry, and supply all branches of industry. Much is hoped from these great concentrations of industrial forces. We will merely consider the principal, indicating some of the largest undertakings. The Sindarco di Studi per Imprese Elettrometallurgiche Navali was constituted in Venice in February last, with the participation of the Adriatica di Elettricità, the Veneta per Costruzioni ed Esercizi di Ferrovie Secondari, and the Italiana per l'Utillizazione delle Forze Idrauliche del Veneto. This syndicate or trust has a vast programme, and contemplates utilising electric power for shipwrights' yards, foundries, and metal works on the Adriatic and at Venice. The Forze Idrauliche del Veneto Co. has raised its capital from 15,000,000 to 24,000,000 lire. The Forza Motrice dell 'Anza obtains 8,000 H.P. from the Anza River, and will feed a huge network of electric lines in the Province of Novara. It has absorbed the Dinamo Co., which possesses a large hydro-electric station at Varzo, supplied by the Rivers Diveria and Lairasca. The power obtained, about 20,000 H.P., is supplied to important companies, and especially for traction purposes, to the Vares Railway. Each company has a capital of 6,000,000 lire: the new company which is the outcome of the amalgamation will dispose of a capital of 25,000,000 lire. The Società Adriatica di Elettricità has raised its capital to 60,000,000 lire, in order to effect the establishment of the new company, the Società Idroelettrica Veneta. The Società Anonima Elettrica Siderurgica, of Lodi, has increased its capital from 500,000 lire to 2,000,000 lire. The Società per le Forze Idrauliche Ulzo sull' Ada has enlarged its capital from 4,000,000 to 6,000,000 lire, in order to take over the Martesana di Distribuzione d'Energia Elettrica. Great shrewdness characterises the Trezza d'Adda; its former position was certainly not a very brilliant one. In 1914 it had debts amounting to over 1,000,000 lire, which were reduced to 600,000 lire in 1915 and to 347,000 lire in 1916; this burden offered no hindrance to its managers distributing a 20-lire dividend recently. The Società Forze Idrauliche del Montcenisio is at the present moment augmenting its capital from 6,000,000 to 10,000,000 lire. The Elettriche del Piemonte Orientale is in a satisfactory position.

A prosperous development marks the Imprese Elettrica Conti; its available balance on December 31st, 1916, rose to more than 3,000,000 lire. The Elettrica Bresciana is an example of the rapid unfolding of the Italian electric industry. Its capital of 4,000,000 lire in 1905 was raised to 12,500,000 lire in 1907, afterwards to 16,000,000 lire, and in 1910 to 20,000,000 lire, and to 25,000,000 in 1915; it cannot be said that these increases have reached their end, for it appears that the company's field of expansion will shortly call for other augmentations of capital. The Società Caziale di Elettricita forms an exception to the rule; it remains stationary. The Italiana Conduttori Elettrici has raised its capital from 100,000 to 3,500,000 lire; its speciality in electric conductors assures it, since the war, a brilliant future. The Nazionale per Imprese Elettriche, of Milan, is growing; as a consequence of the incorporation of the Società per lo Sviluppo delle Imprese Elettriche, this company has raised its capital from 10,000,000 to 12,000,000 lire. As to the Adriatica di Elettricità, it is laying itself out for great industrial and financial potentialities by the increase of its capital from 36,800,000 to 60,000,000 lire. The Società di Elettricità Alta Italia forms an important trust company. Its capital is 30,000,000 lire, and, with the controlled companies (Piemontese di Elettricità, Magna, Cesnisdhia, and Valle d'Aosta), disposes of a total output of 83,700 H.P. The Forze Idrauliche dell' Apennins Centrale is a small company whose development will be most rapid. With the Elettrica Riviera Ponente Ing. R. Negri are bound up the great schemes which have attracted the attention of the world to Italy's water resources. The projects which the Negri Co. has in hand are huge; to realise them it needs enormous capital; it has already enlarged its capital to 50,000,000 lire, and by its amalgamation with the Officine Elettriche Genovesi, it will dispose of a capital of 200,000,000 lire. Account should also be taken of the fact that when the Negri Co. increased its own capital, it acquired the major part of the shares of the Società per le Forze Idrauliche della Maira. All these operations had the support of the Banca Commerciale Italiana and the Banca Italiana di Sconto. The older industries also take their shares in these undertakings; thus the firm of Ansaldo has participated in the increase of the capital of the Negri. To give an idea of the programme of the trust, we may say that it aims to create a great electrochemical and metallurgical industry in Northern Italy, and to electrify the whole of the railways. The Maira Co. already works the Montcenisio line and the lines of the Giovi. The trials on the Turin-Pinerolo line have been satisfactory; other lines connect Asti, Alejandria, and Genoa. All these lines bear witness to an unusual shrewdness of conception and a perfection of execution that bids defiance to impossibilities. Italy is on the road to a great development; what she has done for the future of the electric industry is a clear proof of this; with immense progammes she is boldly grappling with material difficulties and financial exigencies. It is in the same spirit that she takes in hand huge amalgamations for which enormous capital subscriptions are needed. Within a short while the electric concerns will have absorbed 1,000,000,000 lire; the results will not fall below the power available.

Electrified Wheat.—According to the Agricultural Correspondent of the *Daily Mail*, the coming harvest will prove whether the process of electrifying seeds, especially wheat, oats, and barley, will be a success or a failure.

The electrification consists of soaking the seed in a weak solution of common salt or calcium chloride, passing a comparatively small electric current through the seed in soak for a few hours, and then slowly drying it in a kiln. The system is the invention of Mr. H. E. Fry of Godmanstone, near Dorchester. At present over 2,000 acres are under treated seed, sown under precisely the same conditions as ordinary seed and side by side with it.

At Mr. Allan Sturdy's farm at Trigon, Wareham, electrified oats stand higher than untreated oats, the straw is stronger, the tillering and the size and weight of ear are considerably greater.

At Mr. Duke's farm at Puddletown the average height of treated Benefactor wheat is 45 in., of untreated 41 in., and there is more than a corresponding difference in the length and condition of the ear, though, curiously enough, a square yard cut from both portions weighed equally.

On Mr. Lovelace's farm at Piddlehinton the average lengths are 49 in. and 47 in., and cutting a square yard of each resulted in the treated crop weighing 7¼ lb. and the untreated 4¼ lb.

As far as one can judge at present, says the writer, the electrifying process will add from 2 to 3 sacks to the acre.

Edison-Swan Electric Co., Ltd.—In the Chancery Division, on Tuesday, Mr. Justice Astbury confirmed the reduction of capital of this company under a scheme of arrangement between the company and its debenture stockholders and its members.

Women Chemists.—In view of the increasing demand for women works' chemists, we understand that the Council of the Wigan Mining and Technical College has decided to make provision for their training. It is also stated that the Wigan Electro-Metallurgical Works, Ltd., will in the autumn require a number of trained women analysts.

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Institution and Lecture Notes.—Institution of Electrical Engineers.—In view of the practical impossibility, while the war continues, of holding the A.M.I.E.E. examination and of candidates having the requisite time to prepare for or undergo examination, the Council of the Institution of Electrical Engineers has decided to suspend temporarily the Institution rules with regard to examinations. The greatest care will, nevertheless, be exercised by the Council to ensure that only candidates possessing the qualifications laid down in the Articles in respect of training and experience are admitted to associate membership. Candidates who have been informed that they have been approved for associate membership subject to their passing the examination and who desire their applications to be reconsidered by the Council, are requested to communicate with the Secretary, at No. 1, Albermarle Street, W. 1.

Electrical Association of Australia (N.S.W. Section).—The Association, on April 12th, held a joint meeting with the British Medical Association and the Dental Association; papers were presented by Prof. O. U. Vonwiller on "The Theory of Electrolytic Conduction," and by Messrs. R. Grant (Board of Health) and Mr. W. H. Myers on "Some Practical Points in Ionic Medication."

Electrical Power Engineers' Association.—A meeting of the National Executive Council of the Association was held at Manchester, on July 27th. There were present, representing the Northern Division, Messrs. Annett, Atkinson, Spurr, Lunn, and Thomas; North-Eastern Division, Messrs. Porter and Vernier; Midland Division, Messrs. Mason, Bowser, and Burgess; Southern Division, Messrs. Bostel, Healy, Christmas, and Law. There were also present Mr. G. G. Bell (A.M.E.E., Greater London); Messrs. Parker and Young (C.T.A.A.); and Mr. W. A. Jones (hon. sec. of the E.P.E.A.). Mr. C. H. Wordingham (president I.E.E.) attended the meeting in an advisory capacity.

Mr. Lunn was elected chairman of the meeting.

The hon. sec. reported that as a result of a ballot of members there was a large majority in favour of proportional representation on the National Executive Council. The drafts of rules were considered, and a final draft was agreed upon, subject to legal approval and that of the Registrar before final submission to the members.

The development in connection with the A.M.E.E. and C.T.A.A. since the last meeting was reported upon, and after discussion it was unanimously agreed that it was necessary to safeguard representation of the various grades, namely :—

1. Chief engineers.
2. Departmental chiefs; and
3. The remaining members—on the Sectional and Divisional Committees and National Executive Council.

The following scheme was adopted for the basis of representation :—

10	per cent.	to be elected by	Grade 1.
20	"	" "	Grade 2.
70	"	" "	Grade 3.

Provided that there should be not less than one representative of the three grades on any Committee.

The following officers were elected for the current year :—

President : Mr. A. L. Lunn.
Vice-Presidents : Messrs. R. C. Atkinson and H. Parker.
Treasurer : Mr. G. C. Law.
Hon. Sec. : Mr. W. Arthur Jones.

The thanks of the meeting were accorded to Mr. Wordingham for his attendance in Council.

The inaugural meeting of the Glasgow Branch of the Association took place last Wednesday in Glasgow. There was a large attendance, all sections being represented. The appointment of officials and a Provisional Committee took place. Mr. Holt, of Manchester, was present, and spoke of the rapid progress and excellent prospects of the branch. The Hon. Sec. is Mr. Arthur E. Kelly, 5, Battlefield Avenue, Langside, Glasgow, to whom all communications should be addressed.

Old Dry Cells.—Who that uses dry cells for bells, telephones, pocket lamps, &c., has not felt a twinge of conscience when scrapping worn-out batteries? An enormous amount of valuable material has thus been lost to the world, but fortunately this is no longer an inevitable waste. According to *Salvage*, old batteries need not now be classed among the "rubbish" of the sale yards. They are carefully and systematically "rendered to produce," and they furnish us with their own weight, less an average aggregate loss of weight of 6 per cent., of zinc, brass, pitch, graphite, manganese dioxide, white rags, and paper. The cost of the process, including all charges, is less than 20 per cent. of the value of the "produce" realised.

Late Legal.—Rio Tinto, Ltd., *v.* A.E.G. Electric Co., Ltd.—The Official Referee on Tuesday gave judgment in this case, deciding that the defendants had broken their contract by supplying a blower, the design of which was radically defective, and that the plaintiffs were entitled to damages, but not for loss of profit. The defendants were entitled to £1,757 on their counterclaim. The judgment will be reported in our next issue.

Carnival.—The employés of the Lydbrook Cable Works (H. W. Smith & Co., Ltd.) held a carnival on Saturday in aid of St. Dunstan's Hostel for Blind Soldiers and Sailors. The effort was highly successful, and the proceeds, amounting to £200, have been forwarded to Sir Arthur Pearson.

Municipal Tramways Conference.—Committees of the L.C.C. recommend the Council to send Messrs. A. H. Scott & W. J. Squires to represent it at the above Conference at Leicester in September on "the understanding that the Council is thereby in no way committed as to its policy with regard to matters discussed thereat."

Bosch Magneto Works at Stuttgart Bombed.—Our Independent Air Force visited Stuttgart on the night of July 30th—31st, and dropped nearly 2 tons of bombs on the Bosch Magneto Works, the Daimler Works, and the railway station.

Electro-Harmonic Society.—The annual meeting of this Society was held on Wednesday afternoon at the Institution of Electrical Engineers. The report shows that during the past season 31 new members were elected. There are now 594 names on the register, but this cannot be regarded as the number of effective members, as the rule under which names are removed cannot be applied as strictly as usual in view of the large number of members absent on active service. The arrangements for the 1918-19 season are as follows (all Friday evenings):—*Smoking Concerts* on October 11th and December 13th, 1918, and on January 10th and March 21st, 1919; Ladies' Nights, November 15th, 1918, and February 14th, 1919.

Lightning Accident.—A curious lightning accident is disclosed by Major A. Cooper-Key, H.M. Chief Inspector of Explosives, in his annual report just issued. An explosives factory in Kent was struck by lightning, with the result that one building was blown up and four others were set on fire at the same instant. A ton of nitro-cellulose dough digesting in alcohol, and contained in hermetically-closed iron drums, blew up, although, according to recognised principles, these "hollow conductors" should have been impervious to electric phenomena, and the solvent-impregnated dough should have represented a fire risk only, and should have been incapable of developing explosion. The factory was fitted with lightning conductors of the most modern type, in quite new condition, all light and power cables were well earthed, and the protection against lightning would seem to have been as good as could be devised.

The Skilled-Labour Embargo.—The names of the Committee of Inquiry that has been set up to investigate this subject are as follows :—

The Hon. Mr. Justice McCardie (chairman); Sir Stephenson Kent, K.C.B. (Ministry of Munitions); Sir David Shackleton, K.C.B. (Ministry of Labour); Sir Robert Horne, K.B.E. (Admiralty).

Sir Allan Smith, K.B.E.; Sir Herbert Rowell, K.B.E.; Mr. F. Dudley Docker, C.B.E. Nominated by the Engineering Employers Advisory Committee of the Ministry of Munitions.

Mr. J. Kaylor, Amalgamated Society of Engineers; Mr. G. Wilkinson, Amalgamated Society of General Toolmakers, Engineers, and Machinists; and Mr. W. F. Dawtry, Steam Engine Makers' Society. Nominated by Trade Union Advisory Committee of the Ministry of Munitions.

Mr. C. S. Hurst, secretary.

The terms of reference of the Committee are :—

1. To investigate and report on the labour conditions which have rendered the embargo necessary, and to advise upon the administration of the scheme.
2. To consider and report as to what further measures should be adopted, in view of those conditions, to maintain, and, where necessary, increase the output of munitions, due regard being given to the public interest in the most effective and economical use of labour, money, and material.

All communications should be addressed to the Secretary, at 6, Whitehall Gardens, London, S.W. 1. The first meeting of the Committee is to be held to-day to settle methods of procedure.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—Permission has been granted to the Bradford Tramways manager (Mr. C. J. Spencer) to act on behalf of the Middlesbrough Corporation in the arbitration proceedings which are forthcoming for the acquisition of the tramways in its area.

Mr. C. J. Spencer, general manager of the Bradford Corporation Tramways, tendered his resignation on Monday last, consequent upon his having taken up an important position on the executive of the London Underground group of railways. He has been manager at Bradford for the past twenty years. He commenced his career with the Blackpool Electric Tramways Co., and was later given an appointment with the South Staffordshire Tramways Co. His services have been utilised by the Admiralty for over a year during the war. The Tramways Committee, in accepting the resignation, expressed its great regret at the loss of the services of Mr. Spencer. The resignation will take effect from November 1st.

The Highways Committee of the L.C.C. has authorised special duty payments in respect of extra services rendered during 1917 by the undermentioned officials in the tramways department, as follows:—Mr. E. L. Pope, £25; Mr. H. R. Saxby, Mr. G. T. Dickins, £50; Mr. J. Terry and Mr. E. Cloney, £30 each; Mr. H. R. Docker, £20; Mr. E. W. Dickinson, £50; Mr. J. R. Walker and Mr. H. Underwood, £20 each.

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The Hammersmith B.C. Electricity Committee has appointed Mr. DUFFY, of Wolverhampton, Temporary Engineer in charge at the generating station, at a salary of £175, plus a war bonus of £1 per week, plus 12½ per cent.

Mr. F. GOLDING, chief electrical engineer in the post and telegraph department at Victoria, has been appointed chief electrical engineer on the central staff of the Postmaster-General's department, at £900 a year.—*Australian Mining Standard.*

The marriage has taken place of Mr. GEO. TATCHELL, assistant engineer at the Gravesend Electricity Works, and Miss G. E. Berrey, youngest daughter of Mr. J. Berrey, Mayor of the borough.

Roll of Honour.—BOMBARDIER S. SWEETING, R.G.A., formerly an electrician at Wakefield with the Yorkshire Power Co., has been awarded the Military Medal for gallantry.

LIEUT. ERIC BAINBRIDGE, R.F.C., reported dead after being missing since a patrol flight in September, 1916, when he was brought down in the enemy lines when attacked by six German machines, was prior to the war with Messrs. Crompton & Co., Ltd., of Chelmsford.

Mr. W. J. Head, of the India Rubber, Gutta Percha and Telegraph Works Co., Ltd., Newcastle-on-Tyne, has received news from the British Red Cross that his son, PRIVATE LIONEL HEAD, R.A.M.C., who was reported missing on May 27th, is a prisoner in Germany, and well.

SEC.-LIEUT. J. W. PARKER, West Yorks Regiment, who was awarded the M.C., but did not live to receive it, was, before the war, with the General Electrical Supplies, Ltd.

SAPPER A. E. SHUTTLEWORTH, R.E., who has died in hospital from pneumonia, aged 23 years, was an electrical engineer with Messrs. Simpson Bros., Hapton.

PRIVATE A. JONES, S. Lancashire Regiment, posted missing in August last, and now presumed killed, was an employé of the British Westinghouse Co., Ltd., Trafford Park.

PRIVATE T. FOLEY, Manchester Regiment, missing since last September, and now presumed killed, was employed by Messrs. Baxendale & Co., Ltd., Manchester.

SEAMAN W. RUDDOCK, who was employed at the Keighley Electricity Works, is reported drowned at sea on July 6.

SECOND-LIEUTENANT JOHN SCOTT YOULL, Northumberland Fusiliers, who was employed in the electrical department at the Thornley Colliery, Durham, has been awarded the Victoria Cross. Lieutenant Youll was formerly mentioned in despatches for services in France, and was on July 5th decorated by the King of Italy with the Italian Silver Medal for bravery.

LIEUTENANT F. C. BRABY, Lancashire Fusiliers, son of Mr. Cyrus Braby, managing director of Messrs. Fredk. Braby and Co., Ltd., has received the Military Cross for conspicuous gallantry and devotion to duty during a determined enemy attack under intense machine-gun fire.

Two members of the staff of the heating department of Simplex Conduits, Ltd., have figured in recent honours lists, SERGEANT-MAJOR SURRALL having been awarded a Meritorious Service Medal and SERGEANT-MAJOR CUTTS a Distinguished Conduct Medal. Both of them voluntarily joined up early in the war.

Obituary.—MR. H. C. WALSH, electrical engineer; Blackburn, died last week at the age of 44 years, from pneumonia following influenza.

GAUTHIER-VILLARS.—We recently recorded the death in action of M. Gauthier-Villars, captain of artillery, an officer of the Legion of Honour, and holder of the Croix de Guerre. From the *Revue Générale de l'Electricité* we learn that M. Gauthier-Villars was over military age when war broke out, but rejoined the Army as lieutenant of artillery in August, 1914, and at his own request was sent to the front as commandant of a train of heavy artillery, in which capacity he served up to the time of hs death. He was proprietor of *La Revue Electrique*, and when this well-known journal was combined with *La Lumière Electrique* he became a member of the administrative council of the *Revue Générale de l'Electricité*.

Will.—According to the *Times*, MAJOR AUSTIN GRAHAM, Yorkshire Regiment, of Huntcliffe House, Saltburn-by-the-Sea, Yorkshire, electrical engineer, in business at Middlesbrough, who died from wounds on April 11th, left £5,025.

NEW COMPANIES REGISTERED.

Radio-Electric Clothing Co., Ltd. (151,007).—Private company. Registered July 20th. Capital, £10,000 in £1 shares (5,000 10 per cent. pref.). To carry on the business of manufacturers of and dealers in electrically-heated clothing, and all kinds of devices for lighting or heating by electricity, &c. The subscribers (each with five ord. shares) are:—Carl Magnus Holmquist, 4, Grange Road, Ealing, W., electrical engineer; James Guidici, 57, Uxbridge Road, Ealing Broadway, W., business manager. The first directors are to be appointed by the subscribers. Solicitor: L. C. Tree, 61, Carey Street, W.C.

Platit, Ltd. (151,024).—Private company. Registered July 23rd. Capital, £10,000 in 5,000 20 per cent. pref. shares of £1 each, and 100,000 ord. shares of 1s. each. To take over the business of chemical and electrical plating, and all other kinds of plating, carried on by Agnes Dalby at 137, Cheapside, E.C., as Dalby's Patents, with the patents granted in England, France, Russia, Japan, and the U.S.A., &c. The subscribers (each with one pref. share) are:—B. V. Clerke, F.A.A., &c., 63, Finsbury Pavement, E.C.2; J. Shepherd, Haslemere, Ranelagh Road, Wembley, Middlesex, accountant. The first directors are: E. R. N. Hyde, J. Lee, and Agnes Dalby (managing director). Registered office: 63, Finsbury Pavement, E.C.

Threadgill Electro Deposits, Ltd. (151,059).—Private company. Registered July 27th. Capital £5,000 in £1 shares To take over the business of electro depositors and platers and metal workers carried on at Dudley Port, Tipton, as the Threadgill Electro Deposits Co. The subscribers (each with one share) are:—S. Threadgill, 5, Cannock Road, Falling Park, Wolverhampton, metal plater; J. B. Share, Shirley House, Bridgnorth Road, Wollaston, Stourbridge, engineer, &c. The first directors are to be appointed by the subscribers. Solicitor: J. A. Shephard, 2, Dudley Port, Tipton.

Belleek Felspar Co., Ltd. (150,053).—Private company. Registered July 27th. Capital, £2,000 in £1 shares. To acquire mines, &c., in Co. Fermanagh or elsewhere. Agreement with L. W. Carder. The subscribers (each with one ordinary share) are:—L. Shaffer, 20, Hawkshead Street, Southport, company director; W. Cooper, Hendre, Flixton, Lancs, cotton goods salesman. Governing directors: Louis Shaffer and Laurence W. Carder. Registered office: 24, Brazennose Street, Manchester.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

New Phonopore Telephone Co., Ltd.—Memorandum of satisfaction (*a*) in full on July 11th, 1918, of charge dated 1913, securing not more than £2,000, (*b*) on same date, to the extent of £1,233 6s. 8d., of charge dated 1910, securing £1,500, and (*c*) on July 15th, 1918, to the extent of £1,150, of charge dated January 27th, 1914, securing £1,250, have been filed.

Egham & Staines Electricity Co., Ltd.—Agreement dated July 1st, 1918, to issue £5,000 additional debs. ranking *pari passu* with existing debs., and extending time for repayment of and increasing rate of interest on the £12,000 existing debs.

Burnham & District Electric Supply Co., Ltd.—Debenture dated July 8th, 1918, to secure £2,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: T. G. Folliott and W. Moon.

Also registered:—Memorandum of satisfaction in full on July 8th, 1918, of debentures dated 1915 and 1917, securing £2,000, has been filed.

CITY NOTES.

French Companies.

The Société des Cables de Lyon reports the allocation of £12,000 to depreciation in 1917, leaving net profits and balance forward amounting to £26,000. It is proposed to pay a dividend of £2 per share.

The Société Electro-Métallurgique Francaise of Froges, after setting aside £149,000 for depreciation in 1917, states that the net profits amounted to £141,000 on a turnover of £1,174,000. It is intended to distribute £3 per share on the old capital of £620,000 and £1 8s. per share on the new capital of £380,000.

The Compagnie des Forges et Acieries Electriques Paul Girod of Ugine (Savoy), which is the French successor of the Swiss company of a similar name, reports having been occupied with war contracts during the first year's (1917) activity. The net profits reached £227,000, and a dividend at the rate of 20 per cent. has been declared on the Ordinary share capital of £600,000.

The directors of the *Compagnie Electro-Mecanique* report that new workshops had been constructed at Bourget and Lyons, and the production was largely increased in 1917. As net profits the accounts show the sum of £50,000, which permits of the distribution of £1 12s. per share or 8 per cent. on the old capital, and £1 3s. per share on the new shares.

The Société Westinghouse records net profits and balance forward amounting to £151,000 for 1917. The directors recommend a dividend at the rate of 2 per cent. on the ordinary shares. According to the annual report, the works at Havre were in full operation on the production of electrical and mechanical machinery for Government works or firms engaged on contracts for the national defence. A portion of the plant was also used for the manufacture of artillery undertaken by the company's subsidiary, the Société pour l'Exploitation des Procédés Westinghouse-Leblanc, and extensions of the works were being carried out as rapidly as possible on new sites adjoining the existing works.

The report of the *Ateliers de Constructions Electriques du Nord et de l'Est (Jeumont-Nord)* states that the company's works were still situated in the invaded districts in 1917, with which communication had become more difficult and uncertain. There was every reason, however, for fearing that most of the machinery and stocks had been removed from the works by the enemy. During the year the share capital was raised from £1,200,000 to £1,600,000. A works for the construction of electro-mechanical machinery had been established at Plaine-Saint-Denis, and the pre-war manufactures were being resumed. The order book was well supplied, but difficulties existed in obtaining materials, transport, and competent workmen. It was expected, however, that this works, which was far from being of the same size as the works at Jeumont, would yield satisfactory profits, and that it would allow the company to occupy a good position among electrical manufacturers on the conclusion of peace and pending the restoration of the Jeumont undertaking. The works at Saint-Ouen continued to work for the national defence, and afforded

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favourable results. Concerning the companies in which the company is directly or indirectly interested, the directors mention that all the works of the Electricité et Gaz du Nord were occupied by the enemy. It appeared that the gas works had not been seriously damaged, and that this was the case also with the Jeumont central station, and the buildings at Maubeuge, where no machinery had been installed, were undamaged, but it was believed that a portion of the Lomme central station near Lille had disappeared. Under the circumstances it has been impossible to present any profit and loss account and balance sheet for 1917.

The report of the *Compagnie du Chemin de Fer Métropolitain de Paris*, whose financial results for 1917 were recently recorded in this column, deals with the customary great length with the movements during the year. The directors state that while the receipts experienced a further expansion owing to the growth of the traffic, the financial charges continued to rise, and in still greater proportions in consequence of the high price of coal and the dearness of labour and of raw and other materials for work of maintenance. Dealing with the first-mentioned, the directors state that the cost of coal before the war, which was obtained from the district of the Nord, was £1 per ton delivered at the works, including the city dues. Since then Cardiff coal had been used, and the cost delivered at the works amounted to £1 19s. 6d. in 1915, £2 11s. in 1916, and £3 19s. per ton in 1917, which prices were much lower than those paid by industrial consumers. The consumption of coal in 1913 was 150,000 tons for the production of 110,500,000 KW.-hours of three-phase current by the company's works and the Saint Denis section; 145,000 tons for 89,500,000 KW.-hours in 1915, 159,000 tons for 99,500,000 KW.-hours in 1916, and 153,000 tons for 97,000,000 KW.-hours in 1917, the proportion having varied with the efficiency or quality of the coal. The expenditure on coal in 1917 was £612,000, or £200,000 more than in 1916, and four times greater than in the pre-war period. The prices of materials for maintenance had risen a year ago from 300 to 500 per cent., and they continued to advance during 1917. The final result, as compared with 1916, was an additional outlay of £200,000 for coal, £100,000 for labour, and £40,000 for materials, whilst the City's share in the gross receipts rose by about £160,000. As a consequence, and notwithstanding an augmentation of £460,000 in the receipts in 1917, the net profits declined by about £40,000. The City of Paris, which granted the concession, was at the same time the company's joint partner, but only in regard to the receipts, not in the case of the expenses. The share of the City, which was £680,000 before the war, increased to £760,000 in 1916 and to £960,000 in 1917. The company had consequently asked permission either to advance the passenger fares or for the concession to be modified so as to reduce the City's share in the gross receipts. The Government authorities had already authorised increases in the case of provincial local railways and tramways, gas, electricity, and water works, Parliament had followed with similar sanction for the large railway companies, and at Paris the gas company had been empowered to raise its charges, and the directors believed that the Government would eventually not refuse to assist the company in endeavouring to re-establish the balance which affected the interests of no fewer than 25,000 shareholders.

Prospectus.—*The General Electric Co., Ltd.* In his speech delivered at the annual meeting in July, Mr. Hirst referred to the proposed increase of the capital to £3,000,000 by the creation of 100,000 additional preference shares of £10 each, and 60,000 additional ordinary shares of £10 each. He added that 80,000 and 16,000 of the latter were shortly to be issued to the public. The prospectus for the 6½ per cent. cumulative preference shares at par and for the ordinary at £13 has been before the public this week, the list opening on Tuesday. The purposes for which this new capital is required are: To complete the Fraser & Chalmers purchase (already referred to in these columns)—the price being between £500,000 and £600,000—and the provision of working capital to carry on the operations of that business; the repayment of bankers' advances; the further extension of the Witton engineering and carbon works; the completion of the G.E.C. Kingsway buildings; and the extension of the company's trade at home and abroad.

The financial papers state that the issue was largely oversubscribed on the opening day, and the lists were closed on that day except for applications arriving by Wednesday morning's post.

Stock Exchange Notice.—The undermentioned securities have been ordered to be quoted in the official list:—

British Insulated & Helsby Cables, Ltd.—500,000 additional ordinary shares of £1 each, fully-paid, Nos. 500,001 to 1,000,000.

Bristol Tramways and Carriage Co., Ltd.—Interim dividend for June half-year at the rate of 6 per cent. per annum, free of income-tax, on the ordinary shares.

Sao Paulo Tramway, Light, and Power Co.—Dividend of 2½ per cent., less tax.

Vickers, Ltd.—Interim dividend 1s. per ordinary share, free of tax up to 5s. in the pound.

City of Buenos Aires Tramways (1904), Ltd.—Dividend 1s. 3d. per share (at the rate of 5 per cent. per annum), less tax, for three months ended June.

Chelsea Electricity Supply Co., Ltd.—Interim dividend for the half-year at the rate of 3 per cent. per annum, less tax, on the ordinary shares.

Chatham and District Light Railways, Ltd.—Interim dividend for the half-year on the ordinary shares at the rate of 8 per cent. per annum, less tax.

Metropolitan Railway Co.—Interim dividend at the rate of 1 per cent. on the ordinary stock.

National Gas Engine Co., Ltd.—Interim dividend on the ordinary shares, 3¾ per cent.

Kensington and Knightsbridge Electric Lighting Co., Ltd.—Interim dividend on the ordinary shares at the rate of 5 per cent. per annum.

Oldham, Ashton & Hyde Electric Tramways Co., Ltd.—Interim dividend at the rate of 5 per cent. per annum on the ordinary shares.

Stewarts and Lloyds, Ltd.—Interim dividends at the rate of 6 per cent. per annum on the preference, and 10 per cent. per annum on the preferred ordinary shares.

Yorkshire Electric Power Co.—Net profit for the half-year ended June, £23,683. The preference dividend is to be paid, but in view of the financial conditions arising out of the war the directors are deferring payment of a dividend on the ordinary shares until the accounts are made up for the year.

Westminster Electric Supply Corpn., Ltd.—Interim dividend at the rate of 7 per cent. per annum, less tax.

STOCKS AND SHARES.

Tuesday Evening.

Markets in most parts of the Stock Exchange continue to show activity and strength. There is a good deal of business going on. Considering the holiday season, the volume of trade is much larger than it usually is at this time of the year. Investment and speculation are both active. Contrasted with the corresponding week of four years ago, just prior to the outbreak of war, markets of to-day are cheerful and animated. Electricity supply shares stand below their pre-war levels, as do also nearly all the home railway stocks, but in other industrial lists, many of the pre-war prices have been left a long way behind, and amongst cable stocks and shares, for instance, the rises since July, 1914, have been substantial.

Four years ago, business during the last days of July was paralysed, and impending disaster, so soon to fall in the shape of a general outbreak of hostilities, hung like a pall over the Stock Exchange. Holders of even high-class securities found it practically impossible to realise them, for jobbers shut up their books, and refused to buy unless they knew where they could place what holders wished to sell, and the buyers of that time were few and far between. Since then, the open account, as it is termed, has been largely closed down, and the Stock Exchange of to-day occupies a firmer position financially than it has done for the last half-century. The anomaly is striking enough, and might be made the basis of a series of anomalies quite inappropriate to this column. Therefore, to descend:—

One feature of the past few days is another upward movement in the prices of the Underground Railways issues. Districts, Metropolitans, and the Underground Railways bonds and shares have hardened appreciably. The recovery in Underground Incomes is natural enough, but the rise in Metropolitans is less easy to understand. The return on the money at the present price is very inadequate, and though the company were to increase its dividend to 1¼ per cent., the return would still be a small one. The advance in Districts is due to favourable reports with reference to the profits which the London General Omnibus Co. is declared to be making, added to which there is, of course, the probability that the recent rise in fares will make a substantial difference in receipts. It takes little buying to put up prices of these Underground stocks, but the converse is also the case, and when sellers come in, the market has a habit of moving down sharply.

Electricity supply shares remain as quiet as ever. The gas companies have recently secured an important modification from Parliament whereby the operation of the old sliding scale will be suspended and the companies enabled to increase the charges and dividends at the same time. Upon this, there occurred a brisk rally in the stocks of the principal companies, but this has had no effect upon those in the electric lighting group, which, of course, are not subject to the sliding scale arrangements, but which have a tendency to move in sympathy with gas stocks. The first of the interim dividends have been declared, but up to the present they have proved colourless, and there is nothing to shake the placidity of the market.

It is in the manufacturing group where most of the activity continues to prevail. Edisons have come along with a rush, animation being especially noticeable in the shares £3 paid. The price has jumped to 45s., the movement attracting a lot of speculative interest. British Westinghouse Preference and other similar shares keep good. General Electrics are not much affected by the issue of the prospectus offering new Preference and Ordinary shares, the latter at £13 per share. The prospectus states that the

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directors hope to be able to allot one ordinary share for five preference shares applied for, and if this proves to be feasible in practice, the allottees will secure a cheap investment, the bonus on the ordinary shares being, of course, material, seeing that the existing ordinary stand at 28½. The issue has evoked considerable interest, and rumour is already busy with estimates of the proportion which applicants are likely to receive. The company's preference shares have fallen ⅛ to 10⅜. Babcock & Wilcox at 3 15/16 are 1/16 up, but no news has been published yet with reference to the expected bonus. Fraser & Chalmers have strengthened on the idea that the General Electric Co. may buy up all the shares, and at a higher price than that now current in the market.

Marconis have been active again, and the price of the parent shares rose to 4 on the eve of the meeting, at which it was expected that the chairman would make the important statement promised a week ago. Americans sympathised with a rise to 26s. 9d., but in the shares of the other subsidiaries there is not much doing. Anglo-American Telegraph stocks are better, and rises have occurred in Chile Telephones, Cuba, Globe Preference, United River Plates, and Westerns. The advance in the last-named puts the shares once more at the top of their particular group, so far as the quotation is concerned.

Rubber shares have hardened again. Advance (but not official) statistics have been received from the United States showing that the imports of rubber into America in June were almost up to the 25,000 tons to which the imports into the United States were supposed to be restricted for the whole of three months. The armament, iron, and steel groups are holding their prices with firmness, and quiet improvements have been secured during the past few days in the shares of the companies connected with tin and copper.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price July 30, 1918.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6½	—	£7 13 10
Charing Cross Ordinary	5	4	3½	—	6 3 1
do. do. 4½ Pref.	4½	4½	3½	—	6 18 6
Chelsea	3	5	3½	—	7 13 10
City of London	8	8	11½	+ ½	7 2 3
do. do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
County of London	7	7	10⅜	—	6 17 7
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	6	7	5½	—	6 13 4
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3½	—	7 13 10
Metropolitan	3	4	3⅜	—	6 8 0
do. 4½ per cent. Pref.	4½	4½	3½	+ ½	6 18 6
St. James' and Pall Mall	8	9	6½	— ½	6 18 6
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6½	—	7 7 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	96	+1	6 5 0
do. Def.	1½	1½	22½	+ ½	6 13 4
Chile Telephone	8	8	9½	+ ¼	4 4 3
Cuba Sub. Ord.	7	7	10	—	*7 0 0
Eastern Extension	8	8	15⅝	—	*5 3 3
Eastern Tel. Ord.	8	8	157½	—	*5 1 7
Globe Tel. and T. Ord.	7	7	14⅜	—	*4 17 5
do. do. Pref.	6	6	10	+ ⅛	6 0 0
Great Northern Tel.	24	22	87½	—	5 17 4
Indo-European	13	—	58½	—	5 11 1
Marconi	15	20	4	+ ⅛	5 0 0
Oriental Telephone Ord.	10	10	4⅛	—	2 2 2
United R. Plate Tel.	8	8	7½	+ ⅛	*5 6 8
West India and Panama	6d.	9d.	1/6	—	*3 6 8
Western Telegraph	8	8	16	+ ⅛	*5 0 0
Home Rails.					
entral London Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	1	1	24	+ ½	4 3 4
do. District	Nil	Nil	21½	+2	Nil
Underground Electric Ordinary	Nil	Nil	2⅜	—	Nil
do. do. "A"	Nil	Nil	5/9	—	Nil
do. do. Income	6	4	84½	+1½	*4 14 8
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅜	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	8⅛	+ ⅛	—
do. do. 2nd Pref.	5½	—	2⅜	—	—
do. do. 5 Deb.	5	5	65½	+ ½	7 12 8
Brazil Tractions	—	—	47	+3	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	61½	—	8 2 8
do. do. Preferred	Nil	Nil	45	—	Nil
do. do. Deferred	Nil	Nil	40½	—	Nil
do. do. Deb.	4½	4½	60⅝	—1	7 0 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	44⅛	—	Nil
do. 6 per cent. Bonds	Nil	Nil	36½	—	Nil
Mexican Light Common	Nil	Nil	21	—	Nil
do. Pref.	Nil	Nil	39	+ 3	Nil
do. 1st Bonds	Nil	Nil	49	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3 15/16	+ 1/16	3 16 2
British Aluminium Ord.	10	10	1¾	—	5 6 8
British Insulated Ord.	20	20	2	—	5 0 0
British Westinghouse Pref.	7½	7½	2⅝	—	5 19 6
Callenders	20	25	19½	—	6 11 7
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	3 7/16	—	5 16 0
Edison-Swan, fully paid	—	—	3⅛	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	+1	5 6 0
Electric Construction	7½	10	1 1/16	—	7 12 4
Gen. Elec. Pref.	6	6	10⅞	— ⅛	6 5 4
do. Ord.	10	10	28½	—	*3 10 0
Henley	25	25	2⅜	—	5 17 8
do. 4½ Pref.	4½	4½	3⅜	—	5 12 2
India-Rubber	10	10	16⅜	—	*6 4 0
Telegraph Con.	20	20	44½	—	*5 7 8

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, July 31st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£80	..
a Ammonia, Muriate (large crystal)	"	£75	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£43	..
a Copper Sulphate	"	£65	..
a Potash, Chlorate	per lb.	2/6	..
a " Perchlorate	"	2/-	..
a Shellac	per cwt.	£17 5/-	..
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	"	£35	..
a " Lump	"	£25	..
a Soda, Chlorate	per lb.	1/1	..
a " Crystals	per ton	170/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 3" to 12" basis)	per lb.	..	..
c " Tubes (solid drawn)	"	..	..
c " Wire, basis	"	..	..
c Copper Tubes (solid drawn)	"	1/8½ to 1/9	
g " Bars (best selected)	per ton	£161	£14 inc.
g " Sheet	"	£161	£14 inc.
g " Rod	"	£161	£14 inc.
d " (Electrolytic) Bars	"	£137	..
d " " Sheets	"	£152	..
d " " Wire Rods	"	£145	..
d " " H.C. Wire	per lb.	1/5⅝	..
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/6	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	3/-	1d. dec.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£37	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	6d. to 8/-	..
e " " " medium	"	8/6 to 6/-	..
e " " " large	"	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/8½	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	..	..
n " Wire, Nos. 1 to 16	per lb.	5/-	6d. inc.

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

The Nerve Record of an Air Raid.—How an air raid affected the nerves of a lady may be seen from a report made by Dr. A. D. Waller to the *Lancet*.

Dr. Waller describes interesting results obtained by studying what he calls the "emotive response" or "psychogalvanic reflex" on various individuals. The person experimented upon has the electric current from two battery cells sent through the thickness of the hand from back to palm, or *vice versâ*. Measurement of this current by means of a galvanometer shows that it varies with the emotional experiences of the subject. There is an "emotive response" not only to physical stimuli such as burning, unexpected noise, or smell, but also to mental stimuli such as apprehension, questions, and thoughts, pleasant or unpleasant :—

"From many experiments made on various subjects, besides the big variation in actual resistance, there is a marked difference in emotive response; also in the change of resistance which takes place during an experiment, and in the response of the subject to the same stimulus at different stages of the experiment. In some individuals a greater physiological change may be caused by an imaginary than by a real excitation. This is especially the case in imaginative subjects, such as members of the literary, artistic, and scientific professions. A very interesting record is given of the response of a subject taken during an air raid.

"It would be of extreme interest to know the nature of response in series of subjects who have successfully withstood many nerve-trying ordeals—as, for example, the fighting air-pilot. It is possible that this test would be of value in special cases in the selection of air-pilots, and also invaluable to the military authorities as an adjunct to the ordinary medical examination in classifying doubtful 'nerve' cases—*e.g.*, shell-shock, neurasthenia, and malingering."

German Electricity Works Association.—The annual meeting of the German Association of Central Electricity Stations was held recently in Berlin, when, among other business, reports were presented by Herr Spengel on "The Working of the Limitations on Electricity Consumption from the Technical and Economical Standpoints"; by Herr Coninx on "The Supply of Coal and Other Materials for Central Stations"; and by Herr Döpke on "The Existing Situation in Central-station Supply Work."

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THE EDUCATION AND TRAINING OF ENGINEERING APPRENTICES.

By P. H. S. KEMPTON, A.R.C.Sc., B.Sc.

(*Continued from page 76.*)

For Naval Apprentices.

First year attendance	...	6 hours per week.
Second year attendance	...	7 hours per week.
Third year attendance	...	7 hours per week.
Fourth year attendance	...	4 hours per week.

First year Course.—Fitting and turning, engineering drawing.

Second year Course.—Fitting and turning, engineering drawing, algebra.

Third year Course.—Applied electricity, fitting and turning, applied mechanics.

Fourth year Course.—Applied mechanics, applied electricity.

Prizes are offered for special excellence, and nomination to studentship at the full-time courses at the college with rank as engineer-assistant falls to the best student in each final group of trades.

Failure to profit by the course, misconduct, or "neglect to make a proper effort" renders an apprentice liable to immediate determination of his services.

Abroad.

There is little doubt that the folly of a stubborn adherence to the "splendid isolation" theory has prevented the influx of many valuable ideas into the educational and industrial system of this country. We have only to remind ourselves of the industries which we have lost and are now feverishly striving to regain to see evidence of our refusal as a nation to assimilate successful foreign ideas in science and technology. We have invariably sneered at the idea of industrial research; now we are awakened to its necessity by the thundershock of war. We have hitherto hesitated to introduce systems of management and training into our industrial concerns because they hailed from the States or from Germany; now our alliance with the former and enmity to the latter have forced us to "do something" to bring our industrial organisation into line with that of our rivals. And in educational and technical matters we have been the victims of an obeseness of contentment which has been as insane as it has been unproductive.

In some recent articles in *Engineering*, now reprinted as a booklet entitled "The Training of our Industrial Forces," Mr. H. F. L. Orcutt has made a valiant attempt to rouse the nation to its post-war responsibilities. He says: "We are now faced with a struggle in trade as definite, as fierce, and as widespread as that with which we are now engaged in opposing with an army and navy. Is it not reasonable that we should seriously consider whether or not we are prepared to the last detail? It has been stated that we have every element necessary to success. In these is our man-power comparable with what it should be? This man-power cannot be effective without training, a training particularly arranged to meet new conditions of warfare.

"Our two great competing nations, America and Germany, have already made a beginning. They have not gone so far, however, but we can overtake them. They have gone far enough to demonstrate completely the lines which must be followed, the mistakes to avoid and the practical results which can be attained."

Mr. Orcutt's contention is a sound one, and his marshalling of the facts which ought to deeply concern all who are worthy of the name of Englishman is provocative of thought and action. Here we are concerned mainly with one branch of our industrial forces, and it is to the investigation of the methods of America and Germany in the training of apprentices that we devote the following paragraphs:—

U.S.A.

Under the title "Life in a large Manufacturing Plant: Apprenticeship System," there appears in the January issue of the *General Electric Review* an account of the training of boys by the G.E.C. in connection with their six American factories. The G.E.C. has spent $750,000 in buildings, machinery, instruments, class-rooms, and laboratory equipment for its apprentices' department. The boys are entered at 16, and their training proceeds in the class-room simultaneously with the workshop. The system is in fact a "works school" system, and for equipment and general organisation is probably the most complete of its kind in the world. The class-room courses include instruction in mathematics, including algebra, trigonometry, plane, solid, and descriptive geometry, mechanics, machine drawing and design, and extends over the whole apprenticeship period. In some courses the school instruction in work hours is as much as 10 hours in 50.

In addition to the school or class-room instruction, the company provides special training shops for the apprentices, where beginners are given individual instruction under competent men engaged for the purpose. As the students become more advanced they are transferred to the regular shops where their education is continued under the direction of the foreman of that department and his assistants. In December, 1917, the number of apprentices who were with the G.E.C. and consequently included in the training system was as follows:—

At Lynn, 335; Schenectady, 302; Pittsfield, 113; Erie, 85; Fort Wayne, 82; Harrisson, 20; totalling nearly 1,000 "electrical works undergraduates."

Considerable stress is laid on the social life of the boys, and in all the works one or more complete libraries are available for the apprentices. Opportunity for baseball and boating, football, skating, and skiing are open to all apprentices with athletic leanings; while in connection with most of the works are Y.M.C.A.'s, mutual benefit associations, musical organisations, amateur theatricals, all affording ample opportunities for social life among the young men. The G.E.C. claim that their system of training supersedes to some extent the *college* training. They quote a long list of inventors, scientists and engineers who were *not* college men, including Bessemer, Faraday, Singer, Huxley, Spencer, Edison and Nobel; and argue quite accurately that such a training as is given in the works teaches three important things which are not taught in college, viz., "the value of the dollar, the independence which comes from earning one's own living, and the strength of character developed by working with men."

Similar courses of apprentice instruction are followed in the works schools of the following American engineering companies: Western Electric Co., Westinghouse Electric and Manufacturing Co., Cadillac Motor Car Co., Ford Motor Co., and others.

The National Cash Register Co. have a unique system in which their apprentices attend the works and the works school on alternate weeks during the first two years of apprenticeship. At the end of this period the most proficient students are allowed to commence, at the company's expense, a five-years' course at the University of Cincinnati, in which they spend alternate fortnights at the works and the university. As an alternative to this system, the same company give some of their apprentices part-time day instruction at an outside school up to the age of 20, during which time school fees and wages are paid by the company.

The Pressed Steel Co. and the Cleveland Ironworks have works schools, but the classes are held immediately after and not during works hours.

(*To be concluded*).

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TRADE STATISTICS OF JAPAN, 1916.

The following statement, showing the imports into and the exports from Japan of electrical and similar goods during the year 1916, is taken from the recently-issued official trade statistics; the figures for 1915 are given for purposes of comparison, and notes of any increases or decreases are added:—

IMPORTS.

	1915. Yen.	1916. Yen.	Inc. or dec. Yen.
Galvanised iron wire.—			
From Great Britain	146,000	367,000	+ 221,000
,, Germany	39,000	30,000	− 9,000
,, Belgium	—	4,000	+ 4,000
,, United States	2,969,000	3,797,000	+ 828,000
,, Other countries	21,000	126,000*	+ 105,000
Total	3,175,000	4,324,000	+ 1,149,000
* Canada, Yen 101,000.			
Posts and materials for electric lines,—			
From United States	2,000	4,000	+ 2,000
Copper (pipes and tubes).—			
From Great Britain	37,000	500	− 36,500
,, Other countries	1,000*	500	− 500
Total	38,000	1,000	− 37,000
* United States.			
Insulated electric wire.—			
From Great Britain	6,000	1,000	− 5,000
,, Germany	94,000	1,000	− 93,000
,, United States	13,000	21,000	+ 8,000
Total	113,000	23,000	− 90,000
Steam turbines.—			
From Great Britain	—	22,000	+ 22,000
,, United States	24,000	8,000	− 16,000
Total	24,000	30,000	+ 6,000
Cranes.—			
From Great Britain	20,000	—	− 20,000
,, United States	21,000	—	− 21,000
,, Sweden	—	50,000	+ 50,000
Total	41,000	50,000	+ 9,000
Pumps.—			
From Great Britain	182,000	93,000	− 89,000
,, Germany	9,000	—	− 9,000
,, United States	57,000	121,000	+ 64,000
,, Other countries	19,000	38,000*	+ 19,000
Total	267,000	252,000	− 15,000
* France, Yen 19,000.			
Gas engines, petroleum engines, and hot-air engines.—			
From Great Britain	42,000	6,000	− 36,000
,, Germany	—	3,000	+ 3,000
,, Sweden	85,000	17,000	− 68,000
,, United States	35,000	69,000	+ 34,000
,, France	—	84,000	+ 84,000
,, Other countries	1,000	1,000	—
Total	163,000	180,000	+ 17,000
Steam engines.—			
From Great Britain	51,000	76,000	+ 25,000
,, France	—	81,000	+ 81,000
,, United States	3,000	73,000	+ 70,000
,, Other countries	—	2,000	+ 2,000
Total	54,000	232,000	+ 178,000
Steam boilers.—			
From Great Britain	499,000	1,009,000	+ 510,000
,, Germany	17,000	18,000	+ 1,000
,, United States	52,000	192,000	+ 140,000
,, Belgium	2,000	148,000*	+ 146,000
Total	570,000	1,367,000	+ 797,000
* France, Yen 120,000.			
Dynamos, electric motors, &c.—			
From Great Britain	316,000	241,000	− 75,000
,, Germany	32,000	18,000	− 14,000
,, Switzerland	3,000	62,000	+ 59,000
,, United States	390,000	467,000	+ 77,000
,, Sweden	7,000	—	− 7,000
,, Other countries	1,000	46,000*	+ 45,000
Total	749,000	834,000	+ 85,000
* France, Yen 44,000.			
Telegraphic and telephonic instruments and parts.—			
From Great Britain	29,000	29,000	—
,, United States	14,000	27,000	+ 13,000
,, Other countries	6,000	4,000	− 2,000
Total	49,000	60,000	+ 11,000
Water turbines and Pelton wheels.—			
From Great Britain	24,000	12,000	− 12,000
,, Germany	18,000	—	− 18,000
,, France	15,000	14,000	− 1,000
,, Switzerland	10,000	3,000	− 7,000
,, Sweden	30,000	86,000	+ 56,000
,, United States	21,000	—	− 21,000
Total	118,000	115,000	− 3,000
Incandescent electric lamps.—			
From Great Britain	2,000	5,000	+ 3,000
,, Germany	23,000	—	− 23,000
,, United States	6,000	10,000	+ 4,000
,, Other countries	11,000	1,000	− 10,000
Total	42,000	16,000	− 26,000
Filaments for incandescent lamps.—			
From Great Britain	8,000	88,000	+ 80,000
,, France	8,000	23,000	+ 15,000
,, Sweden	14,000	73,000	+ 59,000
,, United States	108,000	436,000	+ 328,000
,, Other countries	4,000	—	− 4,000
Total	142,000	620,000	+ 478,000
Wattmeters.—			
From Great Britain	8,000	5,000	− 3,000
,, Germany	5,000	4,000	− 1,000
,, United States	62,000	55,000	− 7,000
,, Switzerland	42,000	67,000	+ 25,000
,, Other countries	1,000	1,000	—
Total	118,000	132,000	+ 14,000
Ampere and voltmeters.—			
From Great Britain	2,000	2,000	—
,, United States	43,000	69,000	+ 26,000
Total	45,000	71,000	+ 26,000
Accumulators.—			
From Great Britain	39,000	8,000	− 31,000
,, Germany	—	2,000	+ 2,000
,, Other countries	1,000	1,000	—
Total	40,000	11,000	− 29,000
India-rubber and gutta-percha, crude.—			
From British India	941,000	1,001,000	+ 60,000
,, Straits Settlements	1,727,000	4,968,000	+ 3,241,000
,, Dutch India	226,000	165,000	− 61,000
,, Great Britain	394,000	480,000	+ 86,000
,, Germany	1,000	—	− 1,000
,, United States	118,000	135,000	+ 17,000
,, Other countries	25,000	497,000	+ 472,000
Total	3,432,000	7,246,000	+ 3,814,000

EXPORTS.

Electric machines and parts thereof.—			
To Asiatic Russia	22,000	334,000	+ 312,000
,, China	255,000	350,000	+ 95,000
,, Kwantung Province	150,000	276,000	+ 126,000
,, Philippine Islands	4,000	11,000	+ 7,000
,, Siam	5,000	18,000	+ 13,000
,, Australia	65,000	129,000	+ 64,000
,, Hong-Kong	31,000	41,000	+ 10,000
,, British India	25,000	101,000	+ 76,000
,, Straits Settlements	6,000	14,000	+ 8,000
,, Great Britain	11,000	104,000	+ 93,000
,, Other countries	8,000	69,000	+ 61,000
Total	582,000	1,447,000	+ 865,000
Insulated electric wire.—			
To Siam	5,000	19,000	+ 14,000
,, China	399,000	490,000	+ 91,000
,, Kwantung Province	193,000	213,000	+ 20,000
,, Hong-Kong	61,000	19,000	− 42,000
,, British India	9,000	48,000	+ 39,000
,, Dutch India	10,000	5,000	− 5,000
,, Asiatic Russia	43,000	166,000	+ 123,000
,, Great Britain	160,000	2,000	− 158,000
,, France	13,000	—	− 13,000
,, Australia	4,000	74,000	+ 70,000
,, Other countries	3,000	90,000	+ 87,000
Total	900,000	1,126,000	+ 226,000

Yen = 2s. 0½d.

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THE OXIDE FILM LIGHTNING ARRESTER.*

By CROSBY FIELD.

This paper will be confined to a brief statement of the scientific principles underlying a new type of lightning arrester called the "oxide film arrester." The functioning of this arrester depends upon the fact that certain dry chemical compounds can be changed with extreme rapidity from very good conductors of electricity to almost perfect non-conductors by the application of a slight degree of heat. Lead peroxide is a good example of such a substance. It has a specific resistance of the order of one ohm per inch cube, and the resistance varies with the pressure to which it has been compressed. At a temperature of about 150 deg. C. the lead peroxide ($Pb\ O_2$) will be reduced to red lead, commercially known as minimum ($Pb_3\ O_4$). This has a specific resistance of about 24 million ohms per inch cube. At slightly higher temperatures this minimum will be reduced through the sesquioxide ($Pb_2\ O_3$) to litharge (Pb O), which last named is practically an insulator. There are several other compounds that will give these same results.

If lead peroxide powder be placed between two electrodes and a current passed between them, the temperature due to the resistance at the contact of the peroxide and the metal will cause heat to be generated locally at the surface. When this heat is sufficient to create a temperature of about 150 deg. C a film of the lower oxides of lead forms, producing a film of insulation which stops the current.

This method of film formation over a large area is irregular. As an insulating film spread on the metal plates there have been used thin layers of various substances; in all cases the results are similar, varying only with the voltage at which puncture of the film of insulation occurs.

The foregoing designs the principle of the commercial oxide film arrester, fig. 1; it comprises two sheet metal electrodes,

Fig. 2.

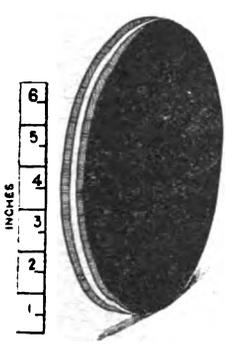

Fig. 1.

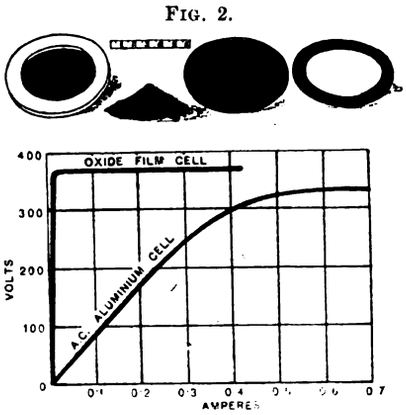

Fig. 3.

Fig. 1.—Single Cell.

Fig. 2.—Disassembled Parts.

Fig. 3.—Comparative Volt-ampere Characteristics of Oxide Film and a.c. Aluminium Arrester Cells.

set about 0.5 in. (12.7 mm.) apart, one or both covered with a thin insulating film and the space between the plates filled with some such substance as lead peroxide. At a permissible voltage of 300 volts per cell the insulating film prevents any appreciable current flowing under normal conditions. As soon as the voltage rises slightly above normal the film punctures in one or more microscopic points, the lightning charge meets with practically no resistance, and flows to earth.

The dynamic current starts to follow, but because the insulation was punctured in such fine points, the current density near these points is exceedingly great. The result is localised heating, which speedily raises the temperature to a value sufficient to change to insulating litharge all the conducting peroxide in this minute path of the current flow in contact with the electrodes. The film consequently reseals, stopping the flow of dynamic current. This action is so rapid that its duration cannot be measured on an oscillograph giving two thousand cycles per second. The action of resealing occurs in less than one four-thousandth part of a second after the excess of lighting voltage has ceased. Fig. 5 shows the visible spots of insulating litharge plugs on the surface of an electrode.

Of the methods of forming the film the most preferable is by dipping in varnish or lacquer highly burnished surfaces of brass, steel or copper, which method is consequently used in the commercial arrester. The ohmic resistance of the arrester during discharge is quite low (less than 1 ohm per cell). Thus when the insulating film is punctured the arrester offers very slight impedance to the flow of energy at abnormal voltages.

There is a certain range of voltage necessary to pierce any given insulation. The exact voltage depends not only upon the thickness of the insulation and its dielectric strength, but also on the relation of the dielectric spark lag to the duration of the super-spark potential and the frequency of alterations of the transient surge.

If an arrester is to give protection of insulation in shunt with it, the arrester must relieve the abnormal electric pressure before damage is done to the insulation. Although tests are frequently made with the arrester and the insulation it is to protect in parallel, a more convenient method has been standardised and is known as the equivalent sphere gap test. Both the insulation and the arrester are compared by comparing each to the equivalent sphere gap.

The equivalent sphere gap of the oxide film arrester may be analysed into separate and distinct parts. First, there is the

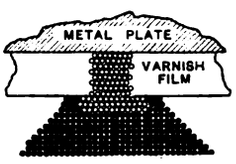

Fig. 4.

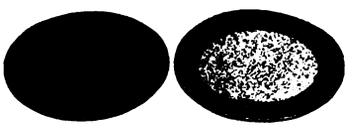

Fig. 5.

Fig. 4.—Magnified, Imaginary Representation of one Film on one Metal Plate.

Fig. 5.—New Electrode and one after having passed through it Several Thousand Discharges.

equivalent sphere gap of the main gap in series with the cells. Second, the equivalent sphere gap to initiate a discharge through the insulating film on the plate surface of the cell. Third, there is the equivalent sphere gap of the resistance drop of the current discharging through the powdered peroxide in its path. Fourth, there is the equivalent sphere gap of the inductance of the arrester.

Commenting on these factors in their relation to this arrester, the main gap is itself a sphere gap which has the fastest spark of any practical gap. The gap setting is only slightly above that of the normal voltage of the circuit. The equivalent sphere gap of the film is several times greater than the thickness of the film because solid material has a greater dielectric spark lag than air, but with this multiple of the thickness of the film the equivalent sphere gap is still low. Since peroxide is a good conductor, the series resistance in the path of the discharge is insufficient to give an undesirable voltage drop. As to the inductance of the arrester, it has a minimum value due to the fact that each cell is only 0.5 in. long, as shown in Fig. 1, and these cells are placed one on top of another. In other words, the total length of the arrester (which constitutes the inductance) is short as compared to the necessary length of conductor from line to earth.

One of the obstacles that had to be overcome in the making of this arrester was the increase in the resistance after a great many heavy discharges had passed through it.

In all the commercial oxide film arresters used for alternating current the power factor is nearly unity. For special purposes the power factor can be made anything desired from 10 per cent. to unity. This is obtained by combining with the conducting oxide other non-conducting materials. This principle has been made use of for condensers, but it has not been found desirable to incorporate it in the arrester.

To summarise—an arrester operating under a new principle has been made which comprises in essence one or more metal electrodes covered with an insulating film, and separated by a conducting powder, which has the peculiar characteristic of

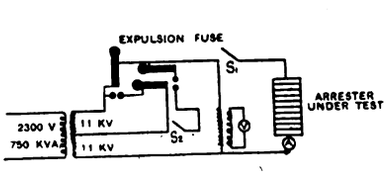

Fig. 6.

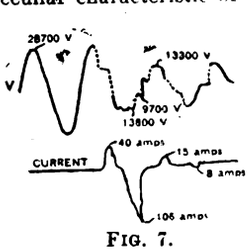

Fig. 7.

Fig. 6.—Test Circuit Arrangement of Oxide Film Arrester.

Fig. 7.—Operation of Arrester on Double Voltage and its Recovery.

becoming a non-conducting powder upon the application of heat. Voltage higher than that which can be withstood by the insulating film punctures it in one or more points of about 0.005 cm. diameter. Dynamic current flowing gives a high current density in the conducting powder adjacent to these punctures which in turn heats it up rapidly, reducing the powder to a non-conductor, and sealing the holes in the film. The powder being a poor heat conductor localises this action, so that very little more powder is reduced than is actually necessary to seal up the minute punctures. The critical spark voltage and that part of the equivalent sphere gap controlled thereby is a function of the thickness and kind of material used for the film.

* *Proceedings*, A.I.E.E., Vol. 37, No. 6. Abstract.

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The earliest form of non-electrolytic film arrester was known as the dry aluminium arrester. One of the objects of the development of this arrester was to decrease the cost of manufacture, and it was found with the new principle involved in the oxide film arrester, where the powder furnishes the film rather than the plate, that the aluminium could be replaced by a cheaper metal, such as steel, and the initial film known in the early stages of development as the "paint skin" type could be furnished by a layer of varnish. On first sight, knowing the extreme thinness of the hydroxide film on wet aluminium cell it might not seem that the dry cell would give the same general characteristics as the wet cell; but a comparison of the volt-ampere curves shows the same general characteristics. The oxide film arrester has no dissolution of the film, as occurs in the wet aluminium cell; charging is not only unnecessary but undesirable. This extends the use of the oxide film arrester to localities where there are no attendants.

In the oxide film arrester the film less than one 1 mil thick (0.025 mm.) initially thickens up by the addition of successive spots of litharge for each successive discharge. This represents the wear on the arrester and limits its total life. Fig. 3 shows comparative volt-ampere characteristics of the oxide film arrester and the A.C. aluminium arrester. Since both of these arresters have a leakage current which wears the plates of the cells when alternating current is supplied, it is necessary to place a spark gap in series with the cells. This spark gap is set at a value slightly above the normal potential of the circuit so that nothing but abnormal voltages will cause a discharge.

The oxide film arrester has general characteristics closely like the standard aluminium electrolytic arrester. It has the obvious advantages of being dry rather than wet, and will not congeal, and needs no daily charging.

In making the characteristic volt-ampere discharge curves the oxide film arrester does not lend itself as readily to the test as the wet aluminium cell. While its critical film voltage is evident, the change from no to full conduction is more sudden, and the discharge rate at double potential is therefore best shown by throwing double potential on the cell and subsequently reducing the voltage to its normal value per cell. In order to conveniently alter the voltage from double value to normal the circuit is arranged as shown in fig. 6.

A transformer with two coils in series impresses voltage on the arrester, and then the contacts of the arrester are automatically shifted to one coil giving half the voltage. A heavy pendulum closes switch S-1 and sets the oscillograph in operation. The full voltage on the transformer is then thrown on to the oxide film arrester under test, which has a number of cells sufficient only for half the voltage of the transformer. This throws double voltage on to the arrester and the heavy current passing through the cells causes fuse F-1 to blow. The operation of this fuse short circuits half the transformer and throws the other half across the arrester. This is done by means of gaps and fuses as follows: When the expulsion fuse F-1 blows, the conducting gases are shot into the open gap G-1 which closes the circuit through fuse F-2 to the mid-point of the transformer. This short circuit on half the transformer causes fuse F-2 to blow and the hot gases discharging from fuse F-2 close the gap G-2 which throws the mid-point of the transformer on to the arrester through the switch S-2 which is closed just previous to starting the test. These several operations occur with a rapidity depending upon the size of fuses used. It is possible by this means to throw momentarily 22,000 volts on an 11,000 volt arrester and note the character attending its discharge and recovery. Fig. 7 shows such an operation on an oxide film arrester. The initial discharge current is 40 amperes during the first half-cycle, due to the point it strikes in the descending wave; during the second half-cycle it is 106 amperes. After the third half-cycle the litharge film has so completely sealed up the path of discharge that the current is too small to show on the oscillogram. The leakage current with no series gap is of the order of a few milliamperes.

Increases in Engineering Wages.—The *Times* states that awards have been issued by the Committee on Production giving an advance of wages to men in the engineering, shipbuilding, and allied trades and in the ship repairing trade in the Liverpool district. They follow hearings by the Committee held in pursuance of agreements between the employers' federations and various trade unions providing for a review of wages in the engineering, shipbuilding, and allied trades every four months during the war. "The Committee heard the parties on various dates in in June and July, when applications for increased wages of varying amounts were submitted. By previous awards the men had received advances over pre-war rates of not less than 20s. a week in the case of time-workers and 13s. a week, plus an increase of not less than 10 per cent. on piece prices, in the case of piece-workers. In addition to these advances, earnings have been increased by grants of a bonus of 12½ per cent. in the case of plain-time workers and 7½ per cent. in the case of piece-workers and other workmen who are not paid at plain-time rates. The present award is that men aged 18 and over are to receive a further advance of 3s. 6d. a week, and boys and youths and apprentices under 18, 1s. 9d. a week. These advances are to be paid on the first pay day in the week ending August 10th. 1918."

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

11,562. "Energy-regulating arrangements for electric circuits." Siemens Schuckertwerke. July 15th. (Germany, June 13th, 1917.)

11,573. "Electric locomotives or cars." British Thomson-Houston Co. (General Electric Co., U.S.A.) July 15th.

11,577. "Magnetic tray control for use in biscuit-making machinery." A. E. Bowers & A. Mason. July 15th.

11,582. "Windings for dynamo-electric machines." British Westinghouse Electric & Manufacturing Co. July 15th.

11,583. "Electric fuse cabinets." W. T. Tallent-Bateman & British Westinghouse Electric & Manufacturing Co. July 15th.

11,587. "Telephone receivers." H. E. Parry. July 15th.

11,595. "Electrical testing devices." R. C. Bierbower. July 15th.

11,598. "Sparking plugs." C. H. Hanwell & O. E. Hanwell. July 15th.

11,613. "Electric lampholders, &c." Wardle Engineering Co. & H. T. Wilkinson. July 16th.

11,616. "Apparatus for teaching telegraph codes." C. R. Woodland and R. Woodland. July 16th.

11,619. "Sparking plugs for internal-combustion engines." W. A. Clark, H. G. Longford, W. W. Longford & Sphinx Manufacturing Co. July 16th.

11,625. "Electric soldering irons." J. G. Clemens. July 16th.

11,628. "Electric cord protector." C. R. Dodge. July 16th.

11,635. "Dry-battery terminals." R. Wilson. July 16th.

11,651. "Bobbins for electrical purposes." A. J. Chevallay. July 16th.

11,657. "Electric circuit-controlling devices." E. C. R. Marks (Splitdorf Electrical Co.). July 16th.

11,664. "Leaf springs for use in breakers, &c." Soc. Anon. des Etablissements L. Blériot. July 16th. (France, April 12th.)

11,709/10. "Telephone repeater systems." R. M. Chamney & C. Robinson. July 17th.

11,725. "Current regulators or transformers of the constant-current type." W. Langdon-Davies & A. Soames. July 17th.

11,739. "Electrolytic cells." E. C. R. Marks (A. T. Stuart). July 17th.

11,751. "Self-starting devices for internal-combustion engines." F. L. Rapson. July 17th.

11,779. "Trolley heads for electric traction." F. Haigh, W. Pickersgill and J. H. Vitt. July 18th.

11,804. "Directional aerials for wireless telegraphy." G. M. Wright. July 18th.

11,856. "Means for measuring electrical currents." H. A. Ewen. July 19th.

11,857. "Automatic or semi-automatic telephone systems." A. E. Laidlaw. July 19th.

11,858. "Electric incandescent lamps." G. Layton. July 19th.

11,869. "Ignition sparking plugs for internal-combustion engines." F. L. Rapson. July 19th.

11,903. "Induction electric motor with variable numbers of poles." Akt. Ges. Brown, Boveri et Cie. July 20th. (Germany, July 21st, 1917.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

4,629. Means for securing shades to the holders of electric lamps. H. F. Wheeler. March 30th, 1917. (116,906.)

5,804. Apparatus for detecting and magnifying minute electric impulses. P. Harvey. April 25th, 1917. (116,908.)

8,934. Dynamo-electric machines. British Thomson-Houston Co. & A. A. Pollock. June 21st, 1917. (116,915.)

9,035. Signalling and train-stopping apparatus. E. H. Whitehead. June 23rd, 1917. (116,918.)

9,230. Electrical boat-raising and lowering apparatus. A. West & Co., A. West & F. N. Pickett. June 27th, 1917. (116,925.)

9,320. Diaphragm horns. Klaxon Co., J. F. Monnot & E. T. Cook. June 28th, 1917. (116,930.)

9,488. Control of combined engines and electric generators. W. A. Stevens and J. Sankey & Sons. June 30th, 1917. (116,941.)

10,372. Thermal ammeters. Weston Electrical Instrument Co. July 27th, 1916. (109,046.)

10,612. Temporary electric connecting clip. S. George & T. J. Hutchison. July 24th, 1917. (116,956.)

11,497. Apparatus for electrically distilling ores and metal-bearing materials. D. B. Jones. December 7th, 1916. (111,835.)

12,924. Luminous electric-light switch. C. D. S. Cranko. September 10th, 1917. (116,978.)

13,166. Automatic electric switching apparatus. M. S. Conner & C. C. Puckette. September 14th, 1917. (116,981.)

14,097. Sparking plugs. M. J. Willcocks. September 29th, 1917. (Cognate application 17,876/17.) (116,992.)

14,992. Troughs for electric cables and the like. F. E. Worsdell and Callender's Cable & Construction Co. October 16th, 1917. (117,001.)

16,932. Electrically-operated overhead lifting gear. W. H. Vaughan and F. Wood. November 17th, 1917. (117,019.)

17,511. Production of alternating current for signalling in telephonic and other systems. Western Electric Co. (Western Electric Co., U.S.A.) November 27th, 1917. (117,020.)

18,449. Machines for applying caps to electrode rods of batteries. S. L. Casella. January 2nd, 1917. (112,933.)

1918.

363. Measurement and correction of any want of equilibrium in the moving systems of electrical instruments. J. Rymer-Jones. January 7th, 1918. (117,038.)

1,124. Driving gear for electric locomotives. Akt. Ges. Brown, Boveri et Cie. March 29th, 1917. (Addition to 112,009.) (114,417.)

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THE

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ELECTRICAL REVIEW.

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NOTICE TO READERS.

In view of the Order recently issued by the Paper Controller, readers are urged to place a definite order with their newsagents for regular supply of the ELECTRICAL REVIEW weekly. In the event of difficulty arising in so doing, a subscription rate order should be forwarded direct to these offices, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

EFFICIENT PUBLICITY WORK.

DURING the progress of the war, journals which represent industries that are of direct importance in connection with the production of war requirements are, for various reasons, debarred from particularising achievements which, under normal conditions, it would be to the advantage of those engaged in such industries to be acquainted with. Such journals have had added to their accustomed responsibilities certain very essential functions, which they perform in the interests of the Allied cause and in the interests of their industries, and their usefulness is recognised in Government quarters as was never the case before the war; but, for obvious reasons, there are accumulating to be described and discussed, in times of greater freedom, when initiative may be exercised under less restraint, what are really arrears of very useful matter. It has been one of the responsibilities of editorial life during the war to practise a ceaseless vigilance in order to prevent the appearance of matter which could be of assistance to the enemy. To the enterprising newspaper always on the look-out for really useful matter, it is naturally a great disappointment to have to refrain from publishing such material when it has been offered. In most cases, however, we believe that the duty has been faithfully and loyally carried out—though not by any means always—because of the earnest desire of the Press to hasten the defeat of the enemy.

The present handicap, however, will come to an end sooner or later, and it appears to us important that if there is any weakness anywhere which will prevent the publication in the technical Press of the facts concerning the abilities and achievements of British electrical and engineering manufacturers, steps should be taken to remove it now. Both during the war and for several years preceding it, we frequently drew manufacturers' attention to their own unfavourable position in comparison with German competitors in this matter. The British method often seemed to be to hide the manufacturers' light under a bushel by adopting a definite policy of secrecy concerning their operations, so that their home competitors should not know what they were doing, or else there was an apathy concerning publicity which let such matters "drift."

There were some brilliant exceptions—but they were rare, and we could count them upon our fingers. We remember other cases where information was flatly refused to the Press for fear anything should be given away; where we were definitely asked to suppress certain items; where there was no time to spare to collect data; or where there was a disposition to help, but no efficient assistance available for securing essential material from a firm's own documents. We believe that the war has brought a new atmosphere and a greater desire for efficiency which will obviate some of these difficulties in future: but what will help the situation more than anything else is the adoption of a fully enlightened policy on the part of the individual manufacturer under which he will co-operate

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with the Press through his own efficient representatives. We use the plural intentionally, because it is not upon what we have come to regard as the "publicity man" that the responsibility for shortcomings has always rested. Some of these representatives have been, in our estimation, "poor things," it is true—quite incapable of efficiently carrying out their duties in co-operation with the Press; others have been first-class men, but—Israelites in Egyptian bondage—they were unable to make bricks without straw, because those to whom they ought rightly to have been able to look for sections of the material necessary for making the complete record, were not possessed by the same appreciation of the importance of publicity as, or were less energetic than, the "publicity man."

The subject is of some considerable importance in connection with our after-the-war industrial activities. There is no doubt whatever that German propaganda methods will have to be very carefully watched by the Press. We know something concerning their methods of the past—good and bad: the former contain points which British manufacturers would do well to copy, for there was no indisposition in Berlin and elsewhere to furnish through a well-organised literary and photographic department, or through recognised literary correspondents, descriptive accounts of inventions and installations which, because of their technical and industrial value, were of interest to British readers. Of their future methods we cannot gather as much information as we should desire all at once, but we have learned some of the possibilities, and to these we may refer later. But while we shall require to exercise great care, in order that their ends may not be unconsciously served, there is, as we say, one thing that is immediately possible, and that is, that individual manufacturers adopt a large-minded policy, and improve their own facilities for meeting the requirements.

Speaking broadly, it must be stated frankly that for many years past the possibilities of commercial publicity propaganda, as a means of securing a firm hold on the markets of the world, though frequently urged upon the mind of the British manufacturer and engineer, have been followed up too apathetically, and, in consequence, with disappointing results on the whole.

The attitude of mind which has resulted in this apparent indifference, and even hostility, to methods which are logically in keeping with the general growth in knowledge and education the world over, may have an easy explanation from the British standpoint. We cradled the world's industries in the past; we built for the world and instructed it: we occupied a position of splendid industrial isolation, and the world came to us: but nowadays the foster parent is surrounded by a numerous thriving progeny—self-reliant peoples to whom British prestige is a memory rather than a reality—and this, we are afraid, many of our manufacturers and engineers are only just beginning to realise. "Brown and Smith," who 60 years ago were as well known in Australia as they were in Sheffield for the excellence of their steelware, seem still to be under the impression that because they are even better known in Sheffield to-day, therefore their reputation in Australia and elsewhere is similarly enhanced.

The utter fallacy of this short-sighted attitude—based on the supposition that "because you know, everybody else knows"—is only too evident.

The Australians went to Brown and Smith 60 years ago because there was no one else to go to, and, no doubt, they got good value for their money, and the firm established a corresponding reputation; but the Australian of 60 years ago is no more, and the "reputation" is in process of being snowed under by the insistent claims and pushful methods of more energetic present-day rivals.

Anyway, a reputation needs careful nursing, or its owner is like to find it wearing away in course of time, and this is precisely what is happening to many British reputations—heirlooms of a bygone generation, valued only by the owner and forgotten by the world. Government trade departments have seen this during the war, and as a result have advised our manufacturers, at all costs, to keep representatives at work in the different markets so as to keep their firm's memory green.

Publicity propaganda is the simple and obvious method, and in many cases the only method, of telling the younger generation what you have done, are doing, and are going to do: in no other way can the modern business world be reached. To the engineer particularly it should appeal, as his products are too bulky and too costly to carry round in the traditional carpet bag.

We believe that in many cases where there is a tendency among the engineering fraternity to disparage publicity work of the best kind, this is, as suggested above, due to the short-sighted views held by the works staffs, on whom the publicity men are generally dependent for information. It is to be feared that some of these gentlemen suffer, perhaps unconsciously, from distorted vision: it may be that like a certain famous Admiral they apply their telescope to a blind eye when they view the world—a comparatively small place, by-the-bye, which surrounds the works—and it is quite certain that they do not realise that they may turn out the finest product on earth and yet eke out a bare existence, because they are comparatively unknown.

In any case, it is up to the works to back up the efforts of their own publicity branch, if they have one, in every possible way, and thereby stimulate the selling of their product, to which their own cussedness is perhaps the only obstacle.

Needless to say, we have the greatest respect for the technical work of our engineer designers and constructors, and their environment affords some excuse for a limited view of life, but that they are hopelessly wrong in adopting this attitude goes without saying.

It would probably be of immense value if our constructional staffs could be better informed on the selling side of their business—the salesman has hold of the right end of the telescope, and is usually under no misapprehension as to the necessity of spreading the fame of his firm in every available market and by every available means; but, so far as publicity is concerned, he finds shoal water—if not a sunken reef—when he approaches the works, and it is a very much overdue and frequently unrecognisable craft which gets clear—if, indeed, it ever does get clear!

We do not wish to inquire who is to blame, so much as to suggest to those whose duty it is to set the matter right that they should urge their staffs to show a befitting spirit of publicity enterprise.

"All's Well that Ends Well."

Shortly after the outbreak of war, a certain organisation for which we have great respect, but which shall be nameless, issued circular letters to its members on a matter of interest respecting its membership. As a result of exchange of courtesies, there were indications of repentance at leisure. Much had to be excused in those days, for everybody was more or less under the influence of excitement, and it fell to our lot to persuade our readers to stay their hand and not to be precipitate in *posting* suggestive or angry letters, even if they must *write* them. To-day, when we are all four years older, and when the times are quite serious enough from every point of view, there may be war-weariness in some quarters—it may even affect some who are either connected with, or somehow or other dependent upon, the electrical industry—but there is no excuse for hurried communications now. Yet when they have been issued without full consideration, it is quite fitting that history should repeat itself, and that repentance at leisure should follow the issuance of some humorous and, therefore, easily misunderstood, some crude and, therefore, ill-thought-out, "Notes on Advertising." The circulation of the following explanatory or corrective missive spares us the necessity for dealing with this matter in detail, as we suggested we might require to do. It has been sent to many of our friends in the industry, and while it is not always easy to get on the heels of a terminological inexactitude, we are content to say that "All's Well that Ends Well." We cannot very well describe the original circular as a "Midsummer Night's Dream": we should be inclined to regard it as an April Nightmare. It certainly is "Love's

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Labour Lost." In any case, it was a "Comedy of Errors" of which we cannot for a moment believe the important Associations saddled with the responsibility for it were really the originators.

[COPY.]

NOTES ON ADVERTISING.

Memorandum of Conference held on July 9th, 1918.

At the end of April a circular-letter, headed "Notes on Advertising," was circulated by the British Engineers' Association and the British Electrical and Allied Manufacturers' Association, which Associations are amongst the founders of the Industrial Publicity Service, Ltd.

At a conference on July 9th between representatives of these Associations and the British Association of Trade and Technical Journals, Ltd., it was pointed out that certain statements in this letter were considered to be prejudicial to the trade Press of this country. As this was contrary to the intention of the circular-letter in question, it was agreed to make the following joint supplementary announcement:—

1. That although the paper situation is serious, there is no intention to publish trade journals fortnightly instead of weekly.
2. That the cost of printing has now increased by 75 per cent., and the price of paper by 600 per cent. or 700 per cent., and the increase to the cost of production fully justified the proprietors raising the advertisement rates or reducing the size of space.

The trade Press of this country is acknowledged by the Ministry of National Service to be of National importance, and in this respect is classified with the daily newspapers. It is in the interest of British manufacturers that trade journals maintain their publications at their present high level, in view of the important part which they must necessarily take in the renewal of commercial enterprise and reconstruction at the close of the war.

Economic Policy.

It is satisfactory that British manufacturers have received from the lips of the Prime Minister and of Mr. Bonar Law a more detailed declaration than has hitherto been found possible concerning our economic policy. Anxieties regarding affairs in France have so engrossed the attention of the Ministry since March last that it is only now, when the outlook has improved owing to the carrying of certain legislative measures and the fuller intervention of American forces, that ideas have been able to take anything approaching definite shape. The policy of Preference within the Empire has been adopted, as already stated; but beyond that, little that is really definite can be said, because the actual decision must be arrived at in consultation with the United States of America, as well as with the British Dominions. Mr. Lloyd George and the Chancellor of the Exchequer have, however, said enough to show that so far as they are concerned the industries of the British Empire will be protected against the future assaults of the enemy. The Prime Minister is very emphatic in the declaration that the industries essential from the point of view of national defence and security must never again be allowed to be weakened. Mr. Asquith, Sir A. Stanley, Mr. Runciman, and others who have filled prominent Ministerial posts during the war have said the same thing again and again—indeed, we think there could hardly be a dissentient voice from any true loyalist on such a point as that. The present interference with trade, imposed under the extreme necessities of unparalleled conditions, must not be continued any longer than is absolutely essential to efficient return to industrial order, but Mr. Lloyd George adopts the view of Dr. Addison and other advisers that there must be a measure of control until the transition period is passed. We believe that manufacturers in their hearts recognise that necessity when they urge in the interests of real industrial progress and security the removal of the irksome restraints and interferences which have irritated and handicapped them for so long. Capital and Labour are both agitating for their freedom; both object to too much control. The former expresses itself in orderly fashion, while the latter breaks out occasionally with strikes against limitations of its liberties and against embargoes. We all want to get back to normal freedom of operations just as soon as ever it can be arranged—it is the independence that is in the very blood of the British Democracy that thus expresses itself. Mr. Lloyd George's hope that the Mother Country and the whole Empire will remain with the Allies in an indissoluble partnership after the war is shared by all who have the interest of world freedom at heart, and we believe it to be inevitable that an economic policy shall be developed between all which will enable us to share in Peace the benefits of common understanding. But the predominant influence on the situation is the fact that America is completely with us in the war, and we have so to frame our economic policy in conjunction with her that harmonious relations shall be perpetuated. Mr. Lloyd George is "very hopeful" that when America is ready to express herself there will be found to exist a ground for complete agreement between us. Taken in conjunction with these sentiments, we find Mr. Bonar Law's declaration and observations equally acceptable as part of a whole policy—presumably developed as far as it is possible to develop it at this juncture, as one of the matters which must inevitably come before the electorate in the course of a few months, when we have to elect a new House of Commons and new Ministers to decide the terms of Peace and to carry us, we trust, through the first few years of reconstruction.

Patents and Enemies.

In our issue of July 12th we stated that the Government were seriously considering the question whether the payment of fees for the maintenance of enemy patents in this country and British patents in enemy countries should be allowed to continue; on July 19th we recorded the fact that the Board of Trade, no doubt instructed by the Cabinet, had summarily prohibited such payments. It was an accomplished fact, and nothing could be done but accept the decree as such. But was it a wise step? We wonder whether the Government secured the advice of competent men before making this unexpected and drastic change in procedure, which may have far-reaching and highly disagreeable consequences.

According to a statement made in the House of Lords, the revocation of the licence relating to the payments to, and on behalf of, enemies, will not have the effect of annulling the 944 enemy applications for patents which have been filed and accepted since the outbreak of war. No other country except, perhaps, Russia, has cancelled such applications. All of them are, or will be, vested in the Public Trustee, who can grant licences to British subjects, if required; their future treatment depends upon the terms of peace.

Lord Somerleyton, speaking for the Board of Trade, said that the withdrawal of protection from inventions in such cases would mean a scramble by each country for the inventions of the other: Lord Armaghdale, who raised the question, held that the object of these patents was to impede British industry. Both seem to have overlooked the fact that the prime purpose of granting Letters Patent is not to create a monopoly for the inventor, but to secure to the public the benefit of inventions. An invention that is not patented may prove as useless to the public as to the inventor, for manufacturers will not put down costly plant to exploit an unprotected invention. It is desirable, therefore, that inventors, whether British or foreign, should be encouraged to apply for Letters Patent, in order that licensees may have protection for their outlay. If enemy applications were cancelled, reprisals would certainly follow, and British applications for patents in enemy countries would be annulled: neither side would benefit.

During the war royalties payable to enemy patentees have been lodged in the hands of the Public Trustee in this country; presumably a similar arrangement obtains in enemy countries, and the disposal of these funds will be a matter for the Peace Conference. If no such reciprocal arrangement existed, it would obviously be out of the question to pay any part of such funds to the enemy.

As the Board of Trade representative remarked, the subject is hedged round with difficulties, and no step should be taken without the fullest consideration of the interests concerned, and the possible results of such action.

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AN ELECTRICALLY-WELDED SHIP.

Particulars are now available of the interesting—and completely successful—experiment in rivetless shipbuilding carried out at a shipyard on the South-East Coast. The first steel vessel constructed entirely without rivets was recently launched in the presence of Lord Pirrie, the Controller-General of Merchant Shipbuilding, and other representatives of the Admiralty and the War Office. She has since been in service with full cargo during exceptionally rough weather, and has answered satisfactorily in every way to the severe tests imposed.

The object of the experiment, to which considerable importance was attached by shipbuilding authorities, was to prove the ability of welded construction to withstand the strains peculiar to a ship at sea. This principle having been established, it is not proposed altogether to dispense with riveting, which in certain sections is cheaper and quicker than welding; it is intended, however, that future vessels should be a combination of riveting and welding. The United States Shipping Board, for instance, having been in close touch with the experimental work, is making arrangements for the construction of a number of 10,000-ton standard ships in which the use of rivets will be reduced to 2½ per cent. of the number originally required.

The recent progress achieved in electric welding by means of the flux-coated metal-electrode process, and its successful use at Admiralty Dockyards and elsewhere in the construction of fitments and superstructures of various vessels, led to permission being obtained for the erection of a standard barge, with riveting eliminated and electric welding substituted throughout. Such a craft is exposed to considerable rough usage in dock, besides being subjected to severe towing strains. In order to utilise material already available on site, this barge differs in no way from the standard riveted type with lapped joints, excepting that the hull-plates were arranged for clinker build and plate edges joggled to permit horizontal downward welding, in order to reduce the amount of overhead work, which is more difficult to execute.

The vessel to be welded was 125 ft. between perpendiculars and 16 ft. beam, with a displacement of 275 tons. The hull was rectangular in section amidships, with only

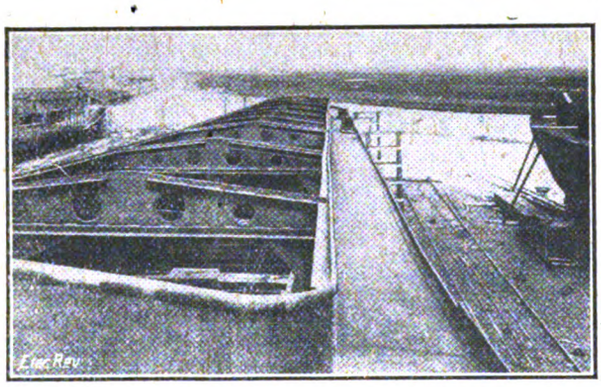

Fig. 1.—View Along Deck of Vessel, Showing Joints in Deck Plating and Hatchway Coamings.

the bilge-plates curved. It was built up of 71 transverse frames, and contained three bulkheads, those fitted fore and aft being watertight and the one amidships non-watertight. The shell-plating was ¼ in. and $\frac{5}{16}$ in. thick. All joints were lapped in the manner described.

Curiously, the first day's work was poor, though all the operators were first-rate men, with extensive experience of electric welding in shops, minor repairs, and structural work at shipyards. This was probably due to the novelty of the undertaking and to the position—lying flat on the keel—which they had to adopt to get at the joints. In a few days, when the men became accustomed to the job, the speed and quality of the work improved to equal workshop standard practice. With the more difficult welding, such as the vertical butt joints on each shell-plating, and overhead work underneath the keel and on bilge-plates, it was noted that the quality of the welds was excellent. For this overhead work special electrodes were employed, and proved well worth the slightly increased cost. All water-tight joints up to and including the underside of bilge-plates were continuously welded both inside and outside, the other watertight joints being welded continuously on one side and tack-welded on the other. On the shell-plating, the continuous welding was on the outside in all cases. For internal non-watertight joints and frame construction, tack welding was adopted, the length of welding being carefully calculated to give a margin of strength over a similar riveted joint.

Taking all positions of work into consideration, the average speed was 4 ft. per hour at the commencement, while towards the end of the work an average of 7 ft. an hour was easily attained.

As to the comparative cost of the electric-welded and riveted barge, in labour, 245 man-hours were saved in construction, which can easily be improved on in future

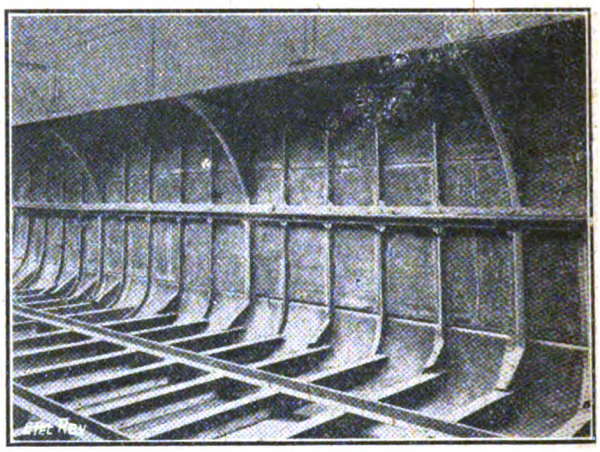

Fig. 2.—Interior of Vessel, showing Attachment of Side and Bilge Plates and Longitudinal Stringers to Transverse Frames.

work. More than 1,000 lb. of metal was saved, owing to the absence of rivets, but greater economy will result when the design is modified to suit electric-welded ship construction. The total cost of welding was £301, detailed as follows: electrodes, £178; electrical energy, £61; men's time, £62.

It is realised by Admiralty experts that the proportion of cost for electrodes is high, but this is mainly due to the present limited demand. Demand and competition will have the usual effect, and should reduce the cost of this item by at least 60 per cent. It will then be possible to build a vessel of this size with an estimated saving of from 25 to 40 per cent. of time and about 10 per cent. of material.

As a result of this demonstration, a new design of barge has been prepared, in which it is proposed to incorporate electric welding and riveted construction to the following extent:—*To be Welded:* Coamings, shell seams to frames, deck butts to beams, bulkheads (including boundary bars), keel plate butts to be welded overlaps, and after shell-seams welded.—*To be Riveted:* Floor riveted to frames, beam knees to frames and beams, frames clear of shell seams.

Standard Magneto Drive-shaft and Coupling Dimensions in America.—At the recent summer meeting of the American Society of Automotive Engineers, the report of the Engine Division of its Standards Committee was adopted. It was stated that the nominal drive-shaft diameter and length and the distance from the drive-shaft to the magneto shaft end for agricultural tractor engines had already been standardised. In order to complete the present standard the following were recommended:—(1) The magneto drive-shaft shall be of selected cold-rolled material, ¾ in. nominal diameter. The diameter limits at the coupling end shall be 0·750 in. and 0·749 in.; (2) couplings for engine magneto drive-shafts shall have bore limits of 0·7505 in. and 0·7495 in., and shall be fastened with a key. In placing the limits on coupling bores it was ascertained that standard reamers had a tolerance of plus or minus 0·0005 in. It will be noted that a coupling with a 0·7495 in. bore is a press fit of 0·0005 in. on a shaft 0·750 in. in diameter. This is the extreme case, and is not considered objectionable, but preferable to a loose fit with a larger coupling.

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THE FUTURE OF COAL USING.

By W. H. BOOTH.

The Interim Report of the Reconstruction Committee dealt with the question of power almost entirely from the old-standing view-point of the man who wishes to manufacture energy in the shape of electricity, and to sell it as such. One of the objects of the Committee appeared to be to increase the amount of power used per head of the working population, so that output per head may be increased and wages may be higher—all of which, of course, presupposes an agreement with Trade Unionism that the wilful restriction of output which prevailed prior to the war, and still exists to a large extent, shall cease. But the Committee further desires that the increase of output shall take place without any increase in coal consumption—a consummation devoutly to be wished, and only to be reached by an utter abandonment of the parochial methods hitherto obtaining.

The report makes a certain limited reference to the possible conservation of the valuable by-products which may be obtained from coal, in the shape of oils, motor spirit, &c., before using such coal as fuel, but the matter is left quite open, and no line is indicated on which such by-products should be conserved. Thus the question of the future motive power of a heat-electrical works is left open as between steam and internal-combustion engines. Thus we are not carried much further along the road of economy, and the one anticipated factor in arriving at a better economy is nothing more than our old friend the big power station with huge generating sets. With a maximum boiler efficiency of 80 per cent., a thermodynamic efficiency of 20 per cent., a conversion efficiency of 90 per cent., and a transmission efficiency of 80 per cent., the overall efficiency is 11½ per cent., and it is extremely doubtful of realisation. The Committee's anticipated figure is 1·54 lb. of coal per H.P.-hour delivered at the consumers' terminals, or 11·8 per cent. if the coal value is taken at 14,000 B.TH.U. per lb.

Assuming that the Committee's figure of 1·54 lb. of coal can be made good, or 21,560 B.TH.U. per terminal H.P.-hour, and that a fifth of this is lost up the chimney and even 20 per cent. of the remainder is converted into electrical energy, the heat in the steam will be 17,248 units, and the heat in the condensing water will be 13,800 units, or practically two-thirds (64 per cent.). Apart, then, from the possible salvation of by-products by some system of low-temperature distillation and the use of the caked residue under boilers, there would still be lost two-thirds of the heat value of the fuel, and, with a distillation system for residuals, there would be large volumes of non-condensable gases of more than ordinary producer-gas heat potential to be consumed in metallurgy if possible, or, failing convenient disposal, by gas engines producing electrical energy and feeding into the mains. Here there are at once found side by side the steam turbine and the large gas engine, for only gas engines of large power would, it is presumed, be regarded as practicable.

If gas engines should be selected for the main power units, their coal consumption per terminal H.P. would not amount to more than 1 lb., seeing that the efficiency of a gas producer should exceed that of a boiler, and that the efficiency of the gas engine, if not yet more than 25 per cent., or thereabouts, may be anticipated to become 30 per cent. when the fuel is fed to the engine on the Diesel principle of high-pressure pure air compression, with fuel added into this compressed air by a separate compressor. In this case, therefore, there would still remain waste heat to the amount of 9,200 B.TH.U. per terminal H.P.; this waste heat being about equally divided between the exhaust gases and the jacket water.

Is this vast amount of waste heat to be saved? Is it worth saving? Is it possible to save it? These are questions which should not be summarily dismissed in a *non possumus* attitude, as they represent what will be the national burden of responsibility for, in each case, about two-thirds of the heat value of the fuel used, though for the gas engine the total fuel is assumed at two-thirds that used by the steam engine, and the waste heat is, therefore, four-ninths. The problem in some respects is an easier one with steam power.

However regarded, the problem of saving the waste heat is apparently one which puts the big power station out of consideration *if the enormous amount of waste heat can be usefully conserved.*

If it cannot so be conserved, and it is somewhat to be feared that this is likely to be the attitude of the big-station advocate who will not listen to anything which would put the big station out of the field, there still remains the question whether the super-station is altogether advisable. The presence of a super-station means an enormous concentration of coal transport facilities, and it represents also an easy target for an enemy. International compacts would be unavailing; it would be fatal to generate energy at so few points that concentrated aeroplane attacks could seriously disorganise any large fraction of our manufacturing capacity, and what would be the effect of a possible invasion which might sever the main transmissions? Whether regarded politically, technically, or economically, the problem demands much careful thought and very open minds. It cannot be dealt with in an off-handed manner by any pre-final ideas as to means or systems, for the possible thermal and chemical economies are vast indeed, and unless future wars are to be rendered impossible, the national safety must come first.

There does not seem to be much information of a reliable order on the question of the heat consumption of a household or an individual, apart from what is represented by electricity.

Probably no electric light company can state the total number of persons served by it, though this may, perhaps, be approximated as five times the number of dwelling houses, which surely is known to some accuracy. It should, therefore, be possible at once to state the electrical consumption per head in various classes of residential areas. Given a means of so arranging electrical supply that waste heat can be supplied to all households concerned, it would seem that on a sound system of heat distribution within a limited radius an enormous fuel economy would be secured, for the great fuel consumers are the fires in living rooms and the kitchen range, both of which appliances send not far from 95 per cent. of their heat up the chimney.

Is electricity to be sent out at a cheap rate from huge stations, or from smaller stations exposed to less danger of interruption? In this second case it would almost appear that no great effort need be made towards motive efficiency, for the heat demand would probably outrun the heat supply.

Real economy would result from a central communal heat supply, and electricity would be a secondary product to heat, or might very easily become so, and one result of this would be that simpler and cheaper machinery might be used. The writer has supplied such cheap machinery when called on to pump water at 50° F. to be used in a swimming bath at 70°. The wasteful little steam engine with a surface condenser could only heat the water to 60°, and further direct boiler steam added the other 10°. Engine economy would have been wasted capital. It is to this end that central house heating should aim; and with this to consider, and the possible superiority of low-pressure boilers and simple machinery, the actual overall economy would be enhanced, for the cost of attendance, repairs, oil, and waste would all be minimised. With the super-station the present wasteful domestic fuel problems would continue.

Electric Vehicle Progress.—According to the Electric Vehicle Section of the N.E.L.A., New York, the Norwegian Government has placed initial orders with American manufacturers for 50 heavy-duty electric trucks, to be used in various communities for the distribution of food which must be distributed in such a way as to avoid waste and spoilage and to assure minimum transportation costs. In Norway, gasolene, when procurable, costs $1 per gallon and electricity 2 cents per KW.-hour. The electric vehicle successfully competed with the gas car when gasolene cost 15 cents per gallon and electricity 5 or more cents per KW.-hour. Many Norwegian cities have adopted electric vehicles, large orders being placed with American manufacturers. Electric trucks are also being successfully operated by a number of commercial concerns, and demands for electric passenger cars are in excess of shipping facilities.

The Gloucester E.L. Committee has decided to purchase an electric lorry for handling coal and ashes.

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MINING ELECTRICAL ENGINEERING.*

By CHRIS. JONES, M.I.E.E.

It has for some years past been recognised that electrical power is the motive power *par excellence* for mining work, and that an efficient and reliable supply of electricity is indispensable to the prosperity of these industries, and with the progress of time the successful working of our mineral fields will more than ever be dependent on transmitted power. It is, therefore, of vital importance that those of us who are engaged at home should exert every effort towards increasing the efficiency and reducing the cost of generating, distributing, and applying the electrical power in mines and kindred industries, at the same time aiming at the maintenance and improvement of safety, simplicity, and reliability.

This paper will be confined to a consideration of the electrical system.

The question of a standard frequency is of great importance, especially so in view of the linking-up proposals of various supply systems. While frequency changers are successfully in use at collieries in this country, the writer thinks that they are best avoided, as they introduce high expenditures and extra plant upon which the supply of power will be dependent. The three-phase, 50-period, system has proved sufficiently flexible to be used for all colliery purposes, the great advantage being that with this periodicity, speeds up to 3,000 R.P.M. can be obtained as a maximum of 1,500 R.P.M. for 25 periods. The increased speed range not only results in economy in working and lower cost, but allows more latitude in design. The increased speed is of great advantage for centrifugal pumps, which are very prominent on a large scale in the South Wales coalfield. With motors of moderate power suitable for single reduction haulage gears, it is found that with 50 periods the cost is high, the power factor poor, and the space occupied large compared with 25-period motors, so that 25 period has its advantage for such gears, but the tendency to-day is to introduce double reduction gear or tandem sets, owing to the width occupied by single reduction, so that the effect of squeeze may be minimised. The 25-period supply is, however, adopted in some districts, and is to be commended if speeds above 1,500 R.P.M. are not required.

Should there be a public power supply station near to the colliery, it is well to adopt the periodicity of that supply, because it can then be used as a stand-by. In some cases the shutting down of generating plants may be effected at times of light loads when such plants are working uneconomically. There is also the possibility of surplus supply being available from the colliery exhaust and mixed pressure sets. This could be fed to the mains of the power company with advantage to both parties.

The question of power factor is one that calls for special consideration, inasmuch as it has not received the attention it merits. When laying or carrying out extensions, it is highly important that the question of power factor should be kept well to the front, in order to permit of the highest possible power factor being obtained, as it is from a point of view of a power company and those who are supplying their own power, a matter of real importance, as it vitally affects the capital expenditure in the items of generators, transformers, and mains. There is no doubt that many alterations in existing lay-outs can be made which will have the effect of largely improving present power factor conditions. Any alteration in tariff which would place a premium on high power factor would undoubtedly result in an all-round improvement. There are but few power supply companies that will offer any inducement to improve the power factor, the cost being the same whether it is 0.5 or 0.9 p.f.

The lower the power factor the higher the current for a given useful load, and consequently the greater the C^2R losses, the increased losses being inversely proportional to the square of the power factor. A low power factor is due to the magnetising currents of power transformers, especially when lightly loaded. This is of importance, and is increasingly so the larger the plant under consideration. Low power factor is also due to induction motors, which is the most prolific of all sources. The low power factor must not be attributed to the makers as not being able to supply a motor of high power factor. This is quite practicable, but it may entail a higher price than is warranted by the benefit derived to stipulate for much higher values than manufacturers' standard. The question is one for the user to decide as to what he has to sacrifice in order to obtain a high power factor motor. The point apart from the design which requires emphasising, and which has often a larger influence on the power factor of the power consumed by the motor installation, is the installing of motors for certain work much larger than they need be. The power factor of the average load taken by such motors being at once reduced. This was the tendency when changing from steam to electric, especially so when using the old original mechanical devices. There is nothing really gained by adopting such a policy, but quite the reverse, as one of the chief advantages of the induction motor is its power to meet any overload without damage so long as it is not overheated. Of course, the size of motor must never be cut down sufficiently to prevent its being able to stand up to the maximum momentary torque impressed on it in ordinary working, but it is often possible to use a motor which is very much smaller than would be necessary if the overload had to be kept within, say, twice full load. An example of such a case is a punching machine, where the power fluctuates over a long range. In such a case the maximum torque obtainable from the motor is generally the limiting factor, and even if the maximum power required is two or three times the output of the motor at its continuous running rating, the motor will never be fully heated. It is, therefore, very necessary when selecting motors to analyse each particular type of work, and to ascertain what the heating effect on a motor will be, and whether this heating effect is the limiting factor in deciding on the size of the motor to be chosen, or whether the maximum torque fixes the limit. If a careful analysis is made in this way, not only is it possible to reduce the cost of the motor considerably without in any way reducing the reliability of the plant, but the power factor of the average load taken by the motor will be kept at a relatively high figure.

It has been the practice of some makers to offer liberally rated motors in order to withstand the permissible temperature rise, at the expense of low power factor. Another factor is that motors of different sizes are standardised, and this practice is to be recommended in collieries having a large number of motors. An alteration in the amount of air gap in an induction motor does not sensibly alter the cost, and produces more effect on the power factor than any slight changes in the design; but an important practical feature is introduced, due to the greater risk of breakdown with small clearance, and it is essential to bear in mind and to recognise that the induction motor is essentially a high-speed machine. The slower the speed the higher the cost, combined with lower efficiency and power factor. It is an advantage to employ, if possible, a few large motors in preference to a large number of small ones. Another cause is the straining for too low temperature rise. It is, however, advisable to compromise between high efficiency, power factor, and reliability. The author finds that coal-cutter motors give a reasonable power factor, considering the size of air gap and its reliability. In cases where a motor will operate on a fluctuating load, and run light for long periods, the selection of the highest speed and lowest horse-power is of special importance in view of the large current taken at reduced loads.

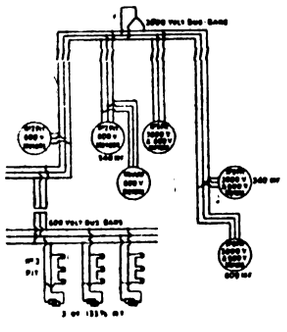

Fig. 1.

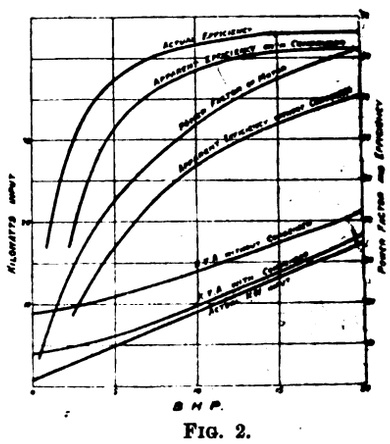

Fig. 2.

Fig. 1.—Arrangement of Static Condensers to Improve Power Factor.

Fig. 2.—Characteristic Curves of Three-phase Induction Motor, showing Condenser Effect.

It is essential that the apparent efficiency of motors be as high as possible in order that the plant be profitably loaded to the highest possible extent. The apparent efficiency is the product of actual efficiency and power factor, and therefore represents volt-ampere input, and as the capacity of a generating station and distribution system is limited by the K.V.A. output, the matter is of the greatest importance. The author, however, strongly urges that the power factor of installation be improved by adding devices which are available for power factor correction. It is gratifying to find some "go ahead" colliery owners who have appreciated its importance, and it is by such ventures that the best improvements can be effected. Some collieries decided to improve the power factor by the installation of static condensers. Fig. 1 shows the outline of the system, the condensers being fixed at sub-stations at end of feeders, in order to effect the saving in feeders, &c., these being placed on 600-volt, 50-cycle circuits. Some of these have been in use for three years, and up to the time of writing not the slightest trouble has been experienced with any of them, and in some cases they are fixed underground, the maintenance costs being approximately nil. Others are being installed on in-bye feeders, which will reduce the line current of a particular feeder, and obviate the necessity of purchasing larger cable. There is a great deal to be said in

* *Proceedings*, South Wales Institute of Engineers. Vol. 34, No. 2. Abstract.

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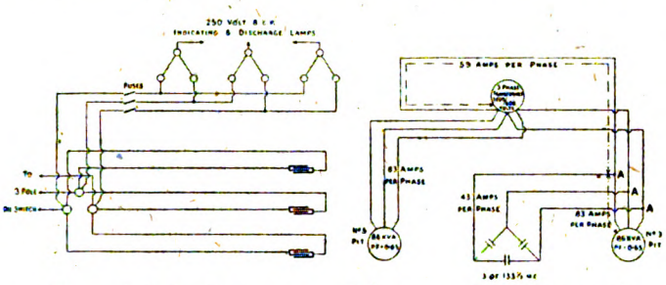
favour of this type of appliance, as they can be fixed across motor terminals in-bye in mines without the slightest difficulty. Fig. 2 shows the effect of a 59 mfd. capacity condenser on a 20-H.P. motor; the results are self-explanatory.

The introduction of these condensers effected the shutting down of a 200-KW. set and a boiler, the one set being able to do the work, the saving effected having more than compensated for the initial outlay. It is important to take the greatest care in not introducing too much capacity on the system, otherwise trouble may arise due to resonance effects. At the present time 3,000-volt, 50-cycle condensers are in use successfully.

Use may be made of phase advancers, such as that of Prof. Kapp's patent vibrator. This is in use successfully on large motors, and there should be a good field for its application where there are a number of motors, and where there is a D.C. supply available. This latter requirement is perhaps the chief drawback to its use in-bye in mines.

The advancer may be used as a slip regulator, which has been done by the American Westinghouse Co., in connection with a rolling mill motor of 2,600 H.P., which is now capable of being overloaded to 4,000 H.P. The inventor of this advancer has also patented an advancer of rotary type, but has not made one yet on account of the war interfering with private work, and he instanced to the writer a case where he had



FIGS. 3 & 4.—DIAGRAMS OF CONDENSER CONNECTIONS.

worked out a design for a 400-H.P. mill motor, consuming about a quarter million units a year. The saving in cost of current (£4 per annum on K.V.A. basis plus ¼d. per unit of power actually used) is about £1,000, which is more than the cost of the phase advancer, so that the speculation would have been a most profitable one to the consumer, and of great advantage to the supply company. Use may also be made of rotary converters and synchronous motors for the improvement of power factor. The latter may be used as rotary condensers in the same manner as spare alternators, which can be dismantled from the prime mover. Synchronous motors may well be applied for the driving of mechanical equipment. In these cases mechanical work is obtained at the same time that the power factor is improved.

Cases may be cited where savings of £20 to £40 per week have been effected on small installations by the improvement of power factor. If by careful attention to details the consumer improves the power factor of his plant an arrangement to the mutual benefit of both parties could be arrived at.

The modern practice is to earth the neutral point of alternators on all systems, and this is best done through resistances, as it provides a means of protection to the plant, and is an insurance against serious interruption of supply. The earthing resistance should be designed to pass sufficient current to operate with certainty any automatic protective device on the machines or feeders; it is essential that the resistance be so rated to carry the maximum current continuously for two minutes without being destroyed. The claim of advocates of the insulated system, that this system may be worked with one phase earthed, is void, in view of the automatic isolation of a faulty feeder; in the event of a fault occurring, as called for in the Home Office Rules. The claim also that two overload trip coils only are required is also uncalled for under certain conditions. With earthed neutral and protective leakage trip gear, two overload coils only are required.

Where automatic generator switches are used, it is now becoming the practice to earth several running machines, so that during the existence of an arcing fault on the system, the serious risks which accompany the breaking of the earth connection may be avoided. With machines having separate resistance between mid-point and earth, switches are not required in the earth connections, and the current which circulates between the machines is minimised. This system may be considered expensive with a number of machines, the mid-point may be connected to earth bar, and from bar through resistance to earth, and if the machines are of similar designs they may be paralleled on to a common earth bus-bar.

The writer has, however, met with cases where, owing to so much difference in design, the circulation of excessive current through the common connection made it imperative to use two bars. In a case where non-automatic generators are employed it is only necessary to earth one running machine. When the neutral points of machines are not accessible, and in a case where a number of small machines which will not run together successfully although the neutral may be accessible, an artificial neutral may be introduced by connecting a three-phase star reactance to the main bus-bar. The writer is of opinion that future legislation will make it compulsory to earth the neutral of a mining installation, in order that leakage protective gear may be universally adopted.

(To be continued.)

RELAY AUTOMATIC TELEPHONES AT AUSTRALIA HOUSE.

JUST over four years ago (July 10th, 1914) we described the new automatic telephone system, consisting entirely of relays, of Messrs. Betulander and Palmgren. We are now enabled, by the courtesy of the Relay Automatic Telephone Co., Ltd., owners of the patents outside Sweden, to describe an exchange on this system for inter-office communication which they have installed at Australia House, which was visited by the King on Saturday last.

The equipment of the exchange, which has been working for over twelve months, is for 80 lines, but the racks fitted provide for 200. At present 74 telephones are in use. That such installations are valuable labour-savers may be gauged from the fact that these 74 telephones make nearly 600 calls per day.

The automatic exchange is located in a small room on the fourth floor, from which 11 10-pair lead-covered cables radiate to eight distribution boxes fitted in convenient parts of the building. From these distribution boxes, a twin lead-covered cable is run to each telephone. The cables and the office wiring are of 10-lb. conductors, enamelled, cotton-covered and waxed, and lead-covered. Use is made generally in cabling of the ventilation ducts over the corridors, and of two ventilation shafts, one on the Strand side, and the other

FIG. 1.—SUBSCRIBER'S TELEPHONE.

on the Aldwych side of the building. Ample provision is made in the cables to the distribution boxes for future growth, the single-pair cables being run as new telephones are fitted. This arrangement gives great flexibility, and especially facilitates the removals which take place in large office blocks, owing to re-arrangements of staff with the growth of the business. In such cases, an official can retain his original telephone number, which is a great convenience. In some cases, where two officials share a room, but where the traffic does not warrant two lines being run, instruments are fitted in parallel in order that either can use the telephone without leaving his desk.

The system which has been installed is unusually interesting from the fact that all the operations of number selecting and connecting, ringing, and disconnecting, are performed by simple telephone relays of the same kind as those usually employed in ordinary manual telephone exchanges. None of the more or less complicated electromechanical switches usually essential to an automatic telephone system are employed. The maintenance charges of such apparatus are claimed to be very low, because mechanical wear and tear has been reduced to a minimum. The relay armatures work on a substantial knife edge, and have a movement of less than 1/32 inch. Relays require no oiling or cleaning.

The requisite energy for talking, signalling, and operating the relays is obtained from a small 24-volt battery of accumulators, which are fitted in duplicate to enable one set to be used whilst the other is being charged from the electric supply main.

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The telephones in use are of three patterns, of which one is shown in fig. 1, adapted for table or desk use. This figure also shows the very convenient form of directory that is provided. The other patterns are respectively a wall set and a special form of desk set embodying a hand combination telephone.

Fitted to each instrument is a dial, by the manipulation of which connection may be had with any other number on the system, in the usual way. If the wanted number is "engaged," an intermittent buzzer sound is heard in the telephone. The caller replaces his telephone on its rest, and calls again later.

Fig. 2 shows a general view of the plant at Australia House. Unit construction is employed, the relays being mounted and wired in groups. It is claimed that this simplifies the installing of the apparatus, and facilitates extension by units of ten lines, without interfering with the existing equipment.

Fig. 3 shows the simple unit with which the relay system is built up.

Primarily the subscribers are divided into 5-line groups, each having access to a number of links which are common to both outgoing and incoming calls. In practice, two 5-line groups are assembled on a common frame to form a 10-line unit. Almost all the wiring is done in the works, leaving a minimum number of soldered connections to be made on site.

We will suppose that subscriber No. 281 calls subscriber No. 347. When No. 281 takes his receiver off the hook, the line relay associated with his line closes a circuit resulting in the first available connecting relay energising and connecting No. 281 to, say, link 1, which it is assumed is disengaged, while at the same time a connecting relay is energised and connects link 1 to OUT trunk 2. A relay at the A and B feed of OUT trunk 2 now energises, also the cut-off relay of No. 281, which releases the line relay.

No. 281 now proceeds to dial for No. 347. When the dial plate is released for the hundreds impulses, OUT trunk 2

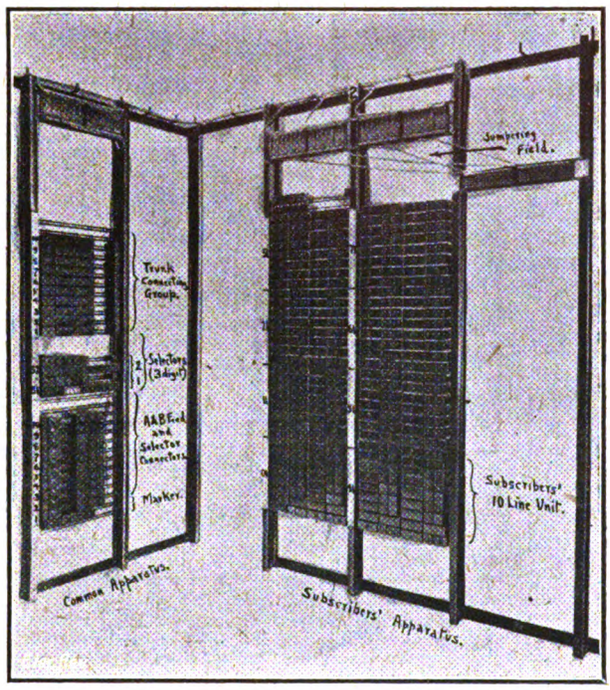

Fig. 2.—Relay Autophone Exchange for 200 Lines (80 lines equipped).

will at the first impulse obtain exclusive connection with selector 1, if it is disengaged, via selector connector 1.

The dialling of the three digits will set a train of impulse relays in the selector which act as intermediaries to energise particular relays for the required hundred, ten, and unit, and in conjunction with a group of relays, call the marker, establish a marking circuit, particular to No. 347, terminating on the connecting relays of that line.

As a result the connecting relay on the first idle link, say, No. 1, in the 5-line unit, which includes No. 347, will energise, also an associated relay, connecting No. 347 to link 1, and link 1 to IN trunk 1.

At the same time, a connecting relay in the trunk-connecting group will energise and connect OUT trunk 2 to IN trunk 1, completing the connection between Nos. 281 and 347.

When the connecting relays have energised, the selector connector No. 1 on OUT trunk 2 de-energises and releases the selector and marker for other calls.

At the A and B feed ringing is then connected to the called line, and is cut off immediately the called subscriber answers. The two subscribers are connected by a "Stone" system transmission circuit.

The connection is released by the opening of the holding circuit of the connecting relays when the calling subscriber hangs up his receiver. If, however, the called subscriber hangs up first, the connection will be released, after a delay of approximately one minute, provided that the caller has not cleared in the meantime.

It is understood that this delayed release by the called subscriber is provided where the plant is unattended, and that a back release alarm can be fitted instead if required.

If the wanted number is engaged, the selector and marker release and busy-back are connected to the calling line at the A and B feed.

A thermostatic timing device is fitted to each OUT trunk to notify faults or errors in dialling and to restore the relays to normal under abnormal conditions.

Provision is made at the selectors to render ineffective accidental impulses sent by the subscriber's switch-hook.

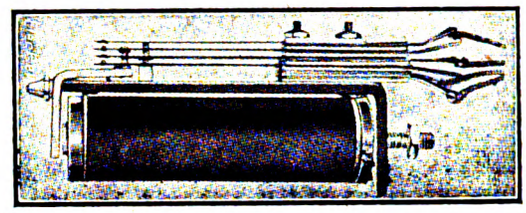

Fig. 3.—One of the Relays.

The operation of the system is remarkably quick; within a second of the completion of the dialling the bell is ringing at the called subscriber's station, or the "engaged" signal is given at the calling station. Thanks to this feature, and to the fact that the selecting apparatus, when it has completed a connection, is instantly set free to take another, only two selectors are needed for the operation of this 80-line exchange. Faults are exceedingly rare, owing to the perfection of modern relays, and attendance thus forms a trifling item. The simplicity and flexibility of the system are also great advantages.

LEGAL.

Rio Tinto Co., Ltd., *v.* A. E. G. Electric Co., Ltd., and A. E. G. Electric Co., Ltd., *v.* Rio Tinto Co., Ltd. (Consolidated.)

Mr. Muir Mackenzie, High Court Official Referee, on July 30th gave judgment in these cross actions, which commenced on July 1st, and lasted 14 days, and which related to the supply of machinery for the extraction of copper from the ore of the Rio Tinto mines. The A.E.G. Co. claimed for the supply of a turbo-blower, and the Rio Tinto Co. claimed damages for the failure of the machine to do the work required of it, and for consequent loss of profit.

The Official Referee, in giving judgment, explained the causes of action and how the proceedings had arisen out of the award of the arbitrator. A tender for the new blower was sent in by the defendants and accepted, and an order was given for it in July, 1913. The reason why the completion and trial of the new blower could not take place at first was that the whole of the plant had not been delivered owing to the late delivery of the plans. The declaration of war affected the situation of both parties in many ways. In November, 1914, the defendants asked for a cheque for £1,154, being the amount of the second instalment. After February 7th, 1915, the whole plant was ready, subject to a few small matters being put right, but defendants declined to send an erector unless the second instalment was paid. The plaintiffs desired to use the blower, and after communications by letter and by telegram an erector was sent from the Spanish company. On July 21st, when everything was ready, the defendants withdrew their erector. Against this the plaintiffs protested, but he did not return. On August 9th, the plaintiffs at the mines proceeded to prepare the machine for starting up. The trial was continued at various dates to September 8th, when at a speed of 1,350 r.p.m. the plant broke down. The defendants were not then informed of anything that had taken place. At an interview presided over by a Board of Trade supervisor, an agreement was arrived at that the defendants should send out a man forthwith to start up the machine, and as soon as it was working commercially the second instalment should be paid. On September 26th Mr. Dafty arrived at the mines, and found that the shaft was bent. A new shaft was made and sent out, and the blower with the new shaft was afterwards tried when alterations had to be made in order to raise the critical speed above the working speed. Again it broke down, and a new shaft had to be sent out, which worked satisfactorily.

The first claim he had to deal with was that of damages for breach of contract. The arbitrator had found that there was a radical defect in design—that the critical speed was too much below working speed. The blower was not in conformity with the contract, and in that regard the plaintiffs

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were entitled to recover damages for breach of contract unless important defences prevailed. One of these was that plaintiffs deprived the defendants of the opportunity of making a trial, and by starting the blower themselves they had freed the defendants from their contract. In July, 1914, the plaintiffs were not ready to make the test, and defendants' man who would have made the test was withdrawn. Taking the findings of the arbitrator, it had been established that the delivery of the requisite documents had been delayed for more than three months, and that by reason of that delay defendants were unable to complete the work within the time specified by the contract. The defendants had complained of the delay, it was true, but he could not find that that should in any way relieve them of their liability for failure to deliver the blower according to contract. The defendants had in their favour the finding of the arbitrator as to the starting of the machine. They said they ought to have received the second instalment before the starting up, but in that they were not justified. As to the allegation of fraud, the evidence fell far short of establishing any case of fraud in the representations made. He decided that the defendants had broken their contract by supplying a blower the design of which was radically defective and by reason of the defect it would not do the work required of it. The plaintiffs were entitled to damages in respect to that.

Dealing with the various heads of damages claimed, the Referee said the most important was the claim for £180,000 for loss of profit, &c., as to which he found that it was not recoverable. The plaintiffs would recover damages to an amount to be assessed hereafter, and the defendants on the counterclaim would be entitled to £1,757. The costs of the action must be the plaintiffs', except so far as regarded the issues upon which they had failed. The costs of the counterclaim would, under similar conditions, be awarded to the defendants. The costs of the arbitration ought to be the plaintiffs', except so far as they were increased by issues in which they had not succeeded. He would not draw up any order as to costs until the matter came before him again on the assessment of damages.

A stay was granted for ten days from the commencement of next sittings pending any application for appeal.

R. Barrett & Son, Ltd., *v.* Wythe Smith.

In the City of London Court, on August 1st, before His Honour Judge Rentoul, K.C., an action was brought by plaintiffs, brass founders, Beech Street, Barbican, E.C., against defendant, an electrical engineer, 32, Park Road East, Acton, to recover £64 11s. 3d. for making lids for air-vane time-limits (electrical machinery) which defendant had contracted to make for Siemens Bros. Dynamo Works, Ltd., Stafford. The claim was admitted, but defendant raised a counterclaim and set-off for £217 6s. as damages which he had lost through being unable to carry out his contract with Messrs. Siemens. Mr. Samuel Duncan appeared for the plaintiffs and Mr. G. A. Scott for the defendant. Mr. Scott said that the claim was made up of £77 13s. 9d., less £13 2s. 6d., for which credit was given. The credit was for 400 lids of gun-metal appliances for the electrical machinery. The total order was for 500 lids. Plaintiffs delivered 100 which were all right, but 400 were faulty, and had never been delivered in the condition that they should have been in. The result was that the defendant had lost the profit on 400 machines. Mr. Duncan said plaintiffs offered to replace the lids complained of with others, and after awaiting defendant's convenience plaintiffs never heard any more. Mr. Scott said that as it happened, Messrs. Siemens were going to take the parts objected to, and utilise the material. Therefore the defendant would abandon the £210 upon the counterclaim, but he persisted in the rest of the counterclaim. Mr. Smith, the defendant, was called in support of the counterclaim. Mr. Duncan said there was no evidence of loss of profit occasioned by the plaintiffs' default. The Judge found for the plaintiffs for £64 11s. 3d. on the claim and counterclaim, with costs.

WAR ITEMS.

H. Traun & Sons.—The "Times" publishes the following under the title "Keeping Alive an Enemy Business":—"Sir Albert Stanley, replying to Sir Leicester Harmsworth, states that the business of H. Traun & Sons, manufacturers of ebonite and vulcanite goods, of 25, Goswell Road, E.C., was ordered to be wound-up on December 21st, 1916. Messrs. Winter and Almenräder, naturalised British subjects of German origin, who had acted as manager and assistant manager of the business, had begun to carry on a similar business in partnership in January, 1915, at the same address under the name of 'Winter & Co.,' and there seems no doubt that this course was taken partly with a view to the business of Traun & Sons being resumed after the war. He has no information of the firm's having received contracts from any Government department, and proposes to refer the case again to the Advisory Committee as soon as the amending Bill now before Parliament has become law."

Exports to China.—The "London Gazette" for August 2nd contains a further list of persons and bodies in China to whom exports may be consigned.

"Liberty," not "Bosch."—Although the importation of American Bosch magnetos into Australia is not prohibited, the machines will not in future be allowed entry into the Commonwealth under that name; they will be, however, allowed in under the name of the Liberty magneto. The factory in which they are made is no longer in Bosch hands, it having been taken over by the American Government.

Part-Time Work of National Importance.—The Ministry of National Service has circulated a letter to Tribunals pointing out that in granting exemption to men on condition that they took up part-time work of national importance, this had been met by the men joining the special police, but it was found in several instances that the number of special police exceeded the pre-war number of regular police. This was certainly a waste of man-power. In the centrally situated boroughs employment could be found in factories which produced munitions and manufactured articles (other than luxuries) for the community. It was suggested that in each borough part-time committees should be appointed, which, with a knowledge of local conditions, should be able to place the labour. The committee should have upon it representatives of the employers and the workmen. Some manufacturers might at first be found prejudiced against the employment of part-time labour, but the calling up of men to the Colours was making them realise the necessity of using it, whilst those who had tried it had been satisfied.

American Determination.—A correspondent has favoured us with a copy of a letter received from the president of several large engineering works in the United States, from which we make a fairly full extract. The letter was written on June 12th, 1918:—

"We have been going through difficult times. The U.S.A. should have entered the war before, but that is now ancient history. The question immediately ahead of us is—what do the Allies expect of the U.S.A.? I am going to answer this question, and in so doing I am going to leave myself open to the charge of exaggeration. There is nothing which you can ask of us which we will not give. The scope of our preparation is too gigantic to be grasped by any one mind. We are in this war to stay with our last dollar and our last man.

"Every manufacturing concern in the United States that can by any means manufacture war supplies is doing so. If a concern cannot manufacture war supplies, it is difficult or impossible for them to operate at all. Their labour is taken from them, they cannot get coal, and they cannot transport their product. We ourselves are building four times as much apparatus as we built three years ago; every dollar for war purposes.

"If necessary we can and will put in the field ten million men. We are going to build aeroplanes as Ford turns out automobiles. One day several years ago, Ford turned out five thousand automobiles in one day.

"We are voluntarily giving up food in order that our Allies may have enough. The preliminary crop reports indicate the largest wheat crop we have ever grown, with all other grains proportionately heavy. As for taxes, I have not heard a single man complain, although I know a number who are paying out within a few days, June 15th, to be exact, 60 per cent. of their income. The tax for next year will be much heavier. One of my companies has been obliged to pass its dividends on account of taxes, and it is doing so gladly. Believe me, the enthusiasm in this country is something immense, and there is a moral and spiritual uplift among our boys that is very remarkable, and a finer lot of chaps than we are sending to France never trod shoe leather. We have a few slackers, but they are very few. When you think what a mixed population we have, I think it is very remarkable that the country should stand so unanimously behind the President.

"Every ship that comes into or leaves our ports has a wireless equipment which includes one or more circuit breakers. One company is turning out one thousand circuit breakers a month, and has received orders for circuit breakers for sixteen battleships, to say nothing of the submarine equipment on which we have been at work for three years.

"The one thing we fear is a German peace offensive. We do not want to have to tackle this kind of job again. We want to put the Hun on his back and cut his throat. We have a saying that the only good Indian is a dead Indian, and we feel the same way about the Hun. Who is responsible for the magnitude of our plans I do not know. We are building plants for the manufacture of guns, which plants will not turn out a single gun within 18 months.

"It is the very immensity of the work we have undertaken which has made us slow, if we have been slow, which I am not prepared to admit. We could hardly be expected to know what was going on in Russia, but England and France should have known, and her downfall should have been prevented. But this, like our own tardiness in getting into this fight, is now ancient history, and we have got to do our best with conditions as we find them.

"Our President talks about making the world safe for democracy. This is not the idea of the man in the street. He does not give a damn for democracy; he wants to make the world decent for old men and boys and for women and

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children to live in. To accomplish this, he is prepared to fight indefinitely.

"The information outlined above comes from one who is in a pretty good position to know what is going on."

H. R. Merton & Co., Ltd.—It is stated that the above company has issued a writ against Mr. W. M. Hughes, the Australian Prime Minister, on account of recent speeches concerning the company.

In Parliament on Monday, in reply to questions regarding the company, Sir A. Stanley, President of the Board of Trade, according to the *Times*, said:—

"The Metalgesellschaft formerly held a large number of shares in Henry R. Merton & Co., Ltd., but does not now hold any shares; the Australian branch of the company has been closed, but I have no information as to the African branch. The present directors of the company are S. Baer, H. Gardner, W. Gardner, O. Lang, E. R. Merton, and M. Wilson. German subjects have an indirect financial interest in the company through the holding of 11,875 shares by a Swiss company which is believed to be under German control. I understand that the company is not now doing any work for the Government. Under the provisions of the Non-Ferrous Metal Industry Act the company will not be able to trade in non-ferrous metals without a licence, and I may inform the hon. and gallant member that in this case the Board of Trade have refused to grant a licence."

A writ for libel has also been issued on behalf of the company against the *Daily Mail*.

Exemption Applications.—Before the Bucks. Appeal Court, the National Service representative appealed against the exemption granted to R. H. Philpott (47, Grade 2), electrician on the Tyringham Estate, on the ground that the electric supply of Tyringham House was not of national importance. The certificate was amended to exemption until September 24th or the man doing work of national importance for 36 hours weekly.

At Reigate, conditional exemption has been granted to Jas Seagrave (50, grade 2), stoker and driver at the Corporation Electricity Works.

Wilts Appeal Court has granted exemption until August 30th, pending protection, to A. H. Mackenzie, electrician, with Messrs. Harris & Co., of Calne.

Rochdale Tribunal, on the recommendation of the Advisory Committee, has given exemption until November 30th to W. Ridgley (33, grade 3), motorman on the Corporation tramways.

Colchester Tribunal has granted conditional exemption to E. P. Harvey (grade 3), engaged at the tramway depôt of the Corporation.

At Dover, on July 31st, the Corporation Tramways Department appealed for G. F. Howard (35, C2), fitter, employed in the repair of tramcars. The manager said that the man's work was necessary for the public safety, and he could do with three or four similar men if he could get them. Three months, subject to substitution, were conceded.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Nottingham Super-Power Station.

The various announcements that have appeared in the technical Press re the report of the specal committee appointed by the Nottingham Corporation to prove the advantages of their city as a suitable site for a super-station are very interesting, and are indeed a "shaking among the dry bones."

Why should the most antiquated and inefficient station in the Midlands suddenly think itself sufficiently capable and experienced to be able to design, equip, and run a national power house, and to supply the surrounding towns and cities who are now generating at higher efficiencies and lower costs?

The records of the towns it is intended to absorb are as follows:—

Town.	Units gen. in millions.	Works costs.	Coal.	Av. price obtained.	Units per head.		Profit.
Chesterfield ...	2·3	·90	·31	1·45	38	+	1,800
Mansfield ...	2·06	1·14	·48	1·9	16	+	1,600
Lincoln ...	5·3	·84	·50	1·22	90	+	3,130
Loughboro' ...	1·5	·86	·39	1·26	68	−	877 loss
Leicester ...	5·25	1·41	·65	2·13	22	−	764 ,,
Kettering ...	2·4	1·48	·55	1·43	78	+	616
Burton ...	4·0	·74	·31	1·37	72	+	3,011
Derby ...	12·18	·72	·43	1·21	80	+	2,600
Nottingham...	14·7	1·34	·62	1·85	31	+	5,300

After twenty years' experience, Nottingham (with the exception of Leicester) is the highest town for works costs, coal, &c., it runs non-condensing, has over thirty sets, and only one larger than 450 KW. Charges are higher, units sold per head disgracefully low, and this year it has not even managed to make both ends meet.

Such a record surely does not warrant the neighbouring towns being handicapped by having to take supply from a station to be managed by such a Committee, even if they have the river Trent and a coal mine in the front garden.

Pickle.

Instruments for Central-Station Switchboards.

I see that Mr. Nield's reply to my letter is mostly insinuation, all of which is entirely baseless. I am not out to sell (or buy) any particular make of meter, but only to obtain the best for the purpose. Further, I have never known a good case improved by the sort of methods he adopts, and I am not going to presume on your space further than to say that I gave the particular items of our tests in which the two types showed a divergence, except that we found that an intense local magnetic field could not be made to affect the mercury meter (on account of its good shielding), but did seriously affect the Aron meter if not maintained constant in position and strength for the complete cycle (21 minutes), or multiple thereof. His "random shot" about increasing voltage is quite wrong; I give the worst condition of the two. I simply intervened in this matter to explain the tests which someone else quoted; time and paper are too precious to allow of my saying more, and as far as I am concerned the matter is closed. If rival manufacturers like to have a scrap, let them—I do not pose as anyone's champoin.

E. Fawssett.

Newcastle-on-Tyne, *August 3rd*, 1918.

It is unfortunate that "A.M.I.E.E." ever wrote his criticism of Mr. Stubbings's article in the tone he did, for he should have borne in mind that on the face of it, it was an out-and-out condemnation of the oldest and most scientific of the watt-hour meters on the market. That this condemnation is not justified is shown by the fact that my sales of the Aron clock-meter were, in 1917, twice those of 1916, a state of things which I believe has not been equalled by any other meter manufacturer.

As the one who entered into the negotiations for the Aron Meter Co., with Mr. Fawssett, I must beg to differ from him as to the general trend of his observations, particularly as they damage our reputation, but have no consequences for him.

He suggests that he started the test with a bias in favour of the Aron meter, but when I called on him for the first time, over six years ago, he refused to have anything to do with the meters, as he said he had tested them years before and would not touch them again. It is worth while noting that Mr. Fawssett had one of our samples 18 months, and then had not time to test it, although it was in his test room until a few months before the above tests took place. When I was asked to supply the meters we were given two weeks to deliver them, and I protested that this was not long enough, particularly as we wished to try some experiments to reduce the temperature coefficient, and we prefer to run the meters longer than this before delivering. I was then told that this was all the time allowed, and we decided to risk sending two meters on the distinct understanding that no temperature tests should be taken into account (although such have been mentioned in the correspondence), for we can supply a whole current type meter with absolutely negligible temperature coefficient, and hoped to make the shunted type as good.

Mr. Fawssett's statement about taking every precaution to ensure accuracy should be qualified, for in the first series of tests I strongly objected to our meters being placed above the adjusting resistance, which I believe carried 300 amperes at times developing a fair temperature.

After seeing the results of the first tests, I asked to withdraw the two meters, for, seeing that the temperature coefficient of one meter was twice that of the other, I came to the conclusion that there was something radically wrong with the one meter.

Now to show where the bias, if any, comes in, I was told we could have the meters back for correction, and we had them back for some weeks, although in the first instance *only two weeks could be given for delivery*. The other make of meters were sent back and altered in design according to Mr. Fawssett's own specification, embodying, I believe, one of his temperature adjustment patents.

Because of a report I sent in to my firm as to the way I considered "the wind to be blowing," and as we were very busy with actual war orders, nothing was done with the two meters until the last moment, and then they were overhauled, but we could not keep them long enough for "running together" tests.

I consider that Mr. Fawssett has been guilty of a serious breach of faith in mentioning the question of temperature coefficient when it was expressly understood that we were not to bother about making any adjustment for this till afterwards. It did not occur to us until too late that if the temperature was allowed to vary, the meters would not run together if they had different coefficients, for we thought wrongly that the temperature would be kept constant.

As this is the second time that harm has been done to our business through a one-sided report from the same source being allowed to filter through the same channel, I strongly

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protest against it in this case. I have had sufficient experience with every type of meter on the British market to be able to bring enough evidence to damn every one if it is only presented in a certain way.

A. E. Jepson.

Southport, *July 30th*, 1918.

Trade Unions: Past, Present, and Future.

I have read "Electrical Fitter's" letter, and am glad to see he has decided to become a trade unionist if the trade union is solely made for him, and to conduct and carry out his ideas of policy and politics.

I can fully understand that it is useless for him to try and bring about reforms in the present trade unions, for time and experience count in all things; besides, his policy is wrong, for all unions adopt the policy of the majority, and are not governed by one, as "Electrical Fitter" would have it.

If he is qualified, it will be very easy for him to join one of the present trade unions, with his spark of patriotism and average intelligence; he will find the former qualification in a larger form than a spark amongst trade unionists, and as to the latter, if he uses it, he will find he has been labouring under a delusion, or has been speaking of things he knows nothing about.

With regard to the movement for helping and lifting purposes, I take it that "Electrical Fitter" means better moral, social, and economic conditions, also better wages, for that is the best way of helping or lifting the worker I know of; well, for his edification, it is one of the present trade unions he is seeking.

As to some of the present labour movements being out to assist the aliens, especially of the enemy variety, if "Electrical Fitter" is referring to strikes that have taken place during this war, for his information all strikes since August 4th, 1914, have been unofficial and against the leaders; it is silly for anyone to expect trade unions to be free from Bolchies, conchies, and aliens, for these are still at large, even in the Government's employ.

"A fair day's pay for a fair day's work." This is the business deal between the employers and trade unions; the trade unions state your rate of pay, and the employers see that you do the work.

Finally, if "Electrical Fitter" still finds he is not being catered for in one or two of the present trade unions, it may be an association he is seeking, not a trade union.

J. W. Woolley, E.T.U.

Whitley Bay, *August 3rd*, 1918.

[This letter has been shortened.—Eds. Elec. Rev.]

Motor Problems.

The interesting article appearing in your issue of the 2nd inst. has raised considerable comment, and as one who has endeavoured to bring about a satisfactory state of affairs in relation to an economical and reliable design of variable-speed induction motor for application to my "Paragon" thermo-electric ship propulsion system, and with my thermo-electrification traction system for railways, I am very interested in your valuable and instructive remarks, which are highly appreciated.

Your article is timely in every respect, as there is no question in all the commercial field of electrical power engineering, which is so pregnant with great possibilities as that of the production of a reliable and satisfactory variable speed induction motor for general purposes.

Think, Sirs, of the thousands of tons of fuel per year that it is possible to save, in the event of a suitable type of motor being brought forward. In every direction in which you can look, the want of this essential motor is noted.

I am pleased to inform you that I have now developed a type of short-circuited induction motor which promises to be of high importance in many directions, permitting the application of polyphase alternating current in fields heretofore entirely given to D.C. machines. It has high power factor, and reduced weight per horse-power at given revolution speed, and can be operated on the "Paragon" variable frequency system at any of a continuously variable speed; I believe that it produces the ideal means of operating, not only ordinary industrial machinery, but also meets the pressing demand for a suitable marine motor for ships' plant, besides being certainly interesting from traction aspects.

William P. Durtnall.

London, S.W., *August 4th*, 1918.

[This letter has been shortened.—Eds. Elec. Rev.]

With reference to the problem which, in your leader of August 2nd, you commend to inventive readers, may I point out that the Igranic Electric Co., of London and Bedford, have standardised several patented devices which dispose of the difficulty you named.

The simplest is their vibrating relay, which can easily, and at comparatively trifling expense, be incorporated with their leaflet No. 200 single-handled combined starter and regulator, which appears to be the type your article specifically referred to. The function of the vibrating relay, which has its operating coil in the motor circuit, so that it is sensitive to conditions which affect the motor, is to automatically prevent the too quick insertion or too quick short-circuiting of field regulating resistance, no matter how quickly the controlling handle may be moved, in either direction. It consequently prevents flashing over, by avoiding the too sudden strengthening of the shunt field.

The Igranic leaflet No. 36 inching starter is equally effective in avoiding the evil you described, because the instant that any backward movement of the starting handle is made the circuit of the motor is opened. When this feature is added (as it often is) to the leaflet No. 200 combined starter and regulator named above, the difficulty that you have named does not arise, because the circuit of the motor is opened before any of the regulating resistance is cut out of circuit.

Of course, merely opening the motor circuit does not necessarily produce a quick stop if the machinery possesses considerable inertia, but if a solenoid-controlled brake be added, in which the solenoid circuit is opened and closed simultaneously with the motor circuit, the kinetic energy can be quickly dissipated.

On the other hand, one might ask, why should an attempt be made to stop the motor as quickly as the machine that it drives? Are there not many machines (as, for instance, newspaper printing presses) which possess so much internal friction that they would quickly stop if relieved from the effect of the inertia of the armature of the motor? In Igranic electrical equipments for large newspaper presses, the press is connected to the motor by a magnetic clutch, which is de-energised when the motor circuit is opened, with the result that the stopping of the press is not in any way delayed by the inertia of the motor armature, and the press consequently can be stopped in the very shortest time that is consistent with safety.

Another instance where quick stopping is essential in emergency is in connection with rubber mills, and for driving these it is common practice to use a magnetic clutch between the motor and the mill, controlled by a switch which can be instantly opened by any operative at any one of a group of mills. A solenoid brake is a standard combination with Igranic clutches, and immediately an emergency arises any operator opens his switch, and all the mills are stopped in the shortest period possible. The Igranic Co., in one of their pamphlets, give an instance of a 200-B.H.P., 590-R.P.M. motor installed in the plant of a large rubber company to drive three rubber mills 20 in. and 22 in. by 60 in. Without the clutch brake attachment it was found that on opening the motor circuit the drive roll periphery travelled 276 in. before coming to rest. The same group of mills, when fitted with the clutch brake arrangement, were stopped with a recorded travel of 4 in. on the drive roll periphery after the time of opening the safety switch.

This method not only ensures a quick stop without the electrical disadvantages you described, but it also relieves the motor from the heavy mechanical stresses which must be set up when an attempt is made to stop very quickly a heavy armature that is rotating at a high speed.

It is an advantage, too, to place the means of stopping at the disposal of more than one person. Experience has proved that in applying a safety cut-off device to rubber machinery the machinery should be grouped; that is to say, the safety cut-off for one rubber mill should be controllable from a number of other mills, because when a workman is caught in machinery he seldom retains sufficient presence of mind to avail himself of the safety devices which have been installed for his protection. It is found that, where magnetic couplings have been installed, workmen at adjoining machines are usually the ones to cut off the power and bring the machinery to rest.

Jno. T. Mould.

London, E.C., *August 7th*, 1918.

BUSINESS NOTES.

Excess Profits Duty.—The Board of Referees have refused an application by the Quasi-Arc Co., Ltd., and the Quasi-Arc Co. (France), Ltd., of 103, Cannon Street, E.C., for an increase of the statutory percentage as respects "the manufacture and sale of electrodes for electric working of iron and steel comprising metallic cores with blue asbestos yarn insulators."

Sports at Chelmsford.—The result of Crompton's, Hoffmann's, Marconi's, and National Steam Car United Works' Sports and Fête, held on July 6th on the Wood Street Grounds, Chelmsford (by kind permission of Crompton's Club), was a net profit of £305—a record. The Committee has allocated £155 to the Chelmsford V.A.D. Hospital and £150 to the Essex Regiment Prisoners of War Fund. The handsome balance was helped considerably by Messrs. Godfrey & Sons supplying all tents, &c., free of charge, and by the valuable help rendered by Capt. C. E. Ramsden, of the A.S.C. Mr. Percy G. Cheverton acted as hon. secretary and treasurer.

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Ignition Magneto Manufacture in Sweden.—In addition to the Prior Co. mentioned in a recent issue, ignition magnetos for use on motor vehicles and aircraft are now being manufactured in Sweden by the Svenska Elektromagneter Aktiebolag, of Amal, and the Svenska Verktygsmaskiner, Swenson & Co., of Stockholm.

Liquidations.—Devonport and District Tramways Co.—Winding up voluntarily, Mr. P. N. Gray, Manchester Hotel, Aldersgate Street, E.C., as liquidator. Meeting of creditors, August 9th.

Brown-Bayley's Steel Works, Ltd.—This company is winding up for the purpose of reconstruction.

The British Engineers' Association and Economic Policy.—The British Engineers' Association has placed before the War Cabinet, the Imperial War Council, and the Heads of Government Departments a resolution placing on record its grave concern at the delay of the Government in making public the economic policy which is to be adopted by this country after the war. On behalf of the industry that it represents, the Association urges that such a declaration should be made at once, in order that this country may be prepared and properly organised to take its place in the economic struggle which will arise at the close of the war, and for which the enemy countries have been systematically and energetically preparing for some time past. The Association feels very strongly that unless the Government declares its policy this country will be at a serious disadvantage with competing countries after the war. It is stated that any further delay on the part of the Government will tend to increase the feeling of distrust and apprehension which is at present making itself felt throughout the country and the Dominions, and that the Government, having received reports of the various Committees and Commissions set up to deal with the questions which will arise at the close of the war, including the Report of the Lord Balfour of Burleigh Committee on "Commercial and Industrial Policy After the War," is now in a position to declare its policy. The Association states that, having fully considered the final Report of the Balfour Committee, it is of opinion that in the main the conclusions come to in the Report are satisfactory, but it desires to make a number of recommendations.

The first of these suggests a number of amendments to the recommendations of the Dalziel Committee respecting enemy aliens. The second is that, having regard to the future of British industries, it is in every way undesirable that control in any shape or form should be exercised either by alien interest or capital in their development. Other recommendations are :—That it should be the primary aim of the Government to ensure and encourage the application of British capital to the development of British industries, and to ensure that all sources of raw materials within the British Empire be brought, and remain, under British control; that the banking system is totally inadequate to meet the needs of the engineering industry, and that it is incumbent on the Government, in the interest of oversea trade, to encourage, and, if necessary, actively support the formation of one or more financial corporations capable of assisting the demands for financial support of the manufacturers or traders of this country.

With regard to the question of fiscal policy, the Association is unable to agree entirely with the Committee's recommendations that protection shall only be given where an industry proves that it is efficient and unable to fight foreign competition, and desires to make the following observations :—

That the underlying principle should be to support an industry in combating foreign competition in the first instance, either by preferential tariff, bounty, or financial assistance, and not to leave such assistance to form matter for consideration at such time as foreign traders shall have established themselves in the markets.

That every industry is primarily entitled to be protected by the Government, and that therefore each industry should be dealt with separately on its own merits.

That where there is reason to believe that production can be efficiently and economically increased within the Empire, a well-devised system of preferential tariffs would give security to the manufacturer, and stimulate him to greater efforts to obtain the highest efficiency in production and increase in his output.

In conclusion, the British Engineers' Association recommends :—

1. That preferential treatment shall be given to the British Oversea Dominions, and that Allied and Neutral countries shall only be permitted to trade in this country on terms equivalent to those granted to this country by the Allied or Neutral country concerned.
2. That for a definite period of years no enemy subject shall be permitted to trade within this country.
3. That British capital shall be used first and foremost for the development of the resources of the Empire *for* the Empire.
4. That rates of inland rail and water carriage shall be revised to make it impossible for goods from oversea to be delivered at inland points cheaper than home-produced goods.
5. That rates of ocean freights shall be so regulated as to make it impossible for the freight charged on British goods to and from British ports to be greater than that charged to and from foreign ports.
6. That the policy of His Majesty's Government shall be specifically directed to the attainment of these ends.

Trade Announcement.—Messrs. Pope's Electric Lamp Co., Ltd., have opened a depôt at 5, Arthur Street, New Oxford Street, London, W.C. 1, where they will carry large stocks of all types of their "Elasta" drawn-wire lamps.

A Cable Factory in Norway.—The plant of the first Norwegian cable and rubber goods factory has been completed at Christiania. The new factory is to specialise in the manufacture of all kinds of wire and cable, as well as in the production, later, of certain rubber goods, the imports of which in 1913 amounted to about 6,000,000 kroner. The plant covers a large area, and the construction cost of the buildings was over 700,000 kroner, making, with the addition of the machinery, about 1,500,000 kroner (krone = 1s. 1½d. at par).—*Board of Trade Journal.*

Patent Applications.—The Comptroller-General of Patents records a further increase last year in the number of applications and complete specifications filed, the former numbering 19,285 as compared with 18,602 in 1916, and the latter 11,539 as compared with 10,700. The number of new patents sealed was 9,347.

Book Notices.—*The Training of Our Industrial Forces.* By H. F. L. Orcutt. London : Engineering, Ltd. Pp. 55. Price 1s. 6d. net.—This booket comprises the series of articles originally contributed to *Engineering* by Mr. Orcutt in August and September of last year. It suggests numerous reforms in the management and operation of British engineering firms, and discusses the possibility of freeing the post-war period from the industrial strife of pre-war days. Mr. Orcutt's theme is the systematisation of the training of our industrial forces, from the manager down to the apprentice. He considers both workmen and staff under three heads – commercial, technical and scientific, and productive—and he has suggestive paragraphs on such important phases of industrialism as "Management and Education," "Management and Production," "The Scientist," "The Buyer," while other sections deal with every trade of importance in the engineering industries. By his advocacy of systematic training and what he calls the "two absolutely necessary preliminaries—raising of wages and raising the school leaving age to 16"—Mr. Orcutt has done a service to the cause of British engineering efficiency.

"Some Characteristics of the Marvin Pyrheliometer." By P. D. Foote. (Scientific Paper of the Bureau of Standards.) Price 10 cents. "Copper" (Circular of the B. of S.). Price 20 cents. Washington : Government Printing Office.

Plant for Sale.—Salford Corporation electricity department has for disposal two 1,000-kw. d.c. turbo-generator sets. For full particulars see our advertisement pages to-day.

Safety Lamp Approved.—The Home Secretary has approved the "Fullex" miners' electric safety lamp for use in mines.

Agencies Wanted.—H.M. Trade Commissioner in Australia reports the receipt of the following inquiries :—

A firm of manufacturers' agents in Melbourne and Sydney and New Zealand desires agencies for manufacturers of electrical goods. Reference No. 204.

A Melbourne firm desires to represent manufacturers of motors, electrical accessories (other than instruments, lamps, switchboards, and switchgear), wires, and cables. References No. 100/22.

Manufacturers' agents established in Melbourne, Sydney, and Fremantle seek agencies for United Kingdom manufacturers of engineers' requirements and power house supplies. References No. 160/28.

H.M. Trade Commissioner at Toronto reports that a firm in that city desires to represent manufacturers of integrating watt-hour meters (a.c. and d.c.). Reference No. 205.

Particulars from Department of Commercial Intelligence, 73, Basinghall Street, E.C.

LIGHTING AND POWER NOTES.

Accrington.—Price Increase.—The T.C. has decided to increase the price of electricity by 10 per cent., except to consumers covered by the coal clause.

Australia.—E.L. Schemes.—The following municipalities have applied for authority to supply electricity within their areas, or are considering the subject :—Ararat (Vic.), Coraki (N.S.W.), Junee (N.S.W.), Hamilton (Q.), Mobilong (S.A.), Murrumburrah and Harden (N.S.W.), Murwillumbah (N.S.W.), and St. George (Q.).—*Commonwealth Engineer.*

Launceston.—For the year ending June 30th last, the income of the city electricity department amounted to £23,957 and the expenditure to £11,278. The net profit was £3,000; generating costs were ·176d. per unit, distributing costs ·357d., and the total costs ·865d.

Batley.—Price Increase.—The T.C. has approved an increase of the price for electricity, as from October 1st, by a further 15 per cent.

Birmingham.—Price Increase.—The E.S. Committee recommends that the charges for electricity to low-pressure consumers be increased by 1½ per cent. on the present scale for every 1s. advance in the price of coal.

Burnley.—Price Increase.—The Electricity Committee has recommended that the price of electricity for lighting be increased from 3¾d. per unit to 4¼d., and that the scale for other consumers be also increased.

Chester.—Year's Working.—The annual accounts show that the income of the Corporation electricity department for the year ending March 25th, 1918, amounted to £26,649, compared with £24,375 in the previous year, and the total expenditure to £14,123, compared with £11,530. The net profit was £2,945. 2,917,148 units were sold during the year, including public lighting, 53,265; tramways, 355,246; private consumers, 1,138,036; and bulk supply, 1,370,601. The works cost per unit was ·652d., against ·548d., and the total cost was 1·02d., against ·925d.

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Chelmsford.—Price Increase.—The Electric Supply Corporation has applied to the B. of T. for an order to increase the maximum price which may be charged for electricity to 9d. per unit.

Continental.—Italy.—The province of Tuscany has erected on the River Garchio, near Gallicano-di-Garfagna, a hydro-electric station capable of producing 6,000 kw., with a fall of 90 metres. The works have been set up by the Società Elettrica Ligure Toscana, and are one of a series of important central stations which the company proposes to establish on the same river. The equipment consists of two 7,500-h.p. Riva turbines, each direct-coupled to a 6,000-kw. Westinghouse alternator, one being held as a reserve, with room for a third group. A third turbine of 3,500 h.p. with alternator, a small turbine of 250 h.p., and a 30-ton crane are other items of the plant. In the transformer house three groups of three-phase transformers raise the energy produced at 3,500 volts and 50 periods to 33,000 volts.

Coventry.—New Works.—The City Council is to purchase a site in Foleshill at a cost of about £8,000 for new electricity works.

Dewsbury.—Price Increase.—From October 1st, the price of electricity is to be advanced as follows:—For power, 10 per cent., an increase of 50 per cent. on pre-war rates; on rateable value basis, 5 per cent. (30 per cent. over pre-war rates); lighting, 5 per cent. (25 per cent. over pre-war rates).

Gillingham (Kent).—Price Increase.—The T.C. has decided to increase the price of electricity from the end of September by ½d. per unit for lighting and ¼d. per unit for heating and power, with an all-round increase of 50 per cent. in place of the existing 50 per cent. on lighting and 60 per cent. on heating and power, making a net increase of ¾d. per unit. Energy is to be supplied to a Gillingham syndicate for the manufacture of cement for the Government.

Hastings.—Year's Working.—The accounts of the Corporation electricity department for the year ending March 31st, 1918, show that the capital expenditure during the year amounted to £697, bringing the total up to £179,725. The loan statement shows that out of the total debt created, amounting to £188,149, £105,005 had been repaid, and that a further sum of £34,497 was available for repayment. The income was £20,941, an increase of £1,854 on last year. The expenditure was £14,404, compared with £13,056 last year. The gross profit carried to net revenue account was £6,537, an increase of £507. The interest and sinking fund charges, &c., amounted to £11,115, compared with £11,127 last year. The adverse balance of £4,658 transferred from net revenue account was met out of the general district rate account. The sum of £1,027 was used for new capital purposes, instead of borrowing from outside sources. The provision made for the repayment of loans to the end of the year was £139,503. The balance due to the treasurer was £1,188, as follows:—Revenue account, £2,997, less capital account in hand, £1,810. The average price obtained was 5·20d. per unit, and total cost per unit sold was 3·28d. Total units sold were 933,904 (919,976 to private consumers and 13,928 to public lighting). Total connections in 30-watt lamps, 73,529; load factor, 20·08; number of consumers, 2,114; maximum supply demanded, 531 kw.; plant capacity, 1,850 kw.

Leeds.—New Plant.—The Ministry of Munitions having sanctioned the replacement by the E.L. Committee of two 1,400-kw. reciprocating engines and alternators by a 6,000-kw. turbo-alternator, the Committee has decided to proceed with the work, and to obtain tenders for the same. With the necessary buildings, extensions, boilers, &c., the estimated cost is £40,000.

Leicester.—Price Increase.—The T.C. has decided to increase the price of electricity for lighting from 5½d. to 6d. per unit, and for power by 12 per cent., which will make an all-round increase of 50 per cent. over pre-war rates.

Leighton Buzzard.—Proposed E.L.—The U.D.C. has inquired whether the Luton T.C. is prepared to supply electricity within the urban district.

London.—Hampstead.—Year's Working.—For the year ending March 31st, 1918, the total net income of the B.C. electricity undertaking was £80,302, and the working expenses £53,112. In the previous year the figures were £76,142 and £48,273. Interest absorbed £7,697, and loan redemption £22,001, leaving a deficit on the year of £2,508, against £2,164. Units sold during the year numbered 5,217,247; generating costs increased from 1·4d. per unit to 1·63d., and fuel from ·91d. to 1·03d. The total cost per unit was 2·44d., against 2·23d.

Hammersmith.—Price Increase.—The Electricity Committee has recommended the B.C. to increase the charges for lighting to 5d. per unit, and by a further 12½ per cent. for other purposes, making 25 per cent. over pre-war prices.

Bermondsey.—Price Increase.—The Electricity Committee has informed the B.C. that it must increase the charge for electricity by a further 7½ per cent.

Kendal.—Year's Working.—There was a deficit of £604 on the past year's working of the T.C. electricity undertaking.

Malvern.—Price Increase.—The U.D.C. has increased the price of electricity for lighting, heating, and power by 1d. per unit from the September reading of the meters.

Redditch.—Reorganisation.—Early in 1914 the Corporation undertaking was making a loss of about £3,000 per annum, the maximum demand was 640 kw., the supply single-phase, 75 periods, the units sold being 1,433,666.

On the advice of Messrs. Handcock, Dykes, & Trotter, consulting engineers, a sum of approximately £40,000 was expended in bringing the station up to date by the addition of two 1,000-kw. Parsons turbo-alternators and condensing plant; two motor-generators to transform from three-phase, 50 periods, to single-phase, 75 periods, or *vice versâ*; condensing plant; new cooling tower; additional boiler plant; extension of engine room; and a system of three-phase mains. This new plant was first put into commission towards the end of 1916, and at the beginning of this year the maximum load on the station had increased to 1,340 kw.

The units sold for last year were 2,643,037, and notwithstanding that wages had more than doubled, and the rise in the price of coal, the reduction in generating costs was such that the station has now turned the corner, and shows a profit after paying running costs, interest, and sinking-fund charges. In a further report given to the Council at the beginning of the year, additional extensions, at an estimated cost of £54,000, were recommended, and approved by the Council, and the general approval of the Director-General of Electric Power Supply having been given to the scheme, the Council at its last meeting placed the above contracts as part of its extension scheme.

Since the original instalment of the new three-phase plant, the largest works in Redditch has shut down all its own plant and relies entirely on the Corporation station, and the majority of the other large works in Redditch are now taking a supply.

Sutton Coldfield.—Price Increase.—The Electricity Committee has informed consumers that there will be a further increase of 10 per cent., making 30 per cent. in all, from the June quarter.

Todmorden.—Bulk Supply.—The T.C. has decided to take a supply of electricity in bulk from the Yorkshire E.P. Co., and has purchased a site for a sub-station.

Twickenham.—The B. of T. has refused to authorise the Twickenham and Teddington E.L. Co. to increase its charges for electricity.

Tunbridge Wells.—Price Increase.—The T.C. has increased the charges for electricity as follows:—Units sold for 5½d., plus 10 per cent., increased to 7d.; 5d., plus 10 per cent., to 6d.; 4½d., plus 10 per cent., to 6d.; 3½d., plus 10 per cent., to 6d., less 20 per cent.; 2½d., plus 10 per cent., by 25 per cent.; 1d., plus 25 per cent., to 1¼d. There is to be a minimum charge of 10s. per quarter to all consumers, except flats, tenements, offices, and stables, the minimum rate for which is to be 5s. per quarter.

Watford.—Price Increase.—The E.L. Committee has recommended that the price of electricity for lighting be increased to 7½d. per unit, and that the recent increase of 20 per cent. be increased to 50 per cent. from the end of December.

West Bromwich.—Year's Working.—There was a net loss of £10,839 on the past year's working of the Corporation electricity department. The income amounted to £41,951, compared with £32,047 in the previous year, and the expenditure to £44,564, an increase of £15,106. Loan charges amounted to £8,226. The E.L. Committee recommends an increase in the charges for electricity as from July 1st.

Price Revision.—The T.C. is taking steps to get contracts for energy supplied to the tramways and certain firms at prices fixed before the war revised, with a view to an increase being made.

West Ham.—Year's Working.—The income of the Corporation electricity department for the year ended March 31st last was £181,705, compared with £153,872 in the preceding year. The expenditure amounted to £160,482, an increase of £23,720, and the net surplus was £5,994, against £2,270; 35,836,900 units were sold during the year (lighting, 2,515,834; power, 27,250,787; heating and cooking, 412,429; public lighting, 59,261; and tramways, 5,598,589), an increase of 538,600 units. The working cost per unit amounted to 1·07d., against ·92d. in the previous year, and the average price obtained was 1·21d. per unit, against 1·04d.

TRAMWAY AND RAILWAY NOTES.

Australia.—Launceston.—The past year's working of the city tramways resulted in an income of £23,139. The expenditure was £13,751, and, after meeting capital charges, £3,657 was carried to the general account and £496 to the reserve fund.

Sydney.—An underground electrically-operated haulage plant for the Wallarah Coal Co., Ltd., has recently been completed by Messrs. Morison & Brearly, Ltd., of Newcastle, N.S.W. The machine is fitted with a Crompton direct-current motor of 125 h.p., which drives, through gearing, a winding drum 8 ft. in diameter.

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Brighton.—Railless Traction.—An extension of a year from August 7th has been applied for by the T.C. for the completion of the overhead equipment for trolley cars under the Brighton, Hove, and District Railless Traction Act, 1911, from Ovingdean to Rottingdean.

Continental.—Germany.—According to the *Daily Mail*, great indignation has been aroused in Berlin by the decision of the Metropolitan Tramway Co. to install its own detective force for the purpose of catching passengers who may be endeavouring to evade paying fares. They are to be dressed in plain clothes, and empowered to exact a fine of 1s. on the spot for each offence. A German paper is quoted as follows:—"The tramway monopoly only wants to enrich its already bulging treasury. It talks about the increased upkeep of rolling stock. . . . We have to ride nowadays in ramshackle old rattle-traps called cars."

East Kent.—Proposed Light Railways.—The Light Railways Commissioners have submitted to the B. of T. for confirmation an order for the construction of light railways from Hammill to Snowdown Colliery, from Little Mongeham to Deal, from Wickhambreaux to Canterbury, from Coldred to Alkham, with a branch to Lydden Colliery, and branches at Little Mongeham and Stonar.

Leeds.—Tramways and Town Planning.—The Tramway Committee has visited Liverpool for the purpose of inspecting the construction of radial roads in relation to town planning. Mr. F. M. Lupton has advocated a separate tramway track for fast traffic on wide arterial roads in Leeds, and the visit was in furtherance of this improvement.

Boycott Failure.—Figures issued by the tramway department show that the boycott of the tramways as a result of the 50 per cent. advance in fares has died a natural death. In the first complete week of the new fares the number of passengers carried was reduced by 400,000 compared with the corresponding week a year ago. In the next fortnight the decrease was less by 20,000, and then a further 60,000. At the end of a month the decrease was again 400,000, but the next week it dropped to 175,000. During the past two weeks it has further diminished, and when the figures were issued it was only 197 less than in the corresponding week last year. Whilst the total reduction during the seven weeks was a million and three-quarters, the receipts increased by over £12,000, and the total takings of the 17 weeks of the current financial year are £31,068 ahead of those of the corresponding period last year.

London.—Wages.—The Highways Committee has recommended the adoption by the L.C.C. of the award of the Committee on Production, which provides for an increase of 5s. per week to all tramway employés at present receiving a war wage of 20s. The claim for the same wages to be paid to women as to men was not established. This increase is estimated to cost £88,000 per annum.

Goods Traffic.—The L.C.C. has decided to incur an expenditure of £100 in the conversion of two tramcars for the carriage of goods, for experimental purposes.

Underground Railway.—Increased Fares.—A few increases in fares on certain sections came into operation on August 1st on the Bakerloo, Piccadilly, Hampstead, and City and South London Tubes and the District Railway. The increase amounted in most cases to ½d., and in no case to more than 1d.

Night Service.—The London Society of Compositors has been informed that the Metropolitan Tramways will run cars from Finsbury Park to Wood Green at about 1 a.m. and 1.30 a.m., the service to begin on August 11th. This arrangement is for the convenience of printers, and is only an experiment for one month, and upon the results will depend whether it shall be maintained.

Northampton.—Year's Working.—There was a gross profit of £13,922 on the Corporation tramways for the year ending March 31st last. The revenue was £46,113, compared with £38,258 in the previous year, and the expenditure £32,190, compared with £29,016. Capital charges amounted to £11,105, and the net profit was £3,235, against a deficit of £3,004 in the preceding year. Passengers carried increased from 9,707,456 to 10,753,042, and the car mileage decreased from 748,271 to 737,007. Working costs amounted to 10·35d. per car-mile, and receipts to 14·77d.

Shipley.—Price Revision.—The U.D.C., which applied for an increase of 50 per cent. for electricity supplied to the Bradford Corporation for the operation of the Shipley tramways, has been informed that the Corporation cannot entertain the payment of more than 20 per cent.

West Ham.—Year's Working.—For the year ending March 31st last, the revenue of the Corporation tramway department amounted to £188,851, against £166,143 in the previous year, and the expenditure to £168,827, an increase of £18,837. After allowing for capital charges (£31,636) and allowances to men on active service (£16,762), there was a deficit of £28,177. The income per car-mile was 12·63d. an increase of 1·7d., and the working costs were 11·279d., an increase of 1·419d.

Wolverhampton.—Year's Working.—The gross profit of the Corporation tramway department for the year ending March 31st last was £32,039, including £2,189 on account of motor-buses. Capital charges amounted to £12,142, £4,351 was transferred to the reserve fund, £8,767 to the maintenance account, and £6,580 to the borough rate account.

TELEGRAPH AND TELEPHONE NOTES.

Germany and Rumania.—A special Agreement has been reached concerning the future regulation of postal and telegraph traffic between Germany and Rumania. The provision affecting telegraphic traffic concerns the laying of a third direct line between Germany and Bukarest, the establishment of a telephone service between Germany and Rumania, a telephone service over the Constantinople-Constanza-Bukarest-Berlin telegraph cable, and an eventual new line to Constantinople. The German Government obtains till the end of 1950 a monopoly of laying cables on the Rumanian coast.—*The Times.*

Royal Visit to the G.P.O.—On Thursday last week the King and Queen visited the General Post Office. The Postmaster-General stated that the Post Office had released about 81,000 men and 1,000 women for naval and military service. Since the outbreak of war the department had provided 40,000 telephones for the Army and Navy Departments. The private branch exchange for the Air Ministry was the largest in the world, and dealt with 2,500 telephones. A special system of telephonic aid raid warnings had been organised, and as many as 20,000 messages had been distributed on the occasion of one raid. In each raid 5,000 messages from the Field-Marshal's Department were circulated to local exchanges.

Russia.—The transmission of private telegrams to Russia has been suspended in consequence of action taken by the Russian authorities.

Underground Submarine Cables.—The New York Telephone Co., Long Island Division, has devised a method of burying a submarine cable so that it will be safe from the anchors of small boats, the spears of eel fishermen, or the rakes of clam or oyster diggers. It consists of a simple plough, which is dragged along in shallow water where there is a mud bottom, and buries the cable 14 in. in the mud. It has proved an unqualified success.

The Long Island division has also developed a plough for burying cables across salt marshes; it opens a trench 4 in. wide and 16 in. deep at the rate of 40 ft. per minute, when pulled by a Ford engine suitably geared to a winch. The ploughshare is curved in such a way that it throws up a layer of sod which merely has to be pulled back into the trench with a rake after the cable has been laid. The line of the trench is then marked with concrete posts where the submarine cable is spliced to the lead cable, and with creosoted wood stakes at about 100-ft. intervals across the marshy islands.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—September 4th. Victorian Railway Commissioners. 800 lighting transformers for signal system. A copy of the specification may be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence) in London.

Belfast.—August 16th. Corporation. Two 6,000-kw. turbo-alternators, &c.; one 500-kw. turbo-alternator, &c.; one 30-kw. balancer-booster; four 48,000-lb. per hour water-tube boilers; four fuel economisers, &c.; two steel chimneys, with fans, &c.; two electrically-driven boiler feed pumps, &c.; accumulators; three 500-kw., and five 1,000-kw. rotary converters, with transformers, &c.; two 250-k.v.a., two 350-k.v.a., and six 1,250-k.v.a. transformers. See "Official Notices" July 19th.

Leeds.—August 10th. Electricity Department. Extension to feeder switchgear; alteration of generator switchgear; one 6,000-kw. turbo-alternator and jet condensing plant; two water-tube boilers, stokers, economisers, &c; coal and ash conveying plant; pipes, centrifugal pump, &c. See "Official Notices" July 19th.

Spain.—The municipal authorities of Albuquerque have just invited tenders for the concession for the electric lighting of the town during a period of five years.

CLOSED.

Australia.—P.M.G.'s Department, South Australia:—

Telephone accessories.—Western Electric Co. (Australia), Ltd., £334.

Commonwealth Railways—

Cable.—British Insulated & Helsby Cables, Ltd., £285.

Victorian Railways Department—

Electric freight lifts at Auburn and Glenferrie.—Holmwood & Oncill, £1,205

Australian Mining Standard.

Gillingham.—T.C.:—

640 b.h.p. Diesel set.—Banks, Warner & Co., Ltd.

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FORTHCOMING EVENTS.

North of England Institute of Mining and Mechanical Engineers.—Saturday, August 10th. At 2 p.m. Annual general meeting.

Junior Institution of Engineers (North-Eastern Section).—Tuesday, August 13th. At 7 p.m. At the Mining Institute, Neville Street, Newcastle-on-Tyne. Paper on "The Manufacture of Cast-iron Pipes," by Mr. T. E. Dimbleby.

Electrical Power Engineers' Association (Southern Division, Western Section).—Thursday, August 15th. At 7 p.m. At Hammersmith B.C. Electricity Works. Inaugural meeting.

NOTES.

Electrician Summoned.—At Leeds West Riding Police Court, last week, William Ernest Poole, electrical engineer, Crossgates, was summoned for an offence under the Defence of the Realm Act, and, after a long hearing, was sentenced to three months' imprisonment. Notice of appeal was given, and defendant was allowed bail in two sureties of £250.

Parliamentary.—ROYAL ASSENT.—The following Acts have received Royal Assent:—

Electric Lighting Orders Confirmation Act, 1918.
County of London Electric Supply Co.'s Act, 1918.

Volunteer Notes.—LONDON ARMY TROOPS COMPANIES, VOLUNTEER ENGINEERS.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Corps Orders No. 33, by Lieut.-Colonel C. B. Clay, V.D., Commanding:—
Captain of the Week.—Capt. W. Darley Bentley.
Monday, August 12th, to Friday, August 16th.—Drills as usual.
Sunday, August 18th.—Commandant's Parade at Waterloo Station, 8.45 a.m., for work at Esher. Dress: Drill order with haversacks and water bottles. Mid-day and tea rations to be carried.

C. HIGGINS, *Capt.* R.E., *Adjutant.*

Australian Production of Electrolytic Zinc and Calcium Carbide.—In the course of an article on the present situation and projected developments of hydro-electric enterprises in Australia, H.M. Trade Commissioner states in the *B. of T. Journal* that the total annual output of zinc concentrates in Australia amounts to about 400,000 tons, derived chiefly from New South Wales and Tasmania. The Electrolytic Zinc Co., whose wharf at Risdon, on the Derwent River, is equipped with ore bins of 3,000 tons capacity, is expending about £200,000 on plant. The present installation is capable of producing by the electrolytic process 10 tons of zinc per day of 24 hours. The zinc is of a purity of over 99 per cent. The sulphuric acid used in the electrolytic process for the manufacture of spelter will be made from sulphur imported from Japan, while the aluminium sheets used are imported from the United States. The experimental trials of the plant point to the production of electrolytic spelter on a commercial scale being thoroughly successful, and at a later date the capacity of the plant will be greatly increased.

The works for the manufacture of calcium carbide, which are situated at Electrona, North-West Bay, some 15 miles distant from Hobart, are now reported to be complete, and the arrival of the transformers is only awaited for energy to be delivered and the manufacture of carbide begun. Nearly all the equipment for manufacturing the product has been made in Australia, having been supplied by an engineering firm in Adelaide.

The foundations of coke ovens have been built at Electrona, as the company proposes making its own electrodes for the electric furnaces. Contracts have been let for the necessary machinery. Firebricks for the ovens are being made in Melbourne. The company has entered into arrangements with the owners of a colliery for the supply of coal, and has an option to purchase the colliery. The limestone will come from the company's own quarries near the works. At present the stone is conveyed over a local timber company's tramway line, but eventually an aerial ropeway, which has already been purchased, will be installed.

Hitherto calcium carbide has not been manufactured in Australia—the imports, which during recent years have averaged about 13,000 tons per annum, having been derived principally from Norway, Sweden, Germany, and Canada. The present capacity of the Electrona Works is 5,000 tons per annum, but it is proposed to increase this. Previous to the introduction of the new tariff in December, 1914, calcium carbide was on the free list, but it is now subject to a duty of 5 per cent. *ad valorem*, except from the United Kingdom, when it is free of duty under the Preferential Tariff. The shortage of supplies of carbide owing to the war situation, and consequently high prices, suggest that this project should prove successful.

The industries which will be likely to establish themselves in Tasmania are electrochemical and electrometallurgical, all of which require very large blocks of power, and for which, it may be added, there is a large amount of raw material within the State itself. These industries, which are regarded as primary, will, in course of time, lead to the development of existing secondary industries, as well as to the establishment of others entirely new in Tasmania. The principal inducement for the secondary industries to establish themselves would be the relatively greater facilities they would have in obtaining their raw material.

Among minor applications of electrical energy, in the opinion of the administration of the Hydro-Electric Department, a very satisfactory business can be developed by applying electricity to incubation. New business has also been started by supplying energy to the medical profession. Motor cars and commercial vehicles propelled by electricity, as well as electric cooking and heating installations, are mentioned as probable developments.

"All That We Have."—The following "War Resolution" was adopted by the National Electric Light Association at the annual meeting at Atlantic City, June 13th-14th, 1918:—

"Resolved, that the National Electric Light Association, in annual convention assembled, desires to extend to the President of the United States and all others in authority, the assurance that in its organisation and its membership it is in thorough accord with the fixed determination of the American people and their chosen representatives to prosecute the war with the utmost vigour and to a victorious conclusion—however long it may take and however much it may cost in men, money, and other forms of sacrifice.

"The goal we seek through the prosecution of the war, is the winning of a great peace—a peace so well established that it cannot lightly be disturbed by autocratic force, wedded to the doctrine that might makes right. For such an end of the war we are ready, cheerfully, to submit to such further restrictions of personal and corporate activities and to such further burdens upon private and corporate property and business as it may be found necessary to impose upon the people and industries of the country.

"We recognise as the one great menace of the future the possibility of an inconclusive peace—an armed truce which would inevitably end in a renewal of the unspeakable horrors of the present war. That must not be, and the only way to prevent it is to carry this war to VICTORY—a victory so complete and overwhelming that the forces of evil will be glad to accept such terms as an outraged world may be willing in justice to accord. No compromise, no half-way measures, no patched-up 'scraps of paper' can accomplish this great end; but only devotion, the patience, the self-sacrifice, and the undying patriotism of our people and their great Allies.

"With a realising sense of the stupendous sacrifices involved, but with an abiding faith in the ultimate result, we pledge all that we have and all that we are to the holy cause."

Planing by Electricity.—A new industry recently established at Montreal is the manufacture of electric planers by the Simplex Floor Finishing Appliance Co. It is claimed that one of these planers does the work ordinarily done by 20 men in hand-planing. The machines are extensively employed in shipbuilding, and eight of them, varying in length from 150 to 300 ft., have been supplied to the Canadian Vickers Co. These planers can be re-set in a few minutes, after planing rough timber, for polishing deck surfaces or ways in shipyards.—*The Ironmonger.*

Fuel Economy.—The Board of Trade announces that owing to the large number of miners called to the Colours and the great need of coal for our Allies, the various Government Departments, and industrial undertakings, the Controller of Coal Mines has instituted a Coal Economy Campaign with the object of reducing fuel consumption in every direction possible.

The Controller is being assisted by a technical staff attached to the Head Office, and arrangements have been made for a large number of engineers in the provinces to attach themselves to the Coal Control Department for this special purpose. This arrangement enables the country to be mapped out in districts, so that all industrial consumers will within a reasonable time be in touch with the organisation.

The scheme comprises two main sections, viz.:—(1) Electrical undertakings: and (2) industrial undertakings.

The work involved includes the careful scrutiny of the quantity and quality of coal consumed by the various undertakings and the efficiency obtained. It also includes the inspection of factories and works by experts, in order to ascertain means by which the fuel consumption may be reduced, and the best methods to that end.

A considerable amount of work in connection with the campaign has already been done, but it is intended to accelerate the rate of progress as much as circumstances will admit. Some 400 skilled engineers will shortly be at work in various parts of the British Isles, and these gentlemen are giving their services to the Government without salary.

Any public body or company or person wishing to effect economies at once, and desiring the Controller's assistance in this direction, is invited to communicate with Coal Control Headquarters, Room 309, Holborn Viaduct Hotel, London, E.C. 1, when arrangements will be made to send a technical expert to look into the conditions under which coal is being consumed, and to co-operate with the consumer in effecting economy.

Apart from special applications of this kind, the Controller's representatives will visit firms in turn, in accordance with a general plan of operations.

So imperative is the need to reduce coal consumption to a minimum that a rationing scheme for all industrial undertakings will be introduced shortly.

Electric Vehicles in New Zealand.—According to news just to hand from Christchurch, the Municipal Council of that city is proposing to take up the business of the sale of electrical industrial motor-vehicles. A deputation from the Council recently waited on the N.Z. Board of Trade to ask for Government assistance in obtaining the shipment from America to New Zealand of a number of electric motor trucks. Mr. E. E. Stark, the city electrical engineer, stated that there was a field in the Christchurch district for the sale and use of 600 electric motor trucks, and that the City Council was in negotiation for taking over an agency for their sale. If the business were secured, at least 4,200 tons of petrol would be saved annually. After hearing the Council's arguments, the Board of Trade officials promised to ascertain whether it would be possible to secure the steamer space for 13 electric motor trucks in the near future.

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Fatality.—Denis White, electrician, was working at wires in a Dublin munition factory, last week, when the pincers which he had in his hand came in contact with a live wire. He had to hold on to the pincers to save himself from falling, and his comrades, seeing his plight, switched off the current. White, however, was unable to recover his foothold, and fell to the ground, striking against machinery on the way. When taken to the hospital it was found that he was dead.

Water Power in India.—In a paper on water power in India, which was read before the Indian Section of the Royal Society of Arts by Mr. Alfred Dickinson, M.I.E.E. (No. 3,417, Vol. LXVI, *Journal* of the Society), particulars are given of the various water-power schemes already developed, the most important of which thus far is that of the Tata Hydro-Electric Power Supply Co. The advantages of water-power development in India will be apparent to those who appreciate the industrial awakenings of the vast Empire. It is the author's opinion that, so far as the captains of finance and industry in the West are concerned, they have not been ignorant of the industrial possibilities in India, but hitherto have not shown the necessary confidence by taking part in helping forward rapid development. They had the opportunity to finance and construct the Tata hydro-electric scheme, but failed to appreciate its importance. It was, therefore, left to India to find the requisite capital, to the great advantage of the Indian investor, for this is the only electrical undertaking of magnitude which, in the first year of its working, has earned and paid a dividend on its full capital; and, although it is as yet incomplete, it is earning a profit of over £190,000 per annum.

In the discussion that followed, the chairman (Lord Lamington) asked whether any reason could be given for the fact that yarn was much better when the motive power used was electricity, and also whether the pipe track of 2¼ miles, with a fall of over 1,700 ft., was not a record. He agreed with the author that it would be very advantageous if the Government of India had a complete survey made of all the possible sources of supply in the country, which ought not, in his opinion, to be worked by the Government, but by private enterprise.

Sir Charles H. Armstrong, Sir Francis Younghusband, and Mr. C. H. B. Burlton all spoke on the large amount of water power that was being wasted at the present time due to ignorance of the hydrographic conditions in India, and the great benefits that would accrue were these water powers to be harnessed and the railways electrified. Mr. E. S. Woollard Moore, replying to the discussion, mentioned that the Tata scheme at Khopoli, earning £190,000 per annum profit at ½d. per unit, showed that the capital expenditure was not incommensurate with the results that had been achieved. The height of the Khopoli Fall was not unique; but although there were higher falls harnessed, their installed horse-power was less. The aggregate horse-power of the three schemes of Messrs. Tata—the Khopoli scheme which was actually at work, the Audhra Valley scheme which was in course of construction, and the Koyna River scheme, the largest of them all, which was being studied—was over half a million continuous horse-power, or about one million horse-power on a 10-hour day basis. Their capacity exceeded the aggregate horse-power of steam turbines installed at the present time in the whole of the United Kingdom. It was somewhat difficult to realise what such huge super-power stations meant. Taking a station of 300,000 H.P., such as the proposed Koyna River station, if that were a steam station operated for 24 hours per day, it would need 30,000 to 35,000 tons of good quality coal per week. The price of coal in India was rising faster than the interest on capital was rising. He thought that coal could be more usefully employed in the development of industry in India in the way of actual direct manufacture than in the production of power. Another point of comparison was that the storage capacity for a 300,000-H.P. steam station in the matter of coal was a point of considerable importance when coal was being used at the rate of 35,000 tons a week. The amount of ashes that would have to be disposed of would be about 5,000 tons a week. The condensers for a station of that size—a problem far more difficult in the Tropics than in a temperate climate—would require about 25,000,000 gallons of water per hour. So that the comparison between water power and steam power in India seemed to tend enormously in favour of water power, and cheap water power for India was no idle dream, but a realisable proposition.

Standardising Fuses for Motor-Car Electric Lighting Sets.—The smallest standard fuse marked under the National Electric Code of the American National Board of Fire Underwriters is 2 in. long with ferrules $\frac{9}{16}$ in. in diameter. Smaller fuses are regarded as special, and the National Board above mentioned recommends that all fuses, whether special or not, shall be marked with their voltage and current capacity. The American Society of Automotive Engineers, on the recommendation of the Electric Equipment Division of its Standards Committee, has resolved that fuses of the same dimensions as the National Electric Code be marked according to the requirements of that code. It has also been decided that the present marking instructions be changed from "Fuses to be marked 25 volts and their carrying capacity," to read "The voltage (V) and current capacity (C) shall be plainly marked on one of the ferrules of each fuse."

Canadian Metallurgy.—In a paper by Alfred Stansfield, F.R.S.C., on recent advances in Canadian metallurgy, read before the Canadian Society of Civil Engineers, the author states that at the outbreak of war a Commission was appointed to consider the situation with respect to the supplies of copper and zinc. The Commission concluded that the electrolytic process offered the greatest probability of filling the need, and made arrangements with the Consolidated Mining and Smelting Co., which led to the establishment at Trail of a plant for producing electrolytic zinc from British Columbia ores. At the present time this plant has a capacity of about 300 tons of zinc per week. During the war, research has been taken up, and although commercial success has not yet been attained, it is expected that work will be resumed during the present year. Experimental work on the production of zinc oxide for paint by the Wetherill process has been carried out, and following on from this a full-sized plant has been erected at Notre Dame des Anges.

Soon after the outbreak of war the International Co. agreed to erect a nickel refinery sufficiently large for the British requirements of nickel. This refinery is now being built at Port Colhone, in Ontario, and should be in operation in the present year; it will have an initial output of 7,500 tons of nickel per annum. Meanwhile, the British America Nickel Corporation, a strong British-Canadian company controlled by the Imperial Government, has acquired about 17,000 acres of mineral land in the Sudbury district, and early in 1917 began the construction of a large smelting and refining works. The new plant is expected to be in operation in 1919, and will have an output of 6,000 tons of refined nickel per annum. By 1919 we may expect a production of some 13,000 tons of nickel in Canada, in addition to, perhaps, three times this amount in matt refined abroad.

Antimony is not produced to any extent in Canada, although a small amount is derived from the electrolytic refining of lead at Trail. In view of the high price and unusual demand for the metal, a mine of low-grade ore at Lake George, New Brunswick, was opened, and an efficient process was devised for extracting the metal from ore by volatilisation. By the time that the process had been brought to a satisfactory condition, other supplies became available, and the mine and smelter had to be closed.

The metal aluminium is made at Shawinigan Falls from bauxite which is imported from France, as no ores of commercial value have been found in Canada. Figures for the production of this metal are not published, as only one firm is engaged in the industry, but the production has increased materially during the war.

The process of extracting aluminium from alumina (purified bauxite) was the only operation in Canada before the war that depended on the electrolysis of fused salts, but a fresh industry of this kind has now been started—the production of the metal magnesium. The author succeeded in producing magnesium in the laboratory, and the process was developed into commercial operation at Shawinigan Falls. At present the crude materials are imported, but ultimately it is intended to use Canadian magnesite as the ore of this metal. Magnesium is now made in considerable quantities at this plant.

Electricians' Allowances.—An increased out-of-town allowance for members of the National Federated Electrical Association and the Electrical Trades Association has been conceded. The award, issued during the week-end, provides for an allowance of 3s. 6d. per night for the first fortnight and 3s. per night afterwards. The old scale of out-working allowance was 2s. 6d. per night.—*Manchester Daily Dispatch.*

Committee on Transport Reform.—A Select Committee of the House of Commons has been appointed to consider what steps, if any, it is desirable to take to develop and improve the internal facilities for transport within the United Kingdom, to secure effective supervision and co-ordination, and to ensure that such developments and improvements shall be adequate and suitable to meet the national requirements; and to make recommendations.

Battery Service for Electrics.—A simple scheme for popularising the extensive use of commercial electric vehicles is outlined in the *Commercial Motor* of June 20th, as carried out by the Edison Electric Illuminating Co., of Boston, which has introduced what is known as a battery and inspection service. The owner of the vehicle enters into an arrangement with the company whereby he is assured of being able to use his vehicle the round 24 hours if the exigencies of his business so demand, the service being divided into two shifts—day and night respectively. The facility with which the electric can be handled has contributed very materially to this end, while the fact that there is virtually nothing to go wrong, so far as the mechanical equipment is concerned, also has appreciably assisted the movement towards 24 hours' duty.

The customer signs an agreement with the company to observe its conditions and the schedule of prices which has been drawn up. This contract is made for a period of 33 months, although it may be terminated at any time by either party by giving 60 days' notice. The contract carries a card on which particulars of the make of the customer's car, its size and rating, are entered, while the vehicle is also given a serial number. The card, which is kept by the accounting department, has space to receive a record of the fixed costs incurred by the vehicle during the period of the contract. The customer is then provided with a new battery, the price of which naturally varies according to the weight and carrying capacity of his vehicle. An advance payment is made on account of this item, ranging from £147, in the case of the ½-tonner, which is fitted with a 9 MV Ironclad battery, to £320 for a 6-tonner, which carries a 21 MV accumulator. This payment is divided into four equal instalments, the first being paid upon the signing of the agreement, the second when the battery is first installed in the vehicle, the third 30 days after its installation, while the final payment falls due at the end of 60 days.

This initial charge is supposed to cover the cost of the battery provided, together with a proportionate additional sum to defray the cost of additional batteries that may be required to guarantee

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the customer a permanent service. Should the latter decide to terminate his agreement at any time prior to four months before the normal expiration of the term of 33 months, the company delivers to him a battery similar to that provided for the vehicle, and having an estimated life, under ordinary duty, equal to the unexpired part of the term, less four months, which is the accepted salvage value of a worn-out battery expressed in terms of use. When the battery is installed the customer is entitled to call at any of the stations maintained by the company for the provision of battery service, to have his battery re-charged, or, if time and business will not permit, to have the run-down unit withdrawn, and a fully-charged accumulator substituted. So far as the customer is concerned, he is merely called upon to pay for the energy contained in the substituted battery in precisely the same way as the driver of a petrol vehicle pays only for the fuel contents when he surrenders an empty tin for a full tin, plus a sum inclusive of depreciation. When making the exchange the company gives a coupon declaring the capacity of the exchanged battery in ampere-hours. Should the battery fail to deliver this capacity and the vehicle accordingly become stranded, the company defrays the cost of towing the vehicle back to the station.

The scale of charges which has been drawn up to assure this battery and inspection service is determined upon a mileage basis. The garage charge is only levied when the customer does not garage his vehicle with the company. For the determination of the mileage run the customer is compelled to fit an odometer of a type approved by the company.

So far as the user is concerned, he merely undertakes to protect and to take care of the batteries while in his possession, subject to reasonable wear and tear, and to maintain his lorries, keeping them well oiled. He also agrees to permit the company at any reasonable time to inspect his vehicle for the purpose of ascertaining the condition of the mechanical and electrical details, as well as the accuracy of his odometer. Should any defects be discovered, he is called upon to remedy them at his own expense. But so far as the battery is concerned, he is exposed to no liability, other than that arising from wilful neglect or damage. The company undertakes to keep this factor in a condition of high efficiency.

The enterprise is meeting with considerable success in Boston, electric vehicle users having enthusiastically embraced the opportunity of being relieved of battery attention. So far as the changing of batteries is concerned, but little delay is incurred. The batteries are disposed in readily demountable cradles, facilitating their removal and substitution. A discharged battery can be removed and a fully charged one replaced within five minutes.

Institution and Lecture Notes.—Association of Mining Electrical Engineers.—Mr. T. J. Nelson, A.M.I.E.E., who has been unanimously elected President of the South Wales Branch of the Association of Electrical Engineers, is the electrical engineer at the Cribbwr Fawr Collieries.

Electrical Power Engineers' Association.—Southern Division, Western Section.—Owing to the large influx of members, it has been decided to form a London Western Section, and an inaugural meeting will be held on Thursday, the 15th inst., at 7 p.m., at Hammersmith Electricity Works. All staff engineers engaged in the generation, distribution, or utilisation of electrical energy within an area of approximately five miles north, west, or south and one mile east of Hammersmith Borough Council Electricity Works are invited to attend.

44 Hours per Week.—According to the *Manchester Daily Dispatch*, the Engineering and Shipbuilding Trades Union Federation has passed a resolution favouring a 44 hours' week, and the employers are to be asked for a joint conference within a month to discuss the question.

Appointments Vacant.—Electrician for the military camps in South Irish district; shift engineer (63s.) for the Stoke-on-Trent Corporation Electricity Department; junior assistant engineer (70s. + £1 and 12½ per cent.) for the borough of Wimbledon Electricity Department; junior shift engineer for the Crewe Corporation Electricity Works; charge engineer for the Dover B.C. Electricity Department; engineer-in-charge (£175 plus £1 plus 12½ per cent.) for the Hammersmith B.C. Electricity Department; assistant shift engineer (68s. 3d.) for the County Borough of Bury Electricity Department; shift engineer (67s. + 12½ per cent.) for Luton Corporation Electricity Works. See our advertisement pages to-day.

Auction Sale.—By order of the Receiver, Messrs. L. Farmer & Sons will sell by auction at Millwall, on August 22nd, the plant and machinery and stock of electrical fittings, &c., of the Blackwall Engineering and Welding Works. Full particulars are given in our advertisement pages to-day.

New Norwegian Electrode Factory.—The new factory at Frederikstad, Norway, for the manufacture of electrodes is owned and to be operated by the A. S. Norske Elektrodeverker, and both carbon and graphite electrodes will be produced. The plant's capacity is 4,000 tons of carbon or 1,000 tons of graphite electrodes a year. The same general standards and sizes of graphite electrodes are to be manufactured as those used throughout the United States. American engineers and machinery experts have been engaged to conduct the work of the factory, in which the machinery is to be almost exclusively of American manufacture. Previous to the war most of the electrodes imported into Norway came from Italy, Sweden, and the United States, but for some time now the imports have come almost solely from the United States.—*Iron and Coal Trades Review.*

Heat Treating in Electric Furnaces.—According to a paper on the electric furnace in the forge shop for heating billets for forging, and the heat treating of forgings, presented to the American Drop Forging Association by Mr. T. F. Baily, president of the Electric Furnace Co., Alliance, Ohio, there is a saving of metal due to the lack of oxidisation in the electric furnace which in extreme cases of, say, 5 per cent. loss on steel worth £16 13s. 4d. per ton would amount to about 16s. 8d. per ton of metal heated. In addition to this, the steel being in much better condition when it goes to the hammer or press due to the absence of scale, there is less wear on the dies, and less danger of the dies being filled up with scale, as it is sometimes difficult even with an air draught to keep the dies entirely free. A typical running sheet on an electric furnace of 600 KW. capacity heating 3½-in. round billets for forging into 3-in. naval shells showed the average energy consumption per ton to be a little less than 260 KW.-hours, but taking as a basis 300 KW.-hours per ton to cover the delays in starting up on this type of furnace and with energy at ½d. per KW.-hour, the cost of heating for electricity would be 12s. 6d. a ton. It was stated that the renewals and repairs should not exceed those of a fuel fired furnace, and in fact these repairs should average much less. Against this cost per ton for electric furnace operation the fuel oil for a similar furnace operating on substantially 2 tons per hour would approximate in the average plant at least 50 gal. per ton. With a consumption of 40 gal. per ton and oil at 2½d. per gal., this charge would be at least 8s. 4d. per ton. Thus if the metal loss on a £16 steel should be over 1¼ per cent., or 4s. 2d. a ton of steel heated, the cost of electric furnace and fuel fired furnace operation would be the same with the exception of a better class of work done in the electric furnace, which would make a greater saving due to the production of more good forgings. The paper also states that in the furnace referred to the difference in metal loss is somewhat over 5 per cent., and the reduction in the number of pierced billets rejected is such that in this item alone there would be at least 5 per cent. more forgings by the electric furnace heating due to the more perfect heating of the billets.—*Iron and Coal Trades Review.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Central Station and Tramway Officials.—Leicester Corporation has increased the salary of Mr. A. F. Lucas, the tramway manager, from £450 to £500 per annum.

Mr. C. A. Nethercot, accountant at the Bath electricity works, has tendered his resignation, having received an appointment under the Ministry of Munitions.

Mr. L. Bradburn has left the position of engineer in-charge to the Mansfield Corporation electricity works, and taken up a similar post under the Ashton-under-Lyne Corporation.

Mr. H. Lees, of Eastbourne, has been appointed shift engineer at the Accrington electricity works in place of Mr. A. Ecroyd, resigned, at a salary of £195, inclusive of war bonus.

General.—The King has authorised the wearing of decorations conferred upon the following by the President of the French Republic:—

Officer of the Legion of Honour.

Sir Edmund Waldbore Smith, Assistant Secretary, Board of Trade, President of the Commission Internationale de Ravitaillement.

Ulick Fitzgerald Wistock, Esq., C.B., C.M.G., Permanent Secretary, Ministry of Food, late Director of Army Contracts.

Charles Hipwood, Esq., C.B., Assistant Secretary, Marine Department, Board of Trade.

Chevalier of the Legion of Honour.

Sir Daniel Macaulay Stevenson, Bt., Chairman of the Scottish Coal Exporters' Association, and of the Joint Committee on the Supply of Coal to France and Italy.

Sir Richard Augustine Studdert Redmayne, K.C.B., Chief Inspector of Mines.

Sir Douglas William Owen, K.B.E., Chairman of the War Risks Advisory Committee, and of the Coal Exports Committee.

Reginald Walter Matthew, Esq., Principal Clerk, Board of Trade.

George Renwick, Esq., of Newcastle-on-Tyne.

Adam Nimmo, Esq., President of the Mining Association of Great Britain.

Roll of Honour.—Lieutenant H. E. Bellamy, R.A.F., has been killed whilst on duty as a flying instructor. Before the war Lieutenant Bellamy was with the Lancashire Dynamo and Motor Co., Ltd., Trafford Park.

Private R. Taylor, Lancashire Fusiliers, previously reported missing and now officially presumed to have been killed, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Bombardier F. Rawcliffe, R.F.A., who has been presented with the Military Medal for repairing communication wires under intense fire, was assistant electrician with Messrs. Thos. Dugdale, Brother & Co., Blackburn.

Corporal P. Sleigh, formerly an electrical engineer in the Salvage Corps of the Glasgow Corporation, has died from wounds received in action.

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Private B. Viggars, R.A.M.C., who was on the electrical engineering staff of the Shelton Iron & Steel Co., Ltd., has gained the Military Medal for gallantry on the field.

Second-Lieutenant J. S. Youll, formerly an electrician at the power station at Thornley Colliery (Co. Durham), has been awarded the Victoria Cross for killing the team of a German machine-gun and turning the weapon on the enemy, and in recognition of other valiant deeds in counter-attacks. He has also received from the King of Italy the Silver Medal for Valour.

Second-Lieutenant A. Marshall, Northumberland Fusiliers, who has been awarded the Military Cross, was an electrician with the Banknock Coal Co.

Private J. W. Wardill, who was employed at the Leeds Corporation Tramways power station at Crown Point, has been wounded.

Obituary.—Mr. Edwin Blakey.—We regret to record the death of Mr. Edwin Blakey, M.I.E.E., consulting engineer, Barmouth, who died on July 24th, at his residence, Cwm Glas, Arthog, near Dolgelley, aged 68 years. He was seized with influenza about a month ago, and it developed into pneumonia. Mr. Blakey before he went to Wales, over 20 years ago, was a partner in the firm of Blakey, Emmott and Co., Halifax, and a pioneer in the telephone line. He was also for some years consulting engineer to the Madeira Electric Lighting Co., and other concerns.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Budenberg Gauge Co., Ltd.—Particulars of £15,000 six per cent. debentures created June 24th, 1918, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £12,800. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees. (Note: £10,000 debentures dated 1903 have been paid off recently.)

Chemico-Electric Co., Ltd.—Mortgage dated March 28th, 1918, created by the company as guarantor in respect of £3,500 owing to the Capital and Counties Bank by Crosby Oil Shales, Ltd., charged on the sum of £3,500 (part of £4,500) owing to this company by the Ballengeich Collieries on certain debentures.

Banbury & District Electric Supply Co., Ltd. (65,746).—Capital, £25,000 in £10 shares. Return dated May 28th, 1918. All shares taken up and fully paid. Mortgages and charges: £5,200.

CITY NOTES.

Marconi's Wireless Telegraph Co., Ltd.

At the annual meeting held on July 31st, Mr. Godfrey Isaacs presided, in the absence of Senatore Marconi in Italy. Mr. Isaacs, referring to the recent verdict against him in the Courts, tendered his resignation of the managing directorship of the company, and offered to terminate his agreement forthwith. The meeting, however, on the motion of Captain H. R. Sankey, declined to accept it, and expressed its complete confidence in Mr. Isaacs's honour and integrity. After this the chairman proceeded to deal with the report, touching first upon the capital account, and the shares in associated companies, afterwards reviewing the proceedings in the action against the Post Office. Judgment was given for the company, and the matter had been referred to a referee to assess the damages. The learned judge appointed for that purpose would not be able to sit until October. There was, however, at last a fair prospect of the matter being disposed of before the end of the present year. It had always been their wish to arrive at a reasonable and friendly settlement of the matter by which the nation could benefit by the stations, rather than pay a very large sum of money in damages with nothing to show for it. Even at this eleventh hour any reasonable and fair offer would be most willingly accepted by the company. The position with regard to the other sums due from the Government remained just as it was a year ago. There had been some negotiations, but so far no offer even approaching the sum which the company could reasonably accept had been forthcoming, and one almost began to despair of being able to obtain a settlement by negotiation and agreement. Their inventions and patents continued to be used on an immense and ever-increasing scale by the Admiralty, the War Office, and the R.A.F. After passing considerable criticism on the attitude of the Government and the absence of co-ordination and authority, Mr. Isaacs said that the interests of the company abroad continued to develop satisfactorily, on the whole. In the U.S.A. a new company had been formed with the approval of the U.S. Government, by the Marconi Wireless Telegraph Co. of America, with the title of the Pan-American Telegraph & Telephone Co. Its object is to erect stations for the purpose of creating a commercial service of wireless telegraphy between North, Central, and South America. The shares of the company are held as to 40 per cent. by the Marconi Wireless Telegraph Co. of America, as to 20 per cent. by the Federal Telegraph Co., the owners of the Poulsen system interest in the U.S., and as to 40 per cent. by this company. It was intended to proceed immediately with the erection of high-powered stations. The Marconi Wireless Telegraph Co. of America had declared a dividend of 5 per cent. for the past year, and their works had been considerably increased in order to cope with Government orders. The whole of their long-distance and coast wireless stations were under the control of the U.S. Government for the duration of the war upon terms which had been agreed and which were regarded by the management as reasonable, and monthly payments were regularly made. The Canadian Co. had made good progress during the past year and a fair profit resulted. Before, however, the company could be expected to pay dividends some reorganisation of its capital would be required. The matter should not be longer delayed, and they had invited the Canadian company directors to submit their suggestions.

The Australian company, Amalgamated Wireless (Australasia), Ltd., was making excellent progress under the managing direction of Mr. E. T. Fisk and a reconstituted board.

The Argentine company, the Compania Marconi de Telegrafia sin Hilos del Rio de la Plata, in consequence of the war, had necessarily stood still. The Spanish company, the Compania Nacional de Telegrafia sin Hilos, was conducting a very substantial telegraph business, and had made excellent arrangements in other directions, which gave every reason to hope that the company had now turned the corner.

The Russian company, the Société Russe de Télégraphes et Téléphones sans Fil, had been passing through very difficult times. They had, naturally, suffered severely from the difficult labour conditions, but had suffered no other harm, and having regard to the importance of wireless telegraphy in Russia, no matter what the Government of the day might be, there were fair grounds for supposing that importance would always be attached to a business such as that of the Russian company. In these and other circumstances they had not thought it necessary to make any special reserve in respect of the very considerable sum of money they had invested in Russia.

The Belgian company, the Société Anonyme Internationale de Télégraphie sans Fil, notwithstanding the prevailing conditions, had continued to conduct its business satisfactorily. It had, however, been impossible for the board, other than Captain Sankey and himself, to meet, and therefore no dividend could be paid until circumstances changed.

The French company, the Compagnie Francaise Maritime et Coloniale de Télégraphie sans Fil, had continued to do a good business, and had substantially increased its dividend.

The Cie. Universelle de Télégraphie et de Telephonie sans Fil, in which they were so largely interested, was now in course of liquidation. The whole of its tangible assets had been sold to a new company, entitled the Cie. Générale de Télégraphie sans Fil, with a capital of 12,500,000f., the whole of which had been subscribed in cash by about twenty shareholders, amongst which were the French Cable Co. (with the approval of the French Government), the Banque de Paris et des Pays Pas, Banque Francaise pour le Commerce et l'Industrie, Banque Transatlantique, Crédit Mobilier Francais, Messrs. Jacques, Gunzburg et Cie., Société Centrale des Banques de Province, and, again with the approval of the French Government, Marconi's Wireless Telegraph Co., Ltd. It had been agreed that they should subscribe for 40 per cent. of the total capital, and that they had done, representing a sum of 5,000,000f. The liquidation of the Cie. Universelle, when complete, would produce to this company a sum of approximately 11,000,000f. This was a most satisfactory settlement of one of the most troublesome and difficult positions with which he had ever had to deal. Under this new régime, the 40 per cent. of the capital which they now held in this new French company would produce to them right away excellent returns and far more than they ever could have secured through their much larger holding in the Cie. Universelle.

After alluding to the substantial developments of the Marconi International Marine Communication Co., the speaker said that the Italian business had again been of a highly satisfactory nature and most ably directed by the Marquis Solari, their representative in Rome.

The Relay Automatic Telephone Co., Ltd., in which they had a very large interest, had had its sphere of action very considerably restricted in consequence of the war. It had, however, been able to do some business, notably that of installing its system at Australia House, amongst other large establishments, where it was working to perfection. This company, when war closed, had a great future in front of it; unquestionably automatic telephones would be the order of the day when circumstances changed.

They had many important negotiations in many parts of the world of which it would not be wise for him to speak that day, but one might fairly contemplate that the business of wireless telegraphy would be no less important when peace came than it had been during the war. In speaking with an eminent officer of the U.S. Navy Department a day or so ago, he told him that although before the war he was of a very different opinion, he had now come to the conclusion that no new long-distance cables would ever again be laid; that, in his view, wireless telegraphy was thoroughly efficient for all telegraphic purposes. It would not be perhaps altogether advisable for him (the speaker) to express such views, but they were those of a practical man, holding an important position in a great and progressive country.

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Edmundson's Electricity Corpn., Ltd.

At the annual meeting on July 18th, Mr. P. D. Tuckett, who presided, said that despite the ever-increasing difficulties they were able to show approximately the same net profit as for the previous year.

Apart from the Lancashire Power Co., the capital expenditure of the sub-companies had again been extremely small, and this and the virtual disappearance of their private installation work, except on Government contracts, had inevitably reduced the gross trading profit. On the other hand, the item of dividends and interest showed a small but gratifying increase, whilst the loss hitherto shown on the working of the local authorities' and other undertakings was for the first time converted into a profit (£612), as against a loss of £896 for the previous year.

Expenses had risen in every direction, the rise in wages and in the price of coal had added some £22,000 to costs. It was only by advancing rates of charge and by the encouraging growth of power and heating loads that they had been at all able to meet them. Apart from the Lancashire Power Co., they sold over 3,000,000 more units for power and heating, which now accounted for about 85 per cent. of the total output, whilst connections increased by 5,076 KW., of which 92 per cent. represented power and heating. It was surprising how well the connections had been maintained, in spite of the manifold restrictions and other difficulties. Most of them were required for war purposes, and might therefore not be retained in their entirety after the war.

But for the facilities afforded by the electric supply industry it would have been impossible for the pressing needs of increased production to have been promptly met. His only regret was that the benefit to the nation was not reflected in a more adequate and immediate benefit to the shareholders. During the past four years they had connected over 20,000 KW., independently of 7,500 KW. connected by the Lancashire Power Co., and since, during the same period they had spent less than £150,000 capital, and no more than £9,000 and £10,000 the last two years, they were now faced with the necessity in one or two instances of making substantial additions to plant and mains, whilst after the war they would probably have to make good the leeway which had occurred in a good many of their undertakings. It was therefore fortunate that, thanks to their past policy of strengthening the financial stability of the sub-companies by the provision of more adequate reserves, they were to-day in the happy position of finding themselves with something like £75,000 liquid resources, as compared with £14,000 in 1914. These resources would be invaluable after the war. In the meantime, the Ministry of Munitions had agreed to make the Urban Co. a loan of £75,000 to enable it to undertake the extension of its plant, and they were hoping to secure a still larger loan for the Cornwall Co.

Most of their undertakings had done somewhat better, but Guernsey and the Isle of Wight had again suffered severely. In all cases, good and bad, the results were almost entirely determined by war conditions. Where local industry had been stimulated by the war, or where troops had been quartered in the neighbourhood, the undertakings had benefited, and, vice versa. The marked improvement shown by the Urban Co. was largely due to the development of the power load at Twickenham and in Cornwall, and to the prosperity of Grantham. The Lancashire Power Co. had again made some progress, and as a result of its reduction and rearrangement of capital, they had now received a dividend on the preference shares. He had to report the renewal, for a further period of five years, of their contract with the Urban Co. on practically the same terms as before, except that the annual fee payable to them for management was increased from £2,000 to £3,000.

In referring to the difficulties under which they were operating, Mr. Tuckett said that their latest nightmare was the new rationing scheme. It was very doubtful whether the scheme was going to result in any material saving of coal so far as their stations were concerned, the conditions governing the supply of electricity being so entirely different from those governing the manufacture of gas; but it would doubtless have been difficult to ration one without the other.

In addition to the relief which they hoped to derive from increased charges, they could rely on some increase in trading profit this year owing to the much larger capital expenditure which was likely to be incurred by the sub-companies.

Referring to the reports of three Government Committees on various aspects of the electrical industry, the chairman said that the Electric Power Supply Committee's proposals would probably be materially modified before legislative effect was given to them, and it would therefore be premature for him to discuss them in any detail.

Yorkshire Electric Power Co.

For the half-year ended June 30th, 1918, the directors report satisfactory progress. The revenue has increased, and although the cost of coal, labour, and materials continues to rise, the net profit is greater on account of the larger business done. After payment of bank and other interest the net profits for the three half-years ended June 30th were:—1916, £13,550; 1917, £17,617; 1918, £23,683. The 6 per cent. cum. pref. dividend for the half-year has been paid. In view of the financial conditions arising out of the war the directors are deferring the payment of a dividend on the ordinary shares until the accounts are made up for the year. The second 6,000-KW. turbo-alternator at Thornhill power station is now in use. The Bill to extend the company's powers on lines found advisable from past experience has now received the Royal Assent.

The Board of Trade reported on the Bill, that, without expressing any opinion on the merits of the questions raised, it was inexpedient to proceed with Clause 3 pending such action as might be taken as a result of the Report of the Coal Conservation Sub-Committee and that of the Electric Power Supply Committee. In view of this the directors decided to withdraw the clause, and the Bill proceeded as an unopposed measure.

The Act empowers the company and local authorities who have electricity undertakings to make working agreements, and to enter into joint schemes for co-ordinating the whole of the existing supply undertakings in the company's area.

The association of the company with the Corporation of Bradford for joint working has been extended by a further agreement, the benefits to both parties by the first agreement having been fully demonstrated.

Arrangements have also been entered into with the Corporations of Sheffield and Rotherham having a similar object in view, so that the development of the southern portion of the company's area will be made in co-operation with their important undertakings.

A memorandum by the chairman on the recent report of the Board of Trade Committee on Electric Power Supply accompanies the directors' report.

Of the issue of £71,640 of 6 per cent. cumulative preference shares made in September, 1916, £9,675 has been applied for during the half-year, leaving £9,075 still available.

Austrian Companies.

The *Ver. Gluhlampen A.G., of Neupest*, earned net profits of £86,000 in 1917, and the dividend is 15 per cent., or the same rate as in the previous year.

The *Ungarische Siemens-Schuckert Werke A.G.* reports net profits of £24,300 for 1917, as against £24,700 in the previous year, the dividend being 5 per cent. for each year.

The *Gesellschaft fur Elektrische Industrie, of Vienna*, recommends a dividend of 10 per cent. for 1917 on share capital of £250,000, being the same rate as in 1916. It is intended to increase the share capital to £500,000.

The report of the *Oester. Siemens-Schuckert Werke, of Vienna*, states that the requirements of the military authorities had the effect of further reducing the amount of work carried out for peace purposes in 1917, and despite numerous difficulties the works were in full and constant operation. The gross profits amounted to £1,002,000, as compared with £780,000 in 1916. After meeting general expenses, &c., and setting aside £82,000 for depreciation, as against £104,000 in 1916, the net profits are returned at £133,000, as compared with £126,000 in 1916. It is proposed to pay a dividend of 7 per cent. on the ordinary share capital of £1,333,000, being the same rate as in the preceding year. The report states that the demand for peace manufactures has become more pressing in the new financial year.

The report of the *A.E.G.—Union Elektrizitats Gesellschaft, of Vienna*, states that the company was occupied exclusively on direct and indirect army orders in 1917. The gross profits increased from £200,000 in 1916 to £289,000 last year, and after making provision for depreciation, which corresponds to 30 per cent. of the book value of machinery and plant, the accounts show net profits of £69,000 for 1917, or the same as in the preceding year. It is proposed to pay a dividend of 8 per cent. on share capital of £833,000, being the same rate as in the previous year. It is stated that the large new machine shops are to be partly brought into operation this month, and that on their being fully utilised it will be possible for the company to increase the production and be less dependent upon procuring machines from Germany than in the past.

Swiss Companies.

The directors of the *Gotthard-werke, A.G. fur Elektrochemische Industrie, of Bodio*, in which the South German Discount Co., of Mannheim, and the metal firm of L. Weil & Reinhardt, of Mannheim, are interested, recommend a dividend of 15 per cent. for 1917 on the share capital of £80,000, this contrasting with the same rate on £48,000 in the previous year.

The *Société Financière pour Entreprises Electriques aux Etats-Unis, of Geneva*, after deducting general expenses and taxes, reports profits of £26,000 from interest and dividends in 1917, as compared with £31,000 in the preceding year. Owing, however, to losses in exchange and depreciation of investments, the final result is a deficiency of £80,000 on a share capital of £400,000. The directors believe, however, that this loss is merely transitory, and that financial equilibrium will be restored on the conclusion of peace.

The report of the directors of the *A. G. Brown, Boveri and Co., of Baden*, which deals with the financial year ended on March 31st, 1918, states that increasing difficulties were experienced in obtaining raw materials, which could only be procured by having no regard to the prices paid. The materials which advanced the least were twice the cost of the peace-time quotations, whilst others were ten times greater than the latter. As wages were also dearer, the cost of production and consequently sale prices underwent very extraordinary augmentations. Under the circumstances the value of the turnover again rose, although the production continued quantitatively less than in the last peace year. The inland sale of manufactures was favoured by the greater importance attached at present to the utilisation of electrical energy in Switzerland, although considerable difficulties arose in the construction of new power stations. Under the pressure of the inadequate supply of coal the Swiss Federal Railway Administration had approached the question of the conversion to electric traction of the St. Gothard Railway and of other lines, and besides the erection of two large power stations, orders for 24 electric locomotives had so far been placed. In

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the export markets the conditions were the most favourable at present in some neutral countries. The deliveries to belligerent countries also were not inconsiderable, although they seemed to be falling off as the company did not produce actual war material. Business with Russia had ceased, and it was feared that considerable losses would arise on the outstanding debts there. The company's foreign undertakings were yielding appropriate results, which, however, were diminished by the low level of foreign exchange. The accounts show that the gross profits increased from £330,000 in 1916-17 to £441,000 last year, and the net profits from £123,000 to £175,000, permitting of the payment of a dividend of 9 per cent. on share capital of £1,280,000, as against 7 per cent. in 1916-17, and 9 per cent. *pro rata* for six months on new capital of £160,000.

Fife Tramway, Light & Power Co.—The Commercial Bank of Scotland is authorised to receive subscriptions for £130,000 5 per cent. debenture stock at £89 per £100.

National Gas Engine Co., Ltd.—Interim dividend 7½ per cent. per annum, less income-tax, on the ordinary shares for the past half-year.

Rio de Janeiro Tramway, Light & Power Co., Ltd.—Dividend of 1¼ per cent.

Wm. Beardmore & Co., Ltd.—The accounts for 1917 are not yet completed, but a dividend on the ordinary shares of 6 per cent. per annum, free of tax, is announced.

Charing Cross, West End & City Electricity Supply Co., Ltd.—The directors have decided not to pay an interim dividend on the ordinary shares of the West End undertaking.

National Boiler & General Insurance Co., Ltd.—Interim dividend of 12s. per share, less tax, for the half-year.

STOCKS AND SHARES.

Tuesday Evening.

Buoyed up by the splendid news from the Front, Stock Exchange markets are good in nearly all departments. The holiday feeling is somewhat apparent, but, in spite of this, there is a good deal of business about. The strength of the War Loan, Consols, and other Government securities is reflected in rising prices in all gilt-edged stocks. Debenture and preference issues amongst Home Rails are particularly good; buyers are keen upon the cheaper descriptions, of which the Undergrounds afford a few examples. Home Rails are firm, however, in all these classes, and one of the features of the moment is liveliness in the £10 and shilling shares of the Underground Electric Railways of London.

'Bus A, as the market calls the shilling shares, have risen to 6s. 6d., and the ten-pounders to 2⅜, while the Income Bonds are also better. With them, London and Suburban Tractions have hardened, the ordinary being 4s. 3d., and the preference 9s. 6d. Ever-busy rumour reports that a scheme is afoot for amalgamating the London and Suburban with the Underground Electric Co., and it is declared that negotiations have so far progressed as to include the advent to London of a well-known tramway expert whose fame is in the Western counties. Caution suggests that there may be legal difficulties in the way of a railway taking over a tramway, and that Parliamentary consent may be required. However this may be, the position is certainly interesting, and the next developments are eagerly awaited. Meanwhile, the price of London United Tramways debenture stock is unchanged at 40.

Holders of Toronto Power 4½ per cent. debenture are invited to tender their stock for purchase, and the circular containing the offer mentions that the price in the Stock Exchange Official List was, at the time the circular went out, 79-82. Those who feel disposed to tender might be advised to put their price considerably higher. The security is ample, and having regard to the scarcity of such stocks, the price of 80½ is low. We should not advise anyone to tender below 86 unless they want the money for other purposes, and perhaps a point or two higher would not be too extravagant to fix, because even if the tender failed, the proprietor need have little qualm about the investment.

There is still no animation in the market for electricity supply shares. The last-published Regulations affecting rations of coal and illuminants have not yet been sufficiently digested to tempt money into the industry. Prices, nevertheless, keep steady, and there is no pressure to sell. We understand that most of the stock has been placed which came to market recently on behalf of several deceased accounts, so there is nothing to stop a recovery as soon as attention is directed to this section again. But the passing of the interim dividend on the ordinary shares of the Charing Cross and City (West End undertaking) is not pleasant reading.

Manufacturing shares hold their strength, and Babcocks remain popular by reason of the expected bonus. The General Electric Co.'s new issue proved a great success, the subscription lists closing very promptly. Probably a market in the new shares will be started at an early date, although dealings may have to wait until allottees are able to supply the distinctive numbers of the new shares in accordance with the Treasury Regulations that govern Stock Exchange business nowadays. The shares are now quoted ex share bonus, and so also are Chile Telephones and Orientals. Ediswans are an active market at about 44s. 9d. for the £3 paid shares, these attracting most of the interest. A good deal of the latest buying has come from Wales. The fully-paid shares have advanced substantially. Fraser & Chalmers dropped sharply on a few thousand shares coming to market, but the supporters of the recent upward movement profess themselves as confident as ever that the General Electric will take over the concern at a price materially higher than Frasers are at present quoted in the market. India-Rubber shares have gained 5s., and Westinghouse preference are a little better.

Marconis took a jump to over £4; the adjourned meeting is regarded as a bull-point, and optimism once more toys with the expectation of what payment the company will receive from the Government when the day of settlement arrives. Marconi Marines, Americans, and Canadians have participated mildly in strength of the patent shares. Cable stocks are a good market, Anglo-Americans being picked up by investors attracted by the character of the security. Rubber shares are better, and the Armament group is very steady.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Aug. 6. 1918.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6½	—	£7 13 10
Charing Cross Ordinary	5	4	3⅜	— ⅛	6 8 0
do. do. do. 4½ Pref.	4½	4½	3½	—	6 18 6
Chelsea	8	5	3½	—	7 13 10
City of London	8	8	11⅝	+ ⅛	7 0 3
do. do. 6 per cent. Pref.	6	6	9⅛	—	6 0 4
County of London	7	7	10⅜	—	6 17 7
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	6	7	5½	—	6 13 4
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3½	—	7 13 10
Metropolitan	3	4	3⅜	—	6 8 0
do. 4½ per cent. Pref.	4½	4½	3½	—	6 18 6
St. James' and Pall Mall	8	9	6⅜ xd	—	7 1 2
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6	— ⅛	7 10 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	96	—	6 5 0
do. Def.	1½	1½	22⅜	+ ½	6 11 10
Chile Telephone	8	8	7¼ xd	+ ¼	4 1 7
Cuba Sub. Ord.	7	7	10	—	*7 0 0
Eastern Extension	8	8	15⅛	—	*5 3 3
Eastern Tel. Ord.	8	8	158½	+ 1	*5 1 0
Globe Tel. and T. Ord.	7	7	14⅜	—	*4 17 5
do. do. Pref.	6	6	10	—	6 0 0
Great Northern Tel.	24	22	87½	—	5 17 4
Indo-European	13	—	58½	—	5 11 1
Marconi	15	20	4⅜	+ ⅛	4 17 1
Oriental Telephone Ord.	10	10	8 xd	—	9 6 8
United R. Plate Tel.	8	8	7½	—	*5 6 8
West India and Panama	6d.	9d.	1⅞	—	*3 6 8
Western Telegraph	8	8	16	—	*5 0 0
Home Rails.					
Central London Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	1	1	23¾ xd	—	4 4 3
do. District	Nil	Nil	21½	—	Nil
Underground Electric Ordinary	Nil	Nil	2⅜	+ ½	Nil
do. do. "A"	Nil	Nil	6/6	+ 9d.	Nil
do. do. Income	6	4	86	+ 1½	*4 13 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅜	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3⅜	—	—
do. do. 2nd Pref.	5½	—	2¼	—	—
do. do. 5 Deb.	5	5	65¼	—	7 13 8
Brazil Tractions	—	—	46½	— ½	—
Bombay Electric Pref.	6	6	9½ xd	—	6 9 9
British Columbia Elec. Rly. Pfce.	5	5	61½	—	8 2 8
do. do. Preferred	Nil	Nil	45	—	Nil
do. do. Deferred	Nil	Nil	40½	—	Nil
do. do. Deb.	4½	4½	60½	—	7 0 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	44½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	36½	—	Nil
Mexican Light Common	Nil	Nil	21	—	Nil
do. Pref.	Nil	Nil	39	—	Nil
do. 1st Bonds	Nil	Nil	49	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅛	—	3 16 2
British Aluminium Ord.	10	10	1⅞	—	5 6 8
British Insulated Ord.	20	20	2	—	5 0 0
British Westinghouse Pref.	7½	7½	2⅛	+ 1/16	5 6 9
Callenders	20	25	19½	—	6 11 7
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	3⅞	—	5 16 0
Edison-Swan, fully paid	—	—	3⅜	+ 7/16	Nil
do. do. 4 per cent. Deb.	4	4	75⅞	+1	5 6 0
Electric Construction	7½	10	1⅞	—	7 12 4
Gen. Elec. Pref.	6	6	10¾	—	6 5 4
do. Ord.	10	10	18½ xd	—	*5 8 1
Henley	25	25	2⅜	—	5 17 8
do. 4½ Pref.	4½	4½	3⅜	—	5 12 2
India-Rubber	10	10	16½	—	*6 3 0
Telegraph Con.	20	20	44½	—	*5 7 8

*Dividends paid free of Income Tax.

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Exports and Imports of Electrical Goods during April, May, and June, 1918.

The official returns of electrical exports and imports for the past three months show, as regards exports, totals of £255,741 in April, £446,448 in May, and £266,533 in June, which, compared with the preceding three months—January, £266,533; February, £255,064; and March, £174,482— record an increase of £310,000 over the previous quarter. Telegraphic and telephonic exports reached considerable proportions during the quarter, submarine cable to the value of £247,000 being included in May, and of £14,000 in June. The figures for electrical machinery exports for the three months under review show an increase of over £50,000, while considerable increases appear in the items for batteries, meters and instruments. The electrical imports for the second quarter of the year were:—April, £87,614; May, £102,316; June, £156,311; as compared with £212,434 in January, £163,788 in February, and £200,966 in March, a reduction of £230,000 for the three months; the principal falling off occurring in electrical machinery £140,000, batteries £50,000, and lamps £40,000.

The re-exports of foreign and overseas electrical material show a falling-off in all sections, the figures being:—April, £3,705; May, £3,106; June, £2,780; compared with £11,661 for January, £90,036 for February, and £3,132 for March.

Exports and Imports of Electrical Goods and Machinery during April, May, and June, 1918.

	April.			May.			June.		
	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exports.
Electrical goods and apparatus unenumerated	£31,802	£39,509	£2,481	£34,330	£54,517	£1,128	£33,567	£81,186	£979
Insulated wire and cable (not telegraphic or telephonic)	11,175	417	—	5,811	—	770	11,186	327	—
Electric glow lamps	7,605	440	36	5,300	4,545	364	6,273	11,753	1,292
Arc lamps and parts (not carbons)	3,977	1,608	—	5,277	5,902	—	3,367	3,635	—
Meters and instruments	10,627	2,260	4	16,816	1,360	143	10,359	2,340	18
Electrical machinery (including switchboards and transformers)	115,303	22,563	817	74,994	21,187	649	121,539	40,489	475
Batteries	9,397	6,438	89	12,793	9,955	20	9,484	4,195	—
Carbons	420	6,803	—	608	3,391	—	509	3,418	—
Telegraph and telephone wire and apparatus ...	65,465	7,126	278	290,519	1,459	35	70,279	8,968	16
Totals	£255,771	£87,164	£3,705	£446,448	£102,316	£3,106	£266,533	£156,311	£2,780

THE EDUCATION AND TRAINING OF ENGINEERING APPRENTICES.

By P. H. S. KEMPTON, A.R.C.Sc., B.Sc.

(*Concluded from page* 117.)

Germany.

That we can ill afford to scoff at the progress made by Germany in these matters is evidenced by the recent statement by Dr. W. E. Dalby that ten years ago he found that in Germany 10,000 well-educated men over 18 were studying engineering, compared with only 900 in this country.

It is surprising that we should regard compulsory continuation education as so revolutionary a type of change when we remember that as far back as 1869, in the Gewerbeordnung of the North German Union, permission was given to any local authority to frame laws compelling the attendance at continuation school of apprentices and young workmen under the age of 18. In 1874 the Central Government of the Empire issued an official statement of the principles on which such schools should be run. As a result compulsory continuation education, partly in working hours, is now a regular thing practically all over Germany, and in 1910, Essen was the only large town in Prussia without a public compulsory continuation school. But there the Krupp's firm have established their own works school at which the attendance of apprentices is obligatory.

Mr. Clay, who, at the instance of the Board of Education, undertook a visit to Germany to investigate the systems in vogue in 1909, says: "In the States where the general continuation schools are compulsory they form part of the elementary school system, and are administered by the Minister of Education. In spite of the increasingly technical character of these schools it would be wrong to suppose that they form the main provision for technical instruction even for the workmen. For the leaders of industry and commerce there are the technical, commercial high schools, and schools of mines which in standing are recognised to be fully the equal of the old universities, while below them are various institutes training their students for subordinate but important positions in factories and other industrial undertakings. (Compulsory Continuation Schools in Germany. Educational pamphlet No. 18. Board of Education.)

The best examples of German works schools are to be found in connection with the great engineering and munition of war industries:—

1. Messrs. Siemens & Schuckert, electrical manufacturers, of Nuremburg, Bavaria, established a school for apprentices in 1892. The apprentices enter at 14, and during the first three years of apprenticeship they receive theoretical instruction during the mornings. In this, and in all other German works schools no provision is made for cultural or general education in spite of the early age of entry, and there also appears to be no attempt to foster the social activities of the apprentices.

2. Messrs. Ludwig Löewe & Co., iron founders and engineers, Berlin, founded a school in 1899 in order to give the apprentices "theoretical illumination." There are about 100 apprentices, and the theoretical training is given mainly in the mornings from 7 to 8 o'clock, the juniors getting one hour a day, while the more advanced apprentices also receive instruction in mechanical drawing from 4 till 6 p.m.

3. Siemens & Halske, Berlin. These works are devoted chiefly to the manufacture of electrical instruments and apparatus, such as Röntgen ray, electrochemical and sterilisation apparatus, cables, and incandescent lamps.

There are 160 apprentices, who enter at 14. The firm has its own works school, and all apprentices attend evening classes during two or three hours of the 8-hour working day. The sons of workmen do not pay fees, others pay 300 marks for the 4-year course. This school was founded in 1906, and the teachers are all engineers employed by the firm. In this case German and citizenship are taught, in addition to the mathematical and technical subjects, and the firm are convinced of the absolute necessity of the school training.

4. Vulcan Shipbuilding and Marine Engineering Co., Stettin, have in their employment 350 apprentices. Here again attendance at the firm's own school is compulsory, but the classes are held on Sunday mornings from 8 till 11.30, in order to cause no disturbance in the workshop routine. The instruction given in these classes is purely theoretical.

Apart from these cases the majority of the German engineering firms support the continuation schools. In some cases, as with Messrs. Traun, vulcanite manufacturers, and the Hamburg-American Line, facilities are given for such attendance by allowing apprentices to leave work early. In a few cases

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firms allow the apprentices time from work hours to attend these outside classes. A notable feature of Messrs. Traun's scheme is that every boy between 14 and 18 must attend a gymnastic class. In the continuation schools the curriculum is adapted to the special occupations of the students, but the adaptation is of course less complete than in the case of the works schools. In every case, however, German is taught, and thus in breadth of training the outside schools often excel the schools founded by firms merely for the training of apprentices along vocational lines.

One of the chief difficulties which have confronted the German authorities is the provision of suitable teachers for this work, and although the training of such teachers is yet in an experimental stage, there appears to be a tendency to recruit their ranks about equally from among expert workmen by giving them special courses in the theory of education and from among professional teachers by giving them workshop training. In every case, however, and especially in the works schools, it is found necessary to have a nucleus permanent staff of expert teachers and organisers.

On analysis, and in spite of so many dissimilarities, these schemes which represent the definite tested opinions of educational experts and captains of industry both at home and abroad, provide certain fundamental points of agreement upon which it will be safe to build.

In the first place it seems to be agreed that the *education of apprentices should proceed side by side with their trade training, and during work hours.* Whether this should be supplemented by evening classes is doubtful, but it is certain that when a boy has been at work since 6 or 7 a.m. he is in no fit condition to study for any prolonged period at night. In the evidence given before the Lewis Commission there was absolute unanimity against compulsory attendance at evening classes.

A second point of agreement among those best qualified to judge, is that *this educational training should not be entirely vocational, but that general culture, citizenship, and physical training should find a place in the curriculum.*

In most successful schemes promotion to the more advanced courses is made to depend upon the effort and ability of the student. Hence a third point of agreement apears to be that a *periodic sifting process is necessary in order to render the training most efficient and economical.*

The difficulty experienced in connection with all these schemes of obtaining suitable teachers also indicates that *specialised training and adequate prospects must be offered to prospective teachers in such schools.*

Upon the teaching staff of the apprentice school ultimately rests the responsibility for the success or failure of the whole scheme, and no amount of organisation or equipment can make good a lack of sound and enthusiastic teaching capacity.

There remain some minor but important facts upon which agreement has not been reached. Chief among these is the question of the *relation of the school to the works.* Without attempting to dogmatise, it seems reasonable to suggest that where works schools are conducted on a broad basis, as in the case of the British Westinghouse Co. and the General Electric Co. (U.S.A.), there can be no reasonable ground for desiring to remove the education of apprentices to less convenient or more arbitrarily managed concerns outside. It is in fact obvious that the invariable Education Committee of local tradesmen is infinitely less capable of conducting a school for engineers than are members of the engineering profession. On the other hand, any attempt to use the works school to serve as a mere machine for the increase of output and the inflation of dividends must be severely discountenanced, and it ought not to be impossible to devise some means of combining the necessary disinterested control with complete adaptation to the needs of the industry for which the apprentices are being trained. The suggestion on this subject made by the N.E. Coast Committee is perhaps a step in the right direction.

Among other moot points are the *method of entry of apprentices*, the relative advantages of short frequent classes or longer periods of school instruction at less frequent intervals, and the *number of years to which such training should extend.*

Such trivial and theoretical divergencies of opinion are, however, of little account in view of the urgent national necessity for a definite practical programme of action. The hands of Mr. Berriman and Mr. Fleming and other pioneers must be held up. To quote again from Mr. Orcutt's book: "Schoolmasters and Government officials can do little unless supported and guided by our industrial and commercial leaders. A definite programme which has for its object industrial betterment must embrace general education, technical training, science and research, and economics. We must consider these subjects as interlocked and inseparable, if we wish to attain to a position as leaders and put our industries in an unassailable position."

Engineers cannot be produced in a day, and it is necessary to remember that no educational scheme can have any real effect until many months after its adoption. We would repeat that *action in this matter is long overdue*, and any attempt to postpone it is fraught with grave peril to the nation after the war. If we win the war and begin the new era educationally, technically, and commercially impotent we shall indeed only escape Scylla to be wrecked in Charybdis.

TAR OIL AS A MOTOR FUEL.

We have heard much of late regarding the use of tar oil in Diesel engines; many difficulties have been met with in so utilising it, and somewhat refined methods have been devised to overcome them. What, then, may we expect of the suggestion to use tar oil as fuel for motor-cars, electric lighting sets, &c.? Tar oil costs 5d. a gallon—before the war it was 2d.—while petrol costs 3s. 9d. plus tax; the former is a home production, the latter imported. Clearly, if tar oil could be substituted for petrol both the individual and the nation would profit. *It can be done quite easily.*

Last week we had the pleasure of a trip with Mr. F. A. Wilkinson, of Hatfield, in his Overland car, which is fitted with a four-cylinder petrol engine. The fuel used was tar oil, and it was impossible to distinguish any difference in the running of the engine from its behaviour with the fuel for which it was designed. The car was run for a time on coal gas, and the change from one fuel to the other was absolutely imperceptible.

As the use of tar oil presented no peculiarities in operation, there is nothing further to be said under this head; it only remains, therefore, to explain how so heavy an oil can be substituted for the volatile petrol spirit.

We may first recall our article of November 17th, 1916, in which we described the method by which Mr. Wilkinson succeeded in running his car with paraffin. The chief difficulty was in starting, and this was overcome by the use of an electrical heater, of which we reproduce the illustration. The heater A contains a small resistance coil, and is mounted alongside of the carburetter, so that the level of the oil in the heater is always the same as that of the oil in the float chamber. A valve C is connected by a pipe to the T-piece B, which is connected to the induction pipe of the engine. The valve D is connected between the T-piece and the exhaust pipe, and allows a small portion of the exhaust gases to be by-passed into the inlet pipe of the engine, to heat the incoming charge of paraffin and air from the carburetter. These valves are controlled from the dashboard, and a switch and pilot lamp are provided for the control of the heater. When the heater is used no petrol at all is required, as the engine can be started from cold on paraffin; but the heater is only used for starting, and consumes 196 watts for 2½ minutes. If the heater is not installed, the engine can be started on petrol and changed over to paraffin.

To step up—or down—from paraffin to tar oil requires a slight addition to the equipment. This consists of nothing more than a half-inch copper tube passing through the interior of the exhaust pipe, and communicating at one end with the atmosphere, at the other with the air inlet pipe. Through this tube air is drawn by the engine, becoming highly heated by the exhaust gases which surround the tube, and the hot air enters the inlet pipe close to the carburetter

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connection, where the hot blast atomises and vaporises the tar oil on its way to the cylinder. This device, which has been patented by Mr. Wilkinson, is very inexpensive, and in conjunction with the by-pass from the exhaust pipe described above it suffices to enable the engine to run perfectly on tar oil.

It should be clearly understood that the electric heater is not required for this purpose; the heater is used only when it is desired to start from cold with paraffin or tar oil. If the electric heater is not fitted, the engine is started on petrol or gas.

The alterations required to convert the engine to tar oil are so simple that any engine can easily be adapted for this purpose; moreover, by including a couple of valves controlled from the dashboard, the additional fittings can be cut out at pleasure and the engine run on petrol or gas.

Some actual results will be of interest; they show that with the same quantity of fuel the mileage run is practically the same, but the cost of the fuel is vastly different:—

	Sp. gr.	Flash point.	Cost of fuel.	Miles per gal.	Cost per mile.
Petrol	0·745	—	3s. 9d.	19·61	2·29d.
Paraffin ...	0·810	—	1s. 9d.	18·76	1·11d.
Tar oil	1·015	184° F.	5d.	18·33	0·27d.
,, ...	1·040	180—190° F.	5d.	19·18	0·26d.

The car weighs 26 cwt. It has run 7,000 miles in two years on paraffin, and for three months on tar oil. No trouble is experienced with the sparking plugs, nor is pre-ignition ever observed. The only point to which objection can be raised is a slight tendency to emit "visible vapour" when running with tar oil on no load, as when the car is standing with the engine running. On load, the exhaust is

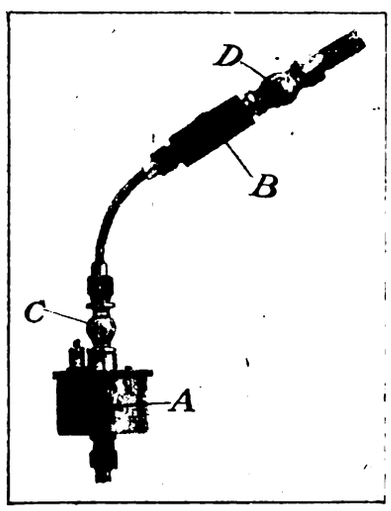

Fig. 1.—"By-pass" Electric Heater.

invisible. With an electric starter (which is fitted on the car referred to) there is no need to keep the engine running on light load.

Precisely the same considerations apply to stationary petrol engines, such as those driving electric lighting sets, &c. We understand that with these the cost of fuel per kw.-hour is 0.75d., and obviously the matter is of considerable importance to the users of these sets.

Being an electrical engineer, Mr. Wilkinson favours electric driving, but considers the scarcity of charging stations on some routes to be a serious drawback to the battery vehicle. He therefore has worked out a scheme for an oil-electric vehicle, involving the minimum of departure from the existing designs of motor-cars. His plan is to install a battery capable of driving the car for about 10 miles unaided. The engine drives a dynamo-motor, with a double-commutator armature, and mechanical clutches provide for the following combinations:—Engine driving dynamo to charge battery, with armature windings in series; battery and motor driving vehicle, with armature windings in parallel; engine driving vehicle, assisted by the battery and motor. Thus the battery can be charged while descending hills or standing, regenerative action being secured in the former case; hills can be ascended at full speed; and the user is independent of charging stations. Such a vehicle has actually been built to Mr. Wilkinson's designs, but has not as yet been tested. The principle is not new, but the method of carrying it into effect is novel, and the idea appears to be very promising. Lastly, by a very simple device, Mr. Wilkinson has arranged his engine to act as a gas compressor —two firing cylinders driving the other two as compressing cylinders—so that, if desired, coal gas can be compressed to 80 lb. per sq. in. with no additional apparatus.

It will readily be understood that our visit to Hatfield was full of interest, and we wish the inventor every success—not in carrying out his inventions, as that part is already accomplished, but in introducing them to the public, the hardest task of all.

TRADE STATISTICS OF INDIA.

The following figures of the imports of electrical and similar goods into British India in the year ending March 31st, 1917, are taken from the recently-issued official trade statistics; details for the year ended March 31st, 1916, are added for purposes of comparison, and notes of any increases or decreases are given:—

	1915-16. £	1916-17. £	Inc. or dec. £
Brass, wrought.—			
From Great Britain ...	46,000	53,000	+ 7,000
,, Japan	42,000	103,000	+ 61,000
,, Straits Settlements	6,000	52,000	+ 46,000
,, Other countries ...	24,000	12,000	− 12,000
Total	118,000	220,000	+ 102,000
Copper and copper ware.—			
From Great Britain ...	309,000	153,000	− 156,000
,, Germany	45,000	—	− 45,000
,, Belgium	10,000	—	− 10,000
,, France	7,000	15,000	+ 8,000
,, United States ...	6,000	4,000	− 2,000
,, Japan	108,000	70,000	− 38,000
,, Other countries ...	9,000	10,000	+ 1,000
Total	494,000	252,000	− 242,000
Iron wire.—			
From Great Britain ...	140,000	199,000	+ 59,000
,, Germany	1,000	1,000	—
,, Belgium	1,000	—	− 1,000
,, United States ...	71,000	62,000	− 9,000
,, Other countries ...	1,000	2,000	+ 1,000
Total	214,000	264,000	+ 50,000
Prime movers, other than locomotives.—			
From Great Britain ...	268,000	229,000	− 39,000
,, Italy	1,000	9,000	+ 8,000
,, United States ...	14,000	17,000	+ 3,000
,, Other countries ...	4,000	6,000	+ 2,000
Total	287,000	261,000	− 26,000
Electric generators.—			
From Great Britain ...	8,000	13,000	+ 5,000
,, Italy	6,500	—	− 6,500
,, United States ...	7,500	7,500	—
,, Other countries ...	500	1,500	+ 1,000
Total	15,000	22,000	+ 7,000
Electric motors.—			
From Great Britain ...	50,000	77,000	+ 27,000
,, United States ...	2,000	13,000	+ 11,000
,, Other countries ...	2,000	1,000	− 1,000
Total	54,000	91,000	+ 37,000
Other electrical machinery.—			
From Great Britain ...	129,000	153,000	+ 24,000
,, Italy	9,000	8,000	− 1,000
,, United States ...	10,000	18,000	+ 8,000
,, Other countries ...	2,000*	1,000	− 1,000
Total	150,000	180,000	+ 30,000
Mining Machinery.—			
From Great Britain ...	63,000	65,000	+ 2,000
,, Switzerland ...	9,000	—	− 9,000
,, United States ...	58,000	38,000	− 20,000
,, Other countries ...	2,000	2,000	—
Total	132,000	105,000	− 27,000
Electric fans.—			
From Great Britain ...	19,000	23,000	+ 4,000
,, Italy	26,000	36,000	+ 10,000
,, United States ...	25,000	29,000	+ 4,000
,, Other countries ...	—	1,000	+ 1,000
Total	70,000	89,000	+ 19,000
Electric lamps and parts.—			
From Great Britain ...	40,000	47,000	+ 7,000
,, Holland	7,000	16,000	+ 9,000
,, Japan	1,000	4,000	+ 3,000
,, United States ...	4,000	5,000	+ 1,000
,, Other countries ...	2,000	1,000	− 1,000
Total	54,000	73,000	+ 19,000
Electric wires and cables.—			
From Great Britain ...	145,000	179,000	+ 34,000
,, Italy	1,000	3,000	+ 2,000
,, Japan	2,000	27,000	+ 25,000
,, United States ...	2,000	7,000	+ 5,000
,, Other countries ...	1,000	1,000	—
Total	151,000	217,000	+ 66,000

* Switzerland, £1,000.

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	1915-16. £	1916-17. £	Inc. or dec. £
Machinery, other (except textile, agricultural, and printing).—			
From Great Britain ...	387,000	387,000	—
,, Japan	2,000	7,000	+ 5,000
,, Italy	3,000	—	− 3,000
,, United States ...	30,000	56,000	+ 26,000
,, Other countries ...	12,000	10,000	− 2,000
Total	434,000	460,000	+ 26,000
Other electrical instruments, apparatus, &c. (except telegraph and telephone materials).—			
From Great Britain ...	257,000	309,000	+ 52,000
,, Holland	6,000	6,000	—
,, Japan	7,000	32,000	+ 25,000
,, United States ...	20,000	38,000	+ 18,000
,, Other countries ...	6,000	6,000	—
Total	296,000	391,000	+ 95,000
Scientific, &c., instruments.—			
From Great Britain ...	48,000	56,000	+ 8,000
,, France	4,000	1,000	− 3,000
,, United States ...	7,000	14,000	+ 7,000
,, Other countries ...	5,000	9,000	+ 4,000
Total	64,000	80,000	+ 16,000
Telegraph construction materials.—			
From Great Britain ...	10,000	6,000	− 4,000
Telephone construction materials.—			
From Great Britain ...	18,000	21,000	+ 3,000
,, Sweden	3,000	2,000	− 1,000
,, Other countries ...	1,000	2,000	+ 1,000
Total	22,000	25,000	+ 3,000

In addition to the foregoing, the following were imported as Government stores:—

Instruments, apparatus, &c. (except musical).—			
From Great Britain ...	171,000	261,000	+ 90,000
,, Other countries ...	1,000	1,000	—
Total	172,000	262,000	+ 90,000
Machinery.—			
From Great Britain ...	127,000	138,000	+ 11,000
,, United States ...	1,500	500	− 1,000
,, Other countries ...	500	—	− 500
Total	129,000	138,500	+ 9,500
Iron wire.—			
From Great Britain ...	16,000	40,000	+ 24,000
Telegraph construction materials.—			
From Great Britain ...	80,000	125,000	+ 45,000
Copper and copperware.—			
From Great Britain ...	128,000	92,000	− 36,000
,, New South Wales ...	193,000	159,000	− 34,000
,, Other countries ...	45,000	70,000	+ 25,000
Total	366,000	321,000	− 45,000

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

CHILE.—Shippers of goods from the United Kingdom to Chile should note that the Chilean regulations require that, when goods destined for Chile are transhipped *en route* to the Republic, the Chilean Customs, on the arrival of the goods at the port of destination, shall be furnished with a certificate issued by the Chilean Consul at the port of transhipment, attesting the operation of transhipment and the necessity therefor. A fine is imposed if this certificate is not forthcoming in such cases; and firms who ship goods to Chile should, therefore, take steps to secure that their agents at the port of transhipment shall obtain and forward the certificate to the consignees in Chile.

CHINA.—The existing specific rates of Customs duty leviable on goods imported into China by sea, which were fixed in 1901, are to be revised by an International Commission now sitting at Peking. This revision has become necessary owing to the general increase of values since that date, the rates fixed no longer yielding an effective 5 per cent. A new draft Tariff on a 5 per cent. basis will accordingly be drawn up by the Commission, which will, it is proposed, calculate the new specific rates on the basis of the average values of goods during the period 1911-13. The assent of the Treaty Powers is necessary before the new Tariff comes into operation.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C 1.

11,940. "Means for separating magnetic material." W. Bowle-Evans. July 22nd.

11,984. "Electric resistances." W. F. Jones. July 23rd.

12,011. "Magneto operating mechanism." E. C. R. Marks (Splitdorf Electrical Co., U.S.A.) July 23rd.

12,021. "Trolley heads, &c., for collecting electric power." S. Butler. July 23rd.

12,042. "Electric motor starters." C. Bonner, C. C. Garrard, P. H. Jackson & A. H. Railing. July 24th.

12,078. "Valves for wireless transmission systems." Edison Swan Electric Co. & C. E. Hiatt. July 24th.

12,086. "Apparatus for electrically controlling air-brakes. W. J. Mellersh (Waterhouse & Prince) & B. A. Prince. July 24th.

12,089. "Manufacture of ionic valves." Cosmos Lamp Works. July 24th.

12,090. "Train-controlling systems." P. H. Jackson (Waterhouse and Prince) & B. A. Prince. July 24th.

12,188. "Cores for Pupin loading coils, magnets, &c." Western Electric Co. (Western Electric Co., U.S.A.) July 26th.

12,189. "Electric heaters." J. H. Robinson & W. O. Workman. July 26th.

12,125. "Process for electroplating metals, particularly for coppering iron and steel." Q. Marino. July 25th.

12,132. "Portable electrical appliances." E. Medway. July 25th.

12,135. "Electrically-driven motor or engine." D. Fowler & J. Fowler. July 25th.

12,140. "Boxes or receptacles for electric fuses, switches, &c." L. Weekes. July 25th.

12,143. "Electric heating element." W. B. Smits. July 25th. (Holland, August 29th, 1917.)

12,145. "Ignition devices." Splitdorf Electrical Co. July 25th. (U.S.A., July 25th, 1917.)

12,201. "Insulators for supporting electric conductors on transmission lines, &c." Callender's Cable & Construction Co. & C. W. Kay. July 26th.

12,212. "Electric switches." H. N. Davis & W. R. Twigg. July 26th.

12,214. "Electrically operating mechanism from a distance." A. G. Bloxam (Russische Akt. Ges. L. M. Ericsson & Co.). July 26th.

12,217. "Relay for electric circuits." D. A. Christian. July 26th.

12,218. "Contacts of electrical switchgear." R. S. O'Neil. July 26th.

12,219. "Method for extracting zinc in electric furnaces." E. S. Bergund. July 26th. (Sweden. October 22nd, 1917.)

12,220. "Wireless control apparatus." D. Fehr & J. S. Gibson. July 26th.

12,238. "Telegraphing apparatus." W. Knowles. July 27th.

12,240. "Sparking plugs for ignition." A. E. Heath. July 27th.

12,262. "Incandescent electric lamps." D. K. Watney. July 27th.

12,266. "Electric heaters." J. R. Quain. July 27th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

15,008. Apparatus for regulating the voltage of dynamos. A. J. Jullin. June 9th, 1914. (101,887.)

1917.

3,558. Apparatus for the reception and utilisation of electric current impulses suitable for wireless or other telegraphy and telephony. W. J. Lyons & Selective Signal Co. March 10th, 1917. (117,090.)

6,320. Electrical heating apparatus. A. F. Berry. May 3rd, 1917. (117,099.)

9,371. Electrical telephones. G. M. Masters. June 29th, 1917. (117,113.)

9,573. Separators or non-conducting supports for accumulator plates. H. Leitner. July 3rd, 1917. (117,121.)

9,585. Electromagnetic vibratory interruptors. Marconi's Wireless Telegraph Co., H. M. Dowsett & W. Platt. July 3rd, 1917. (117,122.)

9,724. Voltage regulators. British Thomson-Houston Co. (General Electric Co., U.S.A.) July 5th, 1917. (117,128.)

9,747. Electric fuses. E. S. Conradi & L. Newitt. July 5th, 1917. (117,132.)

9,897. Electric buzzers. Marconi's Wireless Telegraph Co. & V. A. Smart. July 9th, 1917. (117,138.)

9,964. Distributing mechanism for electric ignition systems. Bosch Magneto Co. January 31st, 1916. (108,473.)

9,973. Distributing mechanism for electric ignition systems. Bosch Magneto Co. February 15th, 1916. (Addition to 9,964/17.) (108,475.)

11,392. Electric transforming and converting apparatus. British Thomson-Houston Co. (General Electric Co., U.S.A.) August 8th, 1917. (117,166.)

11,765. Selective signalling systems and selectively-operable devices therefor. Western Electric Co. (Western Electric Co., U.S.A.) August 16th, 1917. (117,170.)

11,820. Electric bells and the like. Automatic Telephone Manufacturing Co. & S. R. Smith. August 17th, 1917. (117,171.)

13,725. Electrical systems of power transmission and regenerative braking. British Thomson-Houston Co. (General Electric Co., U.S.A.) September 24th, 1917. (117,181.)

14,107. Locking electrical spigot and socket unions. W. Stewart. November 10th, 1916. (117,181.)

14,723. Electric switches. British Thomson-Houston Co. (General Electric Co., U.S.A.) October 11th, 1917. (117,188.)

15,331. Welded joints for metallic plating. Quasi-Arc Co. & W. L. Cole. October 23rd, 1917. (117,190.)

16,856. Sparking plugs for explosion motors. A. Ceffali. May 10th, 1917. (116,069.)

17,292. Electric batteries. A. A. Price. November 23rd, 1917. (117,209.)

1918.

3,305. Automatic telephone systems. Automatic Telephone Manufacturing Co. May 23rd, 1917. (116,075.)

3,870. Contact breakers for magnetos. Compagnie Generale de Magnetos. May 3rd, 1917. (115,620.)

6,899. Railway signalling. McKenzie, Holland & Westinghouse Power Signal Co. April 26th, 1917. (115,239.)

8,143. Wireless and other telegraphic or telephonic receiving apparatus. W. J. Lyons & Selective Signal Co. March 10th, 1917. (Divided application on 3,558/17.) (117,247.)

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VOL. LXXXIII. AUGUST 16, 1918. No. 2,125.

ELECTRICAL REVIEW.

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BRITISH SCIENTIFIC PRODUCTS.

THE crisis of a devastating war would not, at first sight, appear to be an auspicious moment for the holding of an exhibition; but, as in other relations, everything depends upon the circumstances, and in this case the circumstances are unique and cogent in the extreme. We refer to the Exhibition of British Scientific Products which was opened on Monday last at King's College, London, and which has been organised by the British Science Guild to show what has been accomplished by British scientific industries during the past four years of war, and to impress upon the nation the fact that, if it chooses to encourage and develop the talent and ability which it possesses, it can face the future with perfect confidence. In spite of the numerous articles that have appeared in the technical and lay Press, there is no doubt that many members of the public do not yet realise that, spurred on by the national needs in the most threatening emergency that we have ever faced, and protected from destructive competition by the very fact that we are at war with our competitors, our technical and scientific workers have accomplished *miracles*. They have utterly exploded the popular idea, so carefully fostered by our enemies, that scientific production was a German monopoly; and not content with equalling the pre-war German products, they have in numerous instances far excelled them. Consider what this means.

The scientific *personnel* of British manufacturing industry when war broke out was far below what it should have been even in normal times, and still more inadequate to cope with the stress of war conditions; it was further depleted by the enlistment of many of its brightest members, who, alas! will never resume their labours in this sphere: labour was scarce, and in some industries skilled labour was absolutely non-existent in this country; materials and machinery were lacking; technical processes were unknown and had to be worked out afresh by patient but "intensive" research. Are we not justified in claiming that, in these extremely arduous conditions, which might well break the hearts of lesser men, our manufacturers and their technical staffs and workpeople, under the guidance of our scientific experts—who alone could supply the keys to the secrets which had to be unlocked—achieved the impossible, and, therefore, accomplished miracles?

But what have they done? may be asked by the reader whose own endeavours to advance the national cause have restricted the range of his reading and observation. The British Scientific Products Exhibition is intended to supply the answer; there it will be seen that apparatus and materials of which the supply was formerly monopolised by our enemies, are now made by British hands; that processes which the Germans took long years to develop have been equalled and surpassed by us in as many months; that as we have done without the German supplies for years, so we can dispense with them for ever. We cannot here attempt to schedule the items exhibited: there are some 200 exhibitors, few of whom are unable to show products developed during the war to replace former imports. Optical glass, important drugs, potash, hard porcelain, tungsten, magnetos, certain insulating materials, lamp bulbs, glass wool, thermit, searchlight and furnace carbons, dry cells, electromedical apparatus, photographic materials, dopes for aeroplanes, laboratory glassware, miners' lamp-glasses, synthetic dyes, refractory materials—all these are well-known products which formerly were more or less wholly German monopolies, but are now manufactured here in large quantity and of first-class quality. But these are only the items that may be shown to the public now; there

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are many others of which, in the national interest, it is not expedient to speak at present. Even so, there is abundance of evidence to prove beyond all doubt that when the British are put to the test, they can equal and outclass their German rivals, even when heavily handicapped.

Once more let us point out that certain conditions were necessary, to enable our industrialists and scientists to demonstrate their mettle: the compelling incentive of a national emergency, the support of the Government, and protection from the cut-throat methods of German competition. What the last-named means may well be exemplified by the case of photographic paper. At least one British firm, before the war, had developed the manufacture of this material to the commercial stage, and endeavoured to secure a market; retailers were ready and willing to take up the sale of the British product, but the German manufacturers held the field, and those retailers were compelled to carry on the negotiations in the strictest secrecy, for if the Continental combine controlling the trade became aware of the attempt to market British paper, it would immediately boycott the firms concerned and ruin them. It will be seen that the ability to bring about such a result was a trump card in German hands, and this explains why many commodities which could perfectly well have been made in this country, and which manufacturers were anxious to make, could not possibly be put on the market—truly a deplorable state of things, which must never again be permitted to exist. It is obvious also that not only individual, but also co-operative, action was powerless in the face of such an obstacle, for the consumer would insist on having the brands to which he was accustomed, and the German threat of cutting off the supplies compelled distributors to toe the line.

The war has changed all that; the consumer has had to accept the British product, and finds that it is as good as the German. The charm is broken. But even as, before the war, the situation was insoluble without the intervention of the State, which but for the war would never have been granted, so after the war the aid of the Government will be indispensable to prevent the flooding of our markets with cheap German products and the return of the old conditions. There is no possible alternative in the face of the German system.

The catalogue of the British Scientific Products Exhibition contains 100 pages of articles on recent developments, by experts in a score of industries, articles which alone would constitute a work of absorbing interest; and again and again in those essays the same note is struck—in quality we can hold our own; our scientific resources, though undeveloped, are unexcelled; but all will prove of no avail against German State-aided methods of competition unless our manufacturers are protected from their ravages.

Another feature of these articles is the hopeful tone with which they are pervaded—the assurance that in the future, as during the war, the British Empire can, and will, be self-supporting in all essential industries. But this is subject to the proviso that manufacture is carried on under scientific conditions, and supported by the State. The inevitable corollary is that training in science must in future be developed on a vastly greater scale than heretofore. As Prof. Gregory, chairman of the Exhibition Organising Committee, pointed out in an address to the technical Press on Monday, in the United States there are 40,000 students under training as technical experts; in Germany, 17,000; in the United Kingdom, barely 5,000. The funds devoted to the purpose by the respective States vary in a similar ratio; and in the past the prospects offered by our manufacturers to their technical experts have been too poor to attract men into such careers. The necessity for radical reform is as imperative as it is obvious. The root of the trouble is our government by men exclusively trained in a classical atmosphere and utterly ignorant—as the war has proved to demonstration—of the most elementary facts of science, while their whole environment has instilled into them contempt for trade and industry—a heritage from feudal times, fostered by our ancient Universities, which has cost us untold wealth in blood and treasure in this war. Had we been governed by men of affairs instead of politicians, there would have been no war.

Wire Manufacturers and Merchants.

The attitude in the past of British wire manufacturers towards merchants in the trade, while containing nothing hostile in its nature, according to views several times expressed by merchants, has not been encouraging from the point of view of the general welfare of the trade. The opinion was expressed some years ago by a director of an important firm of copper wire manufacturers that there was very little need for merchants in the trade, on the grounds that manufacturers seldom found it necessary to go in search of orders, and that the trade was confined almost exclusively to one industry, the electrical.

At the time this view was expressed, Germany was exporting into this country copper wire, strip, &c., to the value of over £300,000 per annum, which, at the present basis price of copper, would be equivalent to about £800,000 per annum. America was also sending large quantities, and preparing greatly to increase the total. The fact would, therefore, appear to be that a huge amount of merchanting must have been going on in this country before the war, but the *beneficiaries*, instead of being British, were mostly German and American. If it is true, as has been stated, that it was often far easier to sell German wire than British in this country before the war, the cause was probably due to the fact that German wire was the more freely obtainable and sold under fewer restrictions. If, in view of these facts, the British manufacturer had little occasion to go in search of customers, which may be taken to imply that he had as much trade as he could conveniently cope with, either there was need for a considerable expansion in the manufacturing section, or the distributing organisation was not as comprehensive as it might have been.

It will doubtless be recalled, however, that there were frequent occasions in the past when British wire manufacturers, particularly in the fine-wire section, experienced slack periods, some of them of protracted duration. In the full year before the war, 1913, when the German manufacturers exported more fine wire into this country than ever before, there was in two at least of the largest British firms a distinct slackness in this section. Yet these two firms could probably have been maintained on full time had they offered inducements to merchants, or had they even sent out representatives to obtain the orders that were directed elsewhere. It will, perhaps, be admissible that as regards these two cases, which control about a quarter of the country's influence in the copper wire manufacturing industry, the observation that there was little need for merchants was not entirely applicable.

After the war, the demands upon British wire manufacturers will probably for some time greatly exceed their capacity for output, and their undivided attention will be most advantageously employed in the production of manufactured goods rather than in distribution. A few reliable and experienced merchants attached to a firm might prove of great service, especially as regards the handling of the multiplicity of small orders, as also in the shipping section. We have reason to believe that several propositions as regards merchanting have been submitted to American firms by Englishmen, highly experienced in the wire and electrical industries, who are uncertain of the future attitude of the British firms. This also is without taking into consideration the possibility of German wire finding its way through neutral sources into this country, supposing that German goods be placed under an embargo.

The British wire manufacturers have, however, displayed on many past occasions a high capacity for adapting themselves to improved methods both of manufacture and distribution; and this capacity, supported with the lessons the war has taught this country, will doubtless prove equal to whatever demands are made upon it. At the same time, it has to be carefully borne in mind that present conditions demand a more accelerated decision than those of the past; and to this end a still closer co-operation of interests in the trade generally will probably be found quickly to justify the enterprise.

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REGENERATIVE ELECTRIC RAILWAYS.

[COMMUNICATED.]

At the present time, when much discussion is taking place relative to possible methods of saving coal, the question of introducing regenerative systems on electric railways presents itself. Much less is heard about regenerative electric traction in these days than in the past. So far as electric tramways are concerned, the idea of returning energy to the line has not met with the widespread favour that some expected; but on certain electric railways, notably on the Continent and in America, the regenerative principle is making headway. On railways the system shows up to better advantage, owing largely to the greater amount of kinetic energy available, and in a smaller measure to the higher efficiency of the equipment. The system most suitable for regeneration is, of course, the three-phase system as employed mainly in Italy. A three-phase motor of ordinary design will readily act as a generator if the speed of the rotor exceeds that of the revolving field, and on railways possessing steep gradients three-phase regenerative equipments have, as is well known, given excellent results. When regenerative control is used in connection with locomotives on mountain grade sections, the saving in energy is not by any means the only advantage secured. On such railways more accidents occur when trains are running down gradients than when they are ascending gradients.

Accidents may arise as the result of overheated brake shoes and wheels. For the operation of heavy trains on steep gradients the regenerative principle offers marked advantage from the point of view of safety because it provides a better means of holding trains than is obtainable with any air brake system. The motors, however, always depend upon the generating station for their exciting current, irrespective of whether they are acting as motors or asynchronous generators; hence, if the supply fails, the electric braking system no longer remains active, and mechanical brakes must be brought into action. Another point to be noted is that induction motors will only regenerate on the level by bringing into action multiple-speed control, for these motors will not act as generators unless the speed of the rotor exceeds that of the rotating field. With the two-speed cascade control system, for instance, it is only possible to make the motors regenerate on the level by connecting the motors in cascade, and the braking action ceases as soon as the synchronous speed of the combination is reached. The control of the speed whilst the motors are regenerating can only be effected by inserting resistance in the rotor circuit, which naturally impairs the efficiency, but rheostatic losses can be minimised by employing a four-speed equipment.

When trains are running down gradients the economy is well marked, for there is not, as a rule, any necessity to insert resistance in the rotor circuit, and the energy returned to the line is equivalent to the work done by gravity less the usual electrical and mechanical losses. For a given frequency light trains will, under these conditions, descend gradients at practically the same speed as heavy trains, although, at the sacrifice of efficiency, the speed can be varied at will by introducing additional resistance into the rotor circuit. A difficulty sometimes met with in connection with regenerative electric traction systems is that the energy returned to the line occasionally exceeds the demand on other parts of the system, when the surplus energy must be absorbed in water resistances. But in the case of stations that deal with other loads, in addition to traction load, this trouble does not, as a rule, present itself.

In this country, where the direct-current system predominates, no attempt has been made to apply the regenerative principle to railways; but, needless to say, this is not because the direct-current system does not lend itself to regeneration. It is true that three-phase motors will regenerate more readily, but against this must be set the fact that the three-phase system demands two overhead wires. The overhead equipment is, therefore, more expensive to erect and maintain as compared with systems involving only one overhead conductor, and there is a greater risk of breakdown.

With the direct-current system the main difficulties associated with regeneration arise in connection with the motors, but these difficulties are not by any means insurmountable. The fact that the locomotives constructed for the Milwaukee and St. Paul Railroad are designed for regeneration proves, if proof be needed, that the regenerative system is applicable to direct-current railways. There may be possibilities for the regenerative system on interurban and suburban direct-current lines where the runs are short and stops are frequent.

It has been estimated that the power used for propelling trains in some cases is less than that used in grinding up brake-shoes. Under such conditions it seems that a simple and effective regenerative system would be distinctly advantageous. Among other things that have to be taken into account, however, is the fact that the motors would be somewhat larger and heavier than present machines. On lines such as those under consideration, the motors, under existing conditions, only carry current intermittently, whereas electric braking might involve their carrying current nearly all the time. Furthermore, regenerative equipments are necessarily more complicated and more expensive than standard direct-current equipments. So far as the size and weight of the motors are concerned, the difficulties might be considerably minimised by the use of forced ventilation. But as the standard direct-current traction motor is of the series type, it cannot be used directly as a traction generator. Either a shunt winding must be provided in addition to the series winding, or the latter must be separately excited at low potential. A system of regenerative control, differing from the ordinary direct-current systems as applied to electric tramcars, has been tested on the Metropolitan Railway of Paris, and it has been found that the energy consumption is at least 20 per cent. lower than that of a standard equipment. The system, however, involves the use of a combined booster and exciter set, the booster being used for starting and speed regulation as well as for boosting up the generated voltage during the regenerative period. Rheostats are, therefore, eliminated, and an efficient control system is secured. The booster is permanently connected in series with the traction motors, and the exciter, which is directly coupled to the booster, is made to excite the driving motors when it is desired to cause them to return energy to the line. The boosting and exciting set is, of course, an additional unit not met with on trains working under ordinary conditions, and the set naturally requires energy to drive it. So far as general operation is concerned, the system appears to be quite satisfactory, but opinions may differ as to whether this is the best and most efficient method of grappling with the problem.

On single-phase railways the regenerative principle cannot be adopted nearly so easily as on three-phase railways, or even on direct-current railways. Many experiments have been carried out with regenerative single-phase locomotives, especially on the Continent. With series compensated motors there is no difficulty in obtaining an electric braking effect. If a resistance be connected across the terminals of a series single-phase motor, the machine will act as a series-wound generator in the same way as an ordinary tramcar motor. This will, of course, give a braking effect, but when it comes to returning energy to the line, matters become rather more complicated. If a single-phase series motor be connected to the secondary of the transformer it will also act as a direct-current generator, and the current is limited only by the ohmic resistance of the windings. Evidently, then, it is necessary, in order to make a single-phase motor generate alternating current, to excite it separately. It is necessary, moreover, to pay due attention to the phase of the regenerated current. Nothing is to be gained by sending wattless current into the line, and it is in this connection that many single-phase regenerative equipments have proved unsatisfactory. Among other single-phase lines on which regeneration has been called for are the electrified lines of the Midi Railway in France. On the experimental line from Villefranche to Ille the motors of the experimental locomotives had to be capable of sending energy back into the overhead system. The firms that submitted locomotives did not all tackle the problem in the same way, and in some

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cases the results were not altogether satisfactory. One firm using series compensated motors first adopted the plan of exciting one motor from the armature of the other, the motor so excited returning energy to the line. But afterwards this plan was abandoned, and, instead of returning energy to the line, it was dissipated in a resistance fitted to the locomotive. This scheme, as already pointed out, is quite satisfactory as far as electric braking is concerned, but it obviously does not lead to economy at the generating station. During the trials it was found possible to brake a 100-ton train on a 1·7 per cent. gradient, and to regulate the speed between 62 and 10 km. (38 to 6 miles) per hour. The most interesting and most satisfactory regenerative scheme was that employed on the locomotive built by the Ateliers de Constructions Electriques du Nord et L'Est, although, unfortunately, the equipment is a little complicated. Current for exciting the motors during the regenerative period cannot be taken directly from the main transformer, because in this case the energy sent back into the line would have a considerable phase difference with respect to the supply pressure. It is necessary, in order to obtain the desired results, to excite the motors from a circuit in which the voltage has a phase difference of 90° with respect to the supply voltage, and under these conditions the pressure at the terminals of the motors, at no load, will be in phase with the line pressure. When the motors begin to regenerate, however, the armature current will not be in phase with the armature E.M.F., and, in order to maintain the proper phase relation, the phase of the exciting current should alter with the regenerated load. Given these conditions, the regenerated current can be regulated at will by changing the transformer tappings with the aid of contactors, or with an induction regulator in the secondary circuit. In the case of the 1,500-H.P. locomotive under consideration the voltage is controlled entirely by induction regulators which are incorporated in the transformers. The voltage during the starting period is governed by these regulators, which also serve for controlling the energy returned to the line during the regenerative period. Transformer tappings and contactors are, therefore, unnecessary. During the regenerative period the main driving motors are excited by connecting the field windings to a special winding on the auxiliary motors which drive the air compressors and blowers whilst the armature and compensating windings of the main motors remain in series as under normal running conditions, and are connected to the main transformers through the induction regulators. The special windings on the stators of the compressor motors, which excite the main windings on the driving motors during regeneration, are displaced 90° with respect to the main windings of the compressor motors; hence at no load the voltage generated by the main motors has the correct phase relation for returning energy to the line. Current can, therefore, be drawn from the driving motors whilst the locomotive is descending a gradient or whilst being brought to a standstill by making the induction regulator voltage assist the regenerated pressure. But in order that the regenerated current should maintain its proper phase relation with respect to the line pressure, the phase of the exciting current must alter with the amount of regenerated load. The phase of the exciting current is changed by a "compensating" transformer and a series transformer, the primary of the latter being in series with the main secondary circuit through which the main current passes. The secondary of this series transformer is in series with the primary of the compensating transformer, the compressor motor, and main transformer, whilst the secondary of the compensating transformer is shunted across the special exciting winding on the compressor motor which excites the main driving motor.

There is little doubt, however, that where regenerative braking is required the so-called split-phase system is much better than the plain single-phase system. It is well known that with this split-phase system, which has been adopted on a section of the Norfolk and Western Railroad in America, the single-phase current collected from the overhead wire is converted into three-phase current in phase converters, and afterwards supplied to three-phase induction motors which drive the locomotives. In practice the phase converters resemble induction motors with two stator windings displaced by 90°. One winding is connected across the secondary of the main transformer, the ends of which form two of the leads belonging to the three-phase circuit which supplies current to the three-phase driving motors. The other winding of the phase converter has one end connected to some intermediate point on the main transformer, the opposite end of this winding forming the third wire of the three-phase circuit. With this simple arrangement the single-phase current collected from the overhead wire is converted into polyphase current, and all the advantages of three-phase induction motors for driving purposes are obtained. In order to secure a good power factor, however, the rotors of the phase converters are provided with an exciting winding in addition to a squirrel-cage winding, and this exciting winding is fed with direct current from a D.C. exciter.

An equipment of this kind is reversible—that is to say, when the locomotives are running down gradients the three-phase induction motors will act as asynchronous generators in the ordinary way, and will feed three-phase current back into the phase converters, which change it into single-phase current, which is fed into the line. On the Norfolk and Western Railroad the regenerative properties of the split-phase locomotives have proved highly beneficial, and there appears to be no doubt whatever that when regeneration is required on single-phase systems the use of phase converters on locomotives, at any rate, is to be recommended, quite apart from the advantages which arise from the use of three-phase driving motors.

AN EFFECT OF SUBSIDENCE ON ELECTRIC MAINS.

By W. FENNELL, M.I.E.E.

Brine pumping at Northwich not only supplies an article of universal consumption on which several industries depend, but also furnishes a series of engineering problems. There are two beds of rock salt underlying the town—each about 100 ft. thick. The first is met with at a depth of about 100 ft., and a bed of marl about 30 ft. in depth separates the two salt beds. Brine is formed by the action of fresh water which reaches the upper salt bed through the alluvial soil which overlies it, and as the brine runs towards the pumps the salt is eroded in an uneven manner. The soft upper soil, of course, easily follows the uneven top surface of the salt: local subsidences result, and many of these are in the centre of the town. There is a Compensation Board provided with funds to compensate owners of buildings affected, but, unfortunately, its benevolences do not as yet extend to the owners of gas and electricity undertakings.

Visitors to Northwich have recently been able to see an interesting example of the result of a subsidence in one of the main streets of the town. This street runs parallel to the River Weaver. During the last few years there has been a subsidence of about 8 ft. in the centre of a stretch about 100 yards long, so there is an incline of about 1 in 30 each way towards the middle. Buildings were, of course, thrown out of the vertical. Sewers, gas and water mains have been fractured, and electric cables have been strained to such an extent that they have pulled the joint-box fittings into contact with each other, or the cable ends have drawn out of the terminal sockets. The subsided surface of the road was but a little higher than that of the adjacent river, and owing to the porous nature of the soil, premises became unhealthy, and all mains, including sewers, were water-logged.

A partial restoration of the levels, amounting to a rise of 3 ft. in the centre of the depression, is now in full swing, so that conditions will, it is hoped, be tolerable until after the war, when another lift is contemplated. Raising the surface involves also the corresponding lifting of buildings and their surroundings, and also of all mains and services: otherwise the latter would in a few years be completely

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ruined by continued extension, even if they were not practically lost in the depth of made-up ground.

It may be imagined that very special precautions have to be taken in the choice of a cable system, and in the lay-out to cope with these conditions. Fortunately, experience has accumulated in the 20 years of public electricity supply in the town, during which many of the weak spots have been removed.

In raising electric cables, every care has to be taken to provide for further subsidence; the cable must be relaid with slack provided in such a manner that it can again straighten out in following the road surface in its downward course.

There are at times secondary effects of subsidence the reverse of what one would at first sight expect. The illustration shows one of these curious cases. Subsidence has been made up on previous occasions with boiler ashes, and in the present case there has been a movement not merely vertically downwards but in an inclined direction due to the slope and to the loose nature of the ground. The horizontal component of this motion was shown by the lifting

Corkscrew effect on Cable due to Subsidence of Ground.

of the pavement at the middle of the dip, and on excavation some of the cable slack was found to have been carried with the ground down both slopes to the lowest point. The surplus cable had to go somewhere, so it has formed a corkscrew! The cable is ·15 sq. in. area triple-concentric, lead-covered, and armoured, and was made by the B.I. and Helsby Cables, Ltd. The diameter is 1½ in. over the lead and about 2¼ in. over all. The radius of the curve formed is 4½ to 5 in. So far as can be ascertained, the cable is uninjured. If there had been a joint box at or near the spot it is probable, unless precautions had been taken in laying, that the fittings would have been forced out of place, and a short-circuit formed. It is not proposed to straighten the cable any more than is necessary to work some of the slack back up the inclines. There is a somewhat similar kink on the distributor on the opposite side of the road, so that the result shown is a characteristic one, caused by the conditions, and is not due to accidental circumstances.

The illustration shows incidentally the method of building and of raising houses in the unsettled areas. A special design of building has been evolved to meet the conditions. A very strong underframe carries timber uprights; the brick walls are 4½ in. thick, wedged in between the timbers. The whole structure is strongly braced to resist racking due to uneven subsidence, or to the treatment it receives during lifting operations. The underframe is supported on the brick walls, which are built up to 6 in., or even 3 ft. or more above ground level, to allow of the road being raised a moderate amount without lifting the building. The top course of bricks is specially perforated to allow of free access of air to the timber underframe. Ceilings and internal wall linings are usually either match-lined, or are of uralite or other sheeting. It is interesting to note that not only do the local building by-laws allow this light construction with walls thinner than the standard, but the conditions imposed by the Compensation Board practically prohibit the erection of new buildings in the subsiding areas in any other manner. One at first thinks the buildings must be very ancient, but the designers of even the most recent are by circumstances compelled to follow the old timbered style of architecture which is the pride of our ancient country towns.

When the buildings are lifted plentiful supplies of screw jacks and packing are provided by the Compensation Board. The supporting wall is cut away as necessary, and is used as the jacking base. The building shown in the illustration has just been lifted 3 ft.—"Business as usual" being the motto of this china shop. The rough steps will, of course, be removed when the pavement is re-laid at its new level. The final packing is in place ready for the new brickwork which will be carried up from the old foundation.

IMPORT TRADE OF CEYLON.

The following figures, showing the value of the imports of electrical and allied material into Ceylon during 1916, are extracted from recently-issued official statistics. The values for the previous year are given for purposes of comparison, and notes added of any increases or decreases:—

	1915. Rupees.	1916. Rupees.	Inc. or dec. Rupees.
Manufactures of copper.—			
From United Kingdom ...	45,000	19,000	– 26,000
,, India	20,000	26,000	+ 6,000
,, Other countries ...	2,000	7,000*	+ 5,000
Total	67,000	52,000	– 15,000
* Japan.			
Electrical materials.—			
From United Kingdom ...	118,000	253,000	+ 135,000
,, India	—	14,000	+ 14,000
,, Other countries ...	8,000	16,000*	+ 8,000
Total	126,000	283,000	+ 157,000
* United States Rs. 8,000.			
Scientific instruments.—			
From United Kingdom ...	16,000	20,000	+ 4,000
,, India	3,000	7,000	+ 4,000
Total	19,000	27,000	+ 8,000
Lamps.—			
From United Kingdom ...	62,000	123,000	+ 61,000
,, Japan	11,000	31,000	+ 20,000
,, Other countries ...	34,000	66,000*	+ 32,000
Total	107,000	220,000	+ 113,000
* United States Rs. 32,000.			
Machinery, foundry and workshop.—			
From United Kingdom ...	554,000	708,000	+ 154,000
,, United States ...	5,000	22,000	+ 17,000
,, Other countries ...	2,000	2,000	—
Total	561,000	732,000	+ 171,000
Other machinery, dutiable, not including tea, textile, and oil-making.—			
From United Kingdom ...	13,000	43,000	+ 30,000
,, Other countries ...	3,000	11,000*	+ 8,000
Total	16,000	54,000	+ 38,000
* United States Rs. 9,000.			
Ditto, free.—			
From United Kingdom ...	625,000	828,000	+ 203,000
,, Germany	8,000	—	– 8,000
,, United States ...	14,000	87,000	+ 73,000
,, Other countries ...	183,000	23,000	– 160,000
Total	830,000	938,000	+ 108,000
Telephone materials.—			
From United Kingdom ...	11,000	11,000	—
,, Other countries ...	—	8,000*	+ 8,000
Total	11,000	19,000	+ 8,000
* United States Rs. 5,000.			

N.B.—15 Rupees = £1.

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MINING ELECTRICAL ENGINEERING.*

By CHRIS. JONES, M.I.E.E.

(*Continued from p.* 127.)

It is necessary to consider the installing of reactance on systems of present-day magnitude in order to limit the mechanical stress imposed on every winding in the main circuit by the current flowing through a fault between phases, and this is best secured by inserting the reactance at a point where all such fault currents must pass, that is, at the generator terminals.

The types of cables commonly used are vulcanised rubber, paper, sheathed with lead or vulcanised bitumen, and vulcanised bitumen throughout. Vulcanised rubber is rarely considered for shaft and roadway cables on account of its high price. The writer has used this type extensively for interconnections between motors, switch and control gear, &c. In some cases a sheathing of vulcanised bitumen has been applied over the rubber insulation, owing to the deleterious chemical action in positions where the cables were installed. This is also to be highly recommended over the armour of other type of cables in special cases, as met with in some mines. Paper cable has been extensively used in mines for shaft and roadways with success. For overhead suspension the writer has used this type, but without the lead sheath. It is claimed that a paper cable has great advantages over bitumen in that it possesses greater dielectric strength. This is scarcely relevant, since, although the dielectric strength of paper is higher than that of bitumen, the latter is quite suitable for all usual colliery working pressures. Ths writer has used vulcanised bitumen cables on E.H.T. successfully. It is also claimed that paper cable can be worked at higher temperature, and therefore at a greater current density. Paper cables can certainly be worked at a higher temperature than vulcanised bitumen. This, however, does not necessarily imply that a greater current density is possible, since the construction of the latter type provides better means of dissipating heat generated in the cable by C^2R losses, owing to the increased thickness of dielectric. The overall diameter, and consequently the area of radiating surface, of a vulcanised bitumen cable is considerably greater than that of a paper cable with a similar size of conductor. In practice, the question of temperature limitations is rarely a deciding factor, as the sectional area of the conductors is usually determined by the permissible loss of volts in transmission, which keeps the current density well within these limits. For portable machines, such as coal cutters, &c., the cab-tire sheath cable excels any other type in all respects, but the writer thinks that cable makers would greatly add to the safety of the working of portable apparatus if an earth chield was made to surround the cores of such cables. The writer was called to inspect and report upon an electrical installation, and when visiting a portable machine the size of the trailing cable immediately caused doubt as to the earth core being that called for in the H.O. Rules. Upon thorough investigation of cable ends these doubts were confirmed, the earth core being about 15 per cent. of the section called for in the rules. The cable in question was supplied through agents who supplied the machine, and who evidently were not

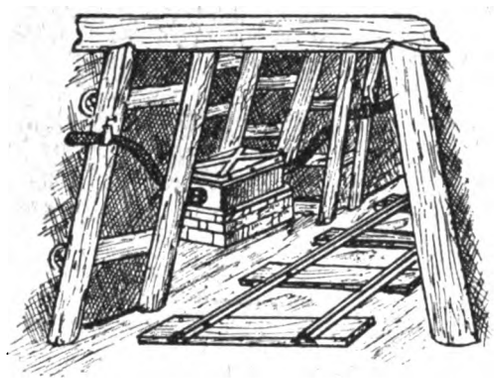

Fig. 5.—Cables Leading in to Joint-box at Back of Timers.

aware of the clause regarding minimum size of earth conductors, viz., 0.022, although the specification read that all was in conformity with the H.O. Rules. Such cases as these are liable to get colliery owners and officials into unpleasant positions.

Cable manufacture is of a very high standard (by reputable makers), and there is no cause to complain. The writer has a large area underground and overhead covered by high- and low-tension, and can say that for the last six years not a single fault has developed due to faulty manufacture Some makers seem to think that to deliver cables with space of ¼ in. and ⅜ in. between armour wires is not detrimental to the cable; but it is certainly so, as it means that when the jute serving is cut off, which is a common occurence due to falls of roof, the layer of armour becomes quite loose. It also makes it easier for sharp tools making contacts with cores to make it alive, and is liable to allow moisture to get in and corrode the armour wires in course of time, as some pit waters attack cables badly. Cables may be installed underground, suspended on road side, at centre of road, and about 6 in. from the floor. The author does not recommend the burying of cables. It is sometimes difficult to fix the cables in order to meet the requirements of the Coal Mines Act and Electrical Rules, so that the above alternative methods have to be adopted. Cables require the greatest care when installed. A common occurrence is to find at joint-boxes and gate-end switches the cables leading in front of the timber instead of at the back, as shown in fig. 5, which is the safest method in view of tubs being derailed. Another matter is the short bends given to cables. Fig. 6 shows the class of bend which cables should receive when leading in and out of switchgear, but, of course, underground conditions do not always allow of the necessary

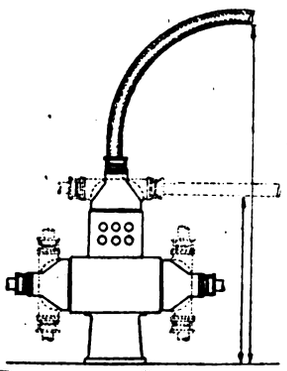

Fig. 6.—Bend which Cable should receive.

height for such bends. It would be advisable to refer some switch designers to figs. 6 and 7, which afford alternative methods when height is not obtainable. It would appear that, owing to recent legislation and past experience of mining electrical plants, the last word has been said *re* cable installation and wiring; but this is not so, as recent electrified collieries have resorted to the use of very low grade insulated cables in steam piping on 500-volt circuits where a great deal of vibration takes place, such as on screens, &c. In another instance, on surface and underground, slip conduit is used on a 500-volt system. This latter practice is highly dangerous. Another instance may be given of single conductor armoured cables being used underground on a three-phase sectional system.

It is essential to give serious consideration to area of feeders when coal-cutting developments are in progress in view of the advancing of coal faces, and the tendency is to overlook the voltage drop question, which is the cause of a great deal of motor trouble. There is also the question of the conductivity of the armour of high-tension systems when transformers are used. This should be equal to 50 per cent. of low-tension feeder, unless an efficient earth plate can be placed in-bye, which is not often obtainable, or unless an earth core forming an integral part of the cable is used.

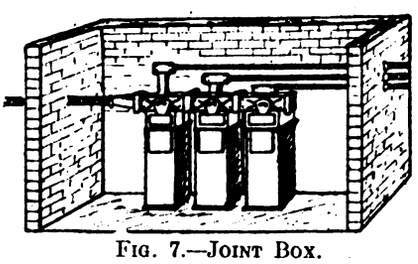

Fig. 7.—Joint Box.

which is the best. The installation of duplicate cables in upcast and downcast shafts is worthy of consideration in view of accidents, so as to enable the most important parts of the colliery to be worked, such as fans and pumps. The recording of areas and length of individual cables, is essential in order that such may be available for fault-finding purposes. The cables should be periodically painted to preserve the jute serving. When inquiring for cables the fullest information should be given to the makers in order that they may offer the best cable for the conditions. The question of overheating of cables is often overlooked.

The ordering of cables should not be left to stores clerks, &c., who simply look at cable makers' lists for a cable to carry so many amperes. Two or three recent cases may be cited where cables have been ordered in this manner. The section that will carry the number of amperes required is purchased. This policy has been the cause of a great many electrical breakdowns. The question of the testing of trailing cables deserves special attention. The greatest care

* *Proceedings*, South Wales Institute of Engineers. Vol. 34, No. 2. Abstract.

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should be taken to maintain the conductivity of the earth conductor equal to that required by rules. The practice of testing such cables with galvanometer is useless, as, for instance, an earth core of 91/0.018 complies with the requirements, but even one strand missing will make such uncompliable, and even if there is only one strand continuous a deflection could be obtained. The best practice is to test for ohmic resistance, or pass full load current through earth core at least once per week, which is the author's practice; also, double working pressure should be applied to such cables weekly, and a continuity test applied with low resistance bell and battery daily is useful. Several accidents have occurred in the past due to defective earth conductors in trailing cables, and it is imperative, therefore, that the strictest attention be given to such cables. The use of armoured cables of single and multi-core types is to be highly recommended for signalling, telephoning, and lighting circuits underground, and for interconnecting motors and switchgear. The use of bare lines is troublesome.

Transformers will be more called for in future than generating plants. When considering the type of transformer, it is often overlooked that for large size the forced-cooled type is cheaper than oil-immersed self-cooled type, and that the oil-immersed self-cooled type is cheaper than the natural-air-cooled type. Another point which appears a very elementary one is the calling of, say, 200-KW. transformer without mentioning the power factor when the K.V.A. output of 200 is really meant. The overload capacity is important. The question of the advisability of having any overload capacity, and, if so, the value, should be carefully considered, as this materially alters the price of the transformer. When purchasing transformers, due consideration must be given to capitalising losses. The losses of competitive offers should be carefully studied and capitalised on the basis of the cost of power, and in many cases it is surprising how soon the better transformer pays for itself, due to its lower losses. The overload capacity of competitive offers should be carefully studied, unless they are of common basis. The question of single- and three-phase is worth consideration. It is essential that the transformer be of sound mechanical construction.

When considering oil-immersed and air-cooled transformers, it must be borne in mind that the oil-immersed type has a much longer life, as oil acts as a preservative on the insulating material. When considering offers of transformers with a number of tappings, care should be taken to see that the K.V.A. output is the same for the various ratios. This is apt to be overlooked. It is essential that good quality oil should be supplied, even if it costs a little more, as it would easily pay for itself. The writer has found the Ferranti float device a very efficient method of preventing sludging of the oil. It is quite common to see tranformers supplied with no provision made for finding temperature, and, after all, the life of a transformer depends upon this factor. Cases are known to the writer where low load conditions give greater heat than full load.

(To be concluded.)

WATER-POWER IN THE BRITISH EMPIRE.

The preliminary report of the Water-power Committee of the Conjoint Board of Scientific Societies has just been issued. This committee was appointed "to report on what is at present being done to ascertain the amount and distribution of water power in the British Empire," and with this in view the Committee has endeavoured to collect all available relevant information. Sir Dugald Clerk was chairman.

The main conclusions to be drawn from the evidence available to the Committee are:—

That the potential water-power of the Empire amounts in the aggregate to at least 50 to 70 million horse-power, much of which is capable of immediate economic development; that except in Canada and New Zealand, and to a less extent in New South Wales and Tasmania, no systematic attempt has as yet been made by any Government department to ascertain the true possibilities of the hydraulic resources of its territories, or to collect the relevant data; that the development of the Empire's natural resources is inseparably connected with that of its water-powers; and that the development of such enormous possibilities should not be left to chance, but should be carried out under the guidance of some competent authority.

In view of these conclusions the Committee submits the following recommendations:—

1. That the British Government bring before the notice of the Indian Government, of the various Dominion Governments and of the Governing Bodies of the Crown Colonies, the necessity, for a close, systematic investigation of all reasonably promising water-powers, and of their economic possibilities.

2. That the British Government take steps to ascertain whether the Governments concerned are prepared to undertake this work.

3. That where such an inquiry is beyond the powers of any governing body, the British or Imperial Government place the work under the direct control of an "Imperial Water Power Board" or "Conservation Commission."

4. That the Government take steps to initiate the formation of such an "Imperal Water Power Board" or "Imperial Conservation Commission," to include a representative from each of the Dominions and Dependencies.

5. That this board act in an advisory capacity.

6. That since it is unlikely that private capital will be available for many years for hydraulic development on any large scale, powers should be obtained to enable the State to assist or to undertake such development if thought advisable.

It is suggested that much might be done to attract private capital, if the State, after careful investigation, were to guarantee a suitable minimum interest on the necessary capital, sharing at the same time in any profits beyond the amount necessary to provide that interest. By this method of assistance private enterprise would be untrammelled, and the management of the concerns so assisted would remain in private hands.

The following is an abstract of the report:—

In spite of the meagreness of the information regarding vast stretches of the Empire, sufficient data are available to show that its water-power resources are in the aggregate enormous; but with the exception of Canada and New Zealand, Tasmania, New South Wales, and possibly South Africa, practically nothing has been or is being done on any systematic basis, to ascertain its true possibilities.

To enable the Empire to recover from the financial burden imposed by the war, it will be necessary to develop its latent resources. Energy is required to enable the mineral ores to be won and refined. It is required for the adequate fertilisation of the land, as well as for the harvesting and transportation of its crops and products; and any scheme for the extensive development of the Empire's resources as a whole, must depend upon the preliminary development of its energy supplies.

While solid and liquid fuels are convenient to handle, can be easily and cheaply transported to any convenient locality, and, in many cases, form, at present, the most convenient and cheap source of power, their supplies are strictly limited, and their ultimate depletion is assured. Fortunately public opinion is now awakening in some degree to the necessity for their conservation. Long before the supplies are actually exhausted, increasing scarcity is bound to put up their cost to a level much higher than that now obtaining.

In view of this, the utilisation, to the utmost possible degree, of the water-powers of the Empire becomes of paramount importance. Excepting the comparatively small supply of energy obtainable from vegetable growth, these at present provide our only practical perennial source of energy.

The economic development of many of our tropical dependencies, whose latent wealth is practically untapped, is directly interconnected with the development of their water-power resources.

The power now being used in the various countries of the world is estimated to be of the order of 120 million H.P., made up approximately as follows:—

World's factories, including electric lighting and street railways ...	75 million H.P.
World's railways	21 million H.P.
World's shipping	24 million H.P.

This includes all steam, gas, and water-power.

Of the 75 million H.P. used for factories and general industrial and municipal activities, a rough approximation of the most probable distribution would appear to be:—

	United Kingdom.	Continental Europe.	United States.	British Dominions and Dependencies.	Asia and South America.
Millions of H.P. ...	13	24	29	6	3

An estimate by the Dominion Water-Power Branch of the Canadian Department of the Interior, outlines the hydraulic situation of the various countries, as follows:—

Country.	Population (latest available figures).	H.P. available (1915 estimate).	H.P. developed (1915 estimate).	Per cent. utilised.
United States ...	92,019,900	28,100,000	7,000,000	24·9
Canada (A)... ...	8,033,500	18,803,000	1,735,560	9·2
Canada (B)... ...	8,000,000	8,094,000	1,725,000	21·0
Austria-Hungary ...	49,418,600	6,460,000	566,000	8·8
France	39,601,500	5,587,000	650,000	11·6
Norway	2,302,700	5,500,000	1,120,000	20·4
Spain	18,618,100	5,000,000	440,000	8·8
Sweden	5,521,900	4,500,000	704,500	15·6
Italy	28,601,600	4,000,000	976,300	24·4
Switzerland ...	3,742,000	2,000,000	511,000	25·5
Germany	64,903,400	1,425,000	618,100	43·4
Great Britain ...	40,831,400	963,000*	80,000	8·3
Russian Empire† ...	182,182,600	20,000,000	1,000,000	5·0

Canada (B) refers to the most thickly populated portion of the Dominion.
Canada (A) includes the area indicated by (B) and includes the 8,000,000 population of (B). The powers given are a 1917 estimate.
* The estimate for Great Britain is almost certainly much too high.
† A recent estimate by the Ministry of Ways of Communication (Electrical Review, February 22nd, 1918).

From this it appears that between 15 and 16 millions of the world's industrial horse-power is at present developed from hydraulic resources. The following table shows approxi-

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mately the hydraulic power developed in the various regions, and also the ratio of this to the total industrial horse-power, excluding railways.

	United Kingdom.	Continental Europe.	United States.	Colonies.
Millions of H.P.... ...	·08	6·5	7·0	2·0
Percentage of total industrial H.P.	0·6	27·0	24·0	33·0

The United Kingdom is the most backward in this respect of all the countries listed, except Russia.

Any estimate of the total amount of potential water-power in the Dominions and Dependencies of the Empire must be looked upon as highly speculative. The main powers are in Canada, India, New Guinea, and New Zealand, and it is fairly certain that in these countries alone there is a potential water horse-power of the order of 40 millions.

The developments in engineering science in the past decade, more particularly in electrochemical, electrophysical, and electrometallurgical processes, and in the possibility of high-voltage electrical transmission have removed some of the reasons for the comparative neglect of water-power in the past. Electrometallurgy and electrochemistry have rendered it possible to handle materials not workable by any other means; have made available new materials; and have greatly cheapened the production of many important materials of wide use. Aluminium, calcium carbide, chromium, cyanide, silicon, and carborundum, the products rendered commercially possible only by electrical processes, while alkalis, hypochlorate, phosphorus, magnesium, and sodium nitrate are produced most economically by such processes. Great developments have recently taken place in the production of electrolytic copper and zinc and in the electric smelting and refining of metallic ores. All these processes demand relatively large amounts of energy. The world's production of calcium carbide, for example, was 340,000 tons in 1913, requiring 400,000 continuous E.H.P. for its production, while the power used at the end of 1915 for electric furnaces in the United States alone was approximately 300,000 E.H.P.

In the utilisation of atmospheric nitrogen for the production of nitric acid and the manufacture of nitrates, great developments have taken place during the last decade, and in Norway alone over 400,000 E.H.P. is now absorbed in its production. The world's annual consumption of nitrogen in its various combinations is about 750,000 tons, representing a value of about £50,000,000, and this demand is increasing yearly. Four-fifths of this supply has been produced hitherto from natural nitrate deposits, but in view of the rapid depletion of these deposits, and of the diminution in the fertility of most of the great wheat and cotton-growing areas of the world, the production of artificial fertilisers by one or other system of nitrogen fixation must, in the near future, become a question of national importance.

At the present time the world's consumption of fertilisers amounts to close upon 6,000,000 tons per annum, and this will probably be doubled within the next 20 years. To-day, the efficiency of the electrical production is low, amounting in the case of calcium nitrate to about three-quarters of a ton per E.H.P.-year. By adopting the cyanamide process the consumption of energy may be cut down to about one-fourth, but even in this case the production of the equivalent of 12,000,000 tons of fertilisers per annum would require 4,000,000 continuous E.H.P.

It is estimated that the 200,000,000 acres of arable land in Canada alone may ultimately require some 10,000,000 tons of nitrates per annum to maintain their fertility, and this in itself would necessitate the absorption of an appreciable portion of the whole hydraulic energy of the Dominion. When to these demands are added those of India, Australia, and Africa, it is evident that the fertiliser demand of the Empire will in itself call for an enormous supply of energy.

Apart from these requirements, which are admittedly for the future, electric power has a wide and practically unlimited field as a motive power conveniently and economically adaptable to any class of service. In the heating and welding of metals as a part of the process of manufacture, electricity by its control, speed, and concentration or distribution, has many advantages over coal or gas.

Electric railroads have not as yet attained more than interurban and terminal use. The electrification of trunk lines, which demands the supply of cheap electric power at frequent intervals along the route, and involves a very large capital outlay, has not as yet become commercially attractive, but the future possibilities in this respect are enormous.

The considerations already outlined would indicate that the conservation and utilisation of the water-power resources of the Empire is likely to be one of the most important problems in our political economy.

In view of the immensity of the interests involved, it is urged that nothing short of statutory control of these developments is desirable. So far as is possible private enterprise should be encouraged, but under conditions which would prevent the perpetual rights being lost to the community.

While it is essential that the State should have the right of ultimate purchase, the period of such purchase should not be unduly short or the terms too onerous. It will be remembered that such legislation had the effect of severely handicapping the electric power and lighting industry in the early days of its development.

The cheapness or dearness of energy is purely relative, and hydraulic powers which are not at present able to compete economically with steam may in the not-distant future be able to do so. Even now, in favourable localities, the cost of electric power generated from hydraulic installations compares favourably with that of steam or oil power.

The cost of such power is made up mainly of charges against capital, interest, depreciation, sinking fund charges, taxes and insurance, which are usually much greater than water charges and costs of operation, maintenance and supplies. These capital charges vary widely with the local circumstances and physical characteristics of the site.

An examination of some 120 European installations shows that for large installations of upwards of 10,000 E.H.P., the minimum cost of the hydraulic works is £8.4 per H.P. installed, and the maximum, £79.6 per H.P. For the majority of the installations the cost lies between £25 and £45. The cost of the electrical generators, switchboards, &c., and transmission lines, also varies greatly, ranging from £1.25 to £28.4 per H.P., while the cost of the turbines ranges from £4 to £8 per H.P. The working costs vary between £1.3 and £6.8 per E.H.P.-year, with an average value of £3. From these figures it appears that on the average, making an allowance of 15 per cent. for interest and depreciation, the cost per E.H.P. per annum is in the neighbourhood of £10.5.

In many installations, however, the cost is very much less than this. The Ontario Power Company, for example, is able to supply power to the Hydro-Electric Commission of Ontario at £1.8 per E.H.P. per annum. It is estimated that many of the large powers in Canada can be developed at a total cost, including all generating machinery and transmission lines, ranging from £12 to £20 per E.H.P., in which case the cost per H.P. per annum should not exceed £2 to £3.

In spite of the great importance of water-powers, many of the potential powers in existence must of necessity prove economically useless, either on account of their great distance from centres of industry, the lack of transport facilities, or from the fact that the storage necessary to give a continuous or fairly continuous supply would be too costly. In the majority of cases the extent to which a scheme is capable of economic development can only be determined after a careful examination of the catchment area and of the site of the proposed works; after a careful and prolonged investigation of the rainfall and run-off records; and, especially in an undeveloped country, after an investigation of the mineral and forestal or agricultural possibilities of the surrounding region.

It has usually been understood that the usefulness of a water supply depends on the possibility of maintaining its uniformity over the whole period of the year, and that the maximum useful power is strictly limited by the minimum power which, by the aid of any suggested storage system, will be available towards the end of the longest probable period of drought.

Where the power is utilised for the supply of some industrial centre this is undoubtedly true, but if the idea were to be generally adopted, it would cut out an enormous aggregate of potential power, more particularly in tropical and semi-tropical countries. The possibility of utilising flood supplies for seasonal operations in connection with mining, agriculture, and forestry, or for the production of nitrates in such cases, would appear to be worthy of close consideration.

In any case, the possibilities of a given scheme can only be determined after a prolonged hydrographical and meteorological investigation of the site and surroundings. To be of real value such an investigation should extend over a long series of years.

(To be concluded.)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Future of Coal Using.

Mr. Booth's article in your issue of August 9th points out that when the waste heat from steam or gas engines can be usefully conserved the big power station is put out of consideration.

There are many practical difficulties in utilising the waste heat of exhaust gases and the jacket water of gas engines; as Mr. Booth says, the problem is an easier one with steam power.

In paper mills, salt works, chemical works, &c., where the latent heat of steam can be utilised for drying or evaporation; and even in factories requiring considerable heating, this utilisation of the latent heat of steam has long been practised.

Turbo-generators of the "reducing" type are then adopted, and such proportion of the steam as can be utilised for drying, heating, cooking, &c., is drawn from the low-pressure stages of the turbine, while the surplus steam goes on to the condenser, transferring its latent heat to the condensing water. When no drying or heating is required, it is undoubtedly economical to transfer all the latent heat of steam to the condensing water.

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Mr. Booth's suggestion is that if small electric supply stations used non-condensing steam engines, utilising the exhaust steam by distributing heat to replace fires in living rooms and kitchen ranges in residential areas within a limited radius, the heat demand would probably outrun the heat supply, when the electricity would become a secondary product.

In America, central stations supplying steam for heating and cooking are successful in city areas; but for residential areas, even in climates involving five months of winter heating, the individual house is the unit of central heating. A single low-pressure boiler, usually fired with anthracite, but in some cases using town gas or occasionally natural gas fuel, is adopted, with radiators in each room; while both gas and electricity are used for cooking.

In the typical instance of the large industrial city of Detroit, Michigan, with which the writer is familiar, there is practically no possibility of enemy attack, but for reasons of coal and water supply, as well as of power distribution, the two riverside electric power stations are miles apart; while the central heat supply is totally distinct, five separate heating stations being used in street areas. Full information as to the latter is given in the illustrated article, pages 646 to 650 of *Power*, May 7th, 1918, by Mr. Walker, of the Detroit Edison Company.

A town plan is given showing how the heat distribution centres closely around the principal and central street, Woodward Avenue; the actual buildings receiving heat are clearly shown, the residential areas being practically untouched.

Grouped near together, in the busiest area of the City of Detroit, are the three principal central heating plants, all generating live steam at 125 lb. pressure in water-tube boilers with archless furnaces and multiple-retort underfeed stokers, giving smokeless combustion and high boiler efficiency over a wide range of load; labour is minimised by this automatic stoking. There are no railway facilities in these street areas, but coal is hoisted to the overhead bunkers from street lorries, which also remove the incombustible ash.

Live steam is distributed over limited city areas at 30 lb. steam pressure, so that 10 lb. steam pressure, as required for cooking purposes, can be guaranteed at the service valves of the consumers.

The two older central heating stations are being converted for identical live steam supply. They were designed as lighting and power plants, with non-condensing engine sets and large mains to distribute exhaust steam; but this practice is now quite obsolete.

While multiple-retort underfeed stokers are assembled from units to suit any size and any make of water-tube boiler, eliminating manual labour and requiring no brick arches, and so giving maximum thermal efficiency and minimum upkeep in all sizes, these features have rendered large boiler units practicable, with undoubted advantages in space, in first cost, and in working costs over small units; and at Detroit, increasing sizes of boilers and stokers have been adopted for their central heating stations.

Thus, in the latest city plant, at Congress Street, the present boilers have 13,000 sq. ft. heating surface each; and it is intended to add three double-edged boilers, each with 23,654 sq. ft. heating surface, having an undivided archless furnace, with two 13-retort underfeed stokers, precisely like the double-ended boilers which supply the 50,000-K.V.A. turbo-generator at the Conner's Creek waterside power station.

Double-ended boilers, each with 20,700 sq. ft. heating surface, at the Bow power station of the Charing Cross Electricity Supply Company, London, are now being fitted with two 12-retort continuous-cleaning Erith-Riley underfeed stokers; for convenience of working they are, however, divided into two individual units by a central wall. The feed-water is heated by auxiliary exhaust, and no economiser or induced-draught fan is used; the Detroit boiler-houses follow the identical practice, getting very high boiler efficiency with archless furnaces and multiple-retort underfeed stokers, and extreme simplicity of boiler-house plant.

Erith's Engineering Co., Ltd.,
CHARLES ERITH, *Director.*

London, E.C., *August 10th*, 1918.

Lightning Accident in Kent.

The wording of the report by Major A. Cooper-Key, H.M. Chief Inspector of Explosives, quoted in your issue of 2nd inst., is calculated to convey a wrong impression, and the facts that follow are, I think, necessary to remove this impression.

Early in June, 1917, Major Cooper-Key 'phoned me that he had a case which he thought would interest me, and at an interview that followed I offered to go to Messrs. Curtis's and Harvey's explosives factory to investigate. Mr. G. Scott Ram, M.I.E.E., of the Home Office, accompanied me on this visit.

I looked for traces of lightning conductors on the remains of the five destroyed buildings, but could not find any, and I could not see any on somewhat similar buildings at the factory, though I noticed a few on buildings which were rather taller, and the manager informed me that none had been provided for the lower buildings, it being considered sufficient to protect the taller ones.

The existing lightning conductors there did not interest me as they did not affect the liability of the ones destroyed to be struck. I cannot, therefore, state whether they were likely to be effective for the buildings on which they were placed, in any case, but I distinctly recollect remarking to the manager that one building, near which we happened to be standing, was not sufficiently protected, and explaining how, by an inexpensive addition, it could be improved.

I enclose copies of my report to Major Cooper-Key on this case, and his reply, which I have his permission to publish.

At an interview I had recently with Major Cooper-Key, he explained that he was mainly interested in the fact that nitro-cellulose dough digesting in alcohol should have detonated, which experts on explosives would regard as remarkable, and the matter of lightning conductors was a subsidiary one. He did not intend to imply that *all* the factory buildings were provided with lightning conductors, but that buildings *at* the factory, i.e., some of them, were so provided, and I think it probable that in stating "the protection against lightning would seem to have been as good as could be devised" he was quoting the opinion of the owners of the factory rather than expressing his own view.

Alfred Hands, M.I.E.E.

London, E.C., *August 10th*, 1918.

[COPY.]

91, Leadenhall Street, London, E.C.,
June 9th, 1917.

Major A. COOPER-KEY,
H.M. Chief Inspector of Explosives,
Home Office, Whitehall, S.W.1.

Dear Sir,—I regret that my visit to —— did not enable me to ascertain how the damage by lightning occurred there. The buildings were so far cleared away that there was really nothing left to investigate.

The buildings that were exploded or fired had no lightning conductors, except that one was adjacent to a small tower on which there was a conductor. Though there were higher structures in their neighbourhood which were fitted with conductors, the destroyed buildings were all liable to be struck, and they may all have been fired by direct lightning strokes, but I do not think this occurred. The description given—fires breaking out simultaneously in all the buildings—suggests that most of, or possibly all, the effects were due to lightning having struck one spot, and the fires breaking out at others owing to induced or surging electrical effects causing sparks where there happened to be, in the buildings, danger gaps between metals that had not been rendered safe by connections made across them.

Explosions or fires in explosives buildings may be caused in two ways:—

1. By the building being struck by a flash of lightning.

2. Through sparks occurring in the interior owing to induced or surging effect caused by a lightning stroke to some other object within a radius of about half a mile of the building fired. Such an effect might even occur (and I think I have seen cases in which it has) without a lightning flash actually occurring between a cloud and the earth, but through induced sparks—echoes of an equalisation of disturbed electrical equilibrium taking place in the clouds overhead.

In the protection against lightning of danger buildings, (1) appears to be all that is generally provided against; (2) is largely ignored, because the matter is not generally understood. But since a spark one-eighth of an inch in length, if occurring in a suitable place, would suffice to ignite or explode such contents as there usually are in these buildings quite as effectively as a direct flash passing through it, and with the same ultimate result, i.e., total destruction, extending perhaps to other buildings, the provision of defence against (2) is, I consider, of even greater importance than against (1), because the likelihood of its occurrence is greater. That a comparatively low structure, covering only a few hundred square feet of ground, will be directly struck by lightning may appear a rather remote contingency, but that another object within a radius of half a mile of it (with or without lightning protection) should be struck, and induced or surging effects occur in the smaller and lower structure, appears to me to be very much more probable

No doubt, in the course of time, the owners of such buildings will realise this danger, and protection against it will become general, but at present it is only resorted to in comparatively few cases.

The explosion, at ——, of a substance contained in metal cases, and therefore each comprising in itself a Faraday cage, may have been caused by an induced spark occurring between two of them. Such a spark might, I consider, cause sufficient heat in the metal case of one (or both) at the point of contact to cause ignition of the contents. I understand these were standing promiscuously. If they happened to touch one another there would be no effect; if there existed a small gap between, the spark would be liable to occur.

Where I have come across such cases I have recommended that the metal containers should stand on a metal floor- or shelf-covering, or that strips of metal should be laid so that, whatever their position, they would always be in metallic connection with one another. Whether these metals should, or should not, be connected to the conductor system proper,

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or otherwise "earthed," has depended on the existing circumstances.

The part that puzzled me in the —— case is the fact that all the buildings, even those that contained neither explosives nor explosives in an inflammable stage, should have been completely ablaze in a few seconds. One wants to know what was the medium that enabled the fires to spread so rapidly. Merely dry woodwork would not account for it; and I do not think that ruberoid roofing would. In some cases I have found such buildings lined with a highly inflammable felt, and with such I could understand the very rapid spread of the fire.

In order to be able to discover the cause of such occurrences, I think one would require to have seen the buildings before the event, in which case I think one should be able to foresee what would happen, or to examine them immediately afterwards, when there would perhaps be something still visible that would enable one to form an opinion.

I am, dear sir,
Yours faithfully,
(Signed) Alfred Hands.

[copy.]

Home Office, Whitehall, S.W.1,
June 11th, 1917.

Dear Mr. Hands,—Very many thanks for your letter of the 9th instant, giving the result of your visit to ——. It is a great pity that you were not able to see things as they were before the accident happened, but your observations are nevertheless of great interest to me, and are most instructive. I am still, however, very much puzzled as to why the explosion in the metal cylinders occurred. I can imagine them being set on fire, but it is most remarkable that an instantaneous detonation should at once follow.

Yours faithfully,
(Signed) A. Cooper Key.

Alfred Hands, Esq.,
91, Leadenhall Street, E.C.3.

Trade Unions: Past, Present, and Future.

If your correspondent, Mr. Woolley, had set out to expose the trade unions, he would have succeeded admirably, but his letter, as an attempt to vindicate them, has failed miserably.

He states in the first place that "all unions adopt the policy of the majority," and follows this up by saying, "all strikes since August 4th, 1914, have been unofficial, and against the leaders."

It is therefore absolutely certain that the so-called "leaders" do not lead; that they do not represent the majority, with whom alone can rest the decision to strike.

If this majority are willing to be led by the "Bolchies, conchies, and aliens," in spite of their "patriotism" and the advice of their so-called "leaders," then there is something very wrong with modern trade unionism. It does not require even "average intelligence" to see that.

"A fair day's pay for a fair day's work," says Mr. Woolley, but excellent as this principle undoubtedly is, he falls into error in his method of bringing it about. "The trade unions state your rate of pay," he says, "and the employers see that you do the work."

The result of this can only be industrial tug-of-war and antagonism, each side being out to score off the other; but Mr. Arthur Henderson, M.P., whose "time and experience counts" in trade unionism, speaking at Brighton on June 22nd, 1918, said: "The idea that the relationships between Capital and Labour must necessarily be antagonistic must be abandoned."

The antagonism can only be abandoned when the trade unions enforce both sides of the bargain. They alone can guarantee a fair day's work in return for a fair day's pay, by the process of expelling from the unions all members who have not "qualified" by their willingness to perform such work.

Thus will the unions encourage production, and thus will they raise the level of trade unionism, and Mr. Woolley, whether he likes it or not, will, sooner or later, have to come into line with these ideas.

Our gallant lads in France and on our other fronts, who have suffered through the strikes, official or unofficial, will be the governing factor after the war, and it is of these that the trade unions must beware, for they have had the real "experience."

The Writer of the Article.

August 10*th*, 1918.

As a student of trade unionism, I have read with much interest the article and letter upon the above subject in the issues of the Electrical Review for July 19th, August 2nd, and August 9th, and I must express myself in perfect association with the article of July 19th, and the views expressed by "Electrical Fitter," which are fully justified and reasonable, and are shared with a multiplicity of others. It is *not* a man's trade merits or qualifications that decide his admission as a member, at least to the E.T.U., as Mr. Woolley seems to infer to "Electrical Fitter." This is a great source of dissension among existing trade unionists and the cause of many not becoming members. Again, Mr. Woolley's remarks with regard to the recent strikes are evidence of the lack of control and the state of disorganisation affecting trade unions and their business ineptitude, savouring of party politics, and their socialistic propaganda, with all its attendant evils and failings, and whose common view and highest standard of uplifting and improving the status of the worker, lies wholly and solely in forcing up wages, which is now, or ought to be, an exploded fallacy.

The time has now arrived when trade unions should be reconstructed upon sound reasoning and broad views, and business competency, with *real* uplifting qualities and education, measures that would be welcomed by present members and non-members alike.

I fully agree with the article of the Electrical Review for July 19th, and I am prepared in every sense to take an active and prominent part in the reconstruction of at least the trade union for electrical industries, and to give the benefit of my studies and researches to the producing community, who are the people who matter.

John A. Tasker.

Battle, *August* 12*th*, 1918.

The Problem of Reconstruction.

The loss of world wealth must be made good as rapidly as possible, and at the same time, the condition of the workers improved.

All industries do not produce wealth equally rapidly, for an industry which produces a value equal merely to a living wage, creates no wealth at all. The importance of an industry to the world and to a nation (but not to an individual) depends thus on the average amount of skill utilised therein, for if a skilled man does not produce a greater value per hour than an unskilled, what would be the use of skill? By skill is not meant, of course, merely manual skill, but the use of brains, intelligence, organisation, &c., attuned to a greater production.

The value of an industry expressed in money, is the sum of the profit of the employer plus the wealth wage of the workers, the latter being the difference between the wage paid and the living wage. Thus an industry which can afford to pay high wages owing to the high value produced, is of far more importance than an industry which pays low wages, even if the latter yields a fortune to the employer. This would apply to every nation, so that its skilled industries are of the utmost importance. And a nation without skilled industries cannot become wealthy.

In an unskilled industry producing merely a living wage there can be no international competition save at the price of the starvation of the workers, and the more skilled it is the greater will be the competition, and it will pay one nation to under-sell another in skilled industries until the whole of the profits and the wealth wage of the workers has disappeared, if by so doing that industry can be weakened or destroyed. Thus even under universal free trade the larger nation can undersell the smaller, so that the skilled industries of the latter can be destroyed, and universal free trade is incompatible with the right of existence of small nationalities.

Protection of skilled industries, far from inducing perpetual war, will permit each nation to develop its own wealth, without interference, and lead its own life, whereas universal free trade would penalise a nation which wished to work shorter hours and set greater store on the happiness of its inhabitants, as compared with mere wealth production.

The effect of protection on the power of a nation to compete in neutral markets is nil, for the following reasons:—

Although the cost of production to an individual is the sum of the price paid for all material and total cost of all wages, it is not the national cost of production, for the wealth wage represents merely a transfer of wealth from the employer to the employé, and the national cost of production is the sum of the value of the irreplacable raw material and the living wage of all the workers. This is evidently unaffected by protection or any artificial increase in prices or wages, the first result of protection being thus a tendency to depreciate the internal value of money.

It can, therefore, be stated that the first factor in reconstruction is that we (and every nation) should reserve to ourselves those industries which produce the greatest wealth per worker, and this, of course, includes all key industries, with the result that not only will wealth be produced most rapidly and shorter working hours become possible, but that owing to the high value produced a number of workers will be set free to improve the condition of all the inhabitants.

Voting money for housing and education will not improve either, but solely the availability of surplus labour and the production of a greater surplus wealth which may be divided among the non-producers.

Trading operations do not produce wealth, but are part of the cost of production, and when they result in a greater efficiency they help to produce wealth just as does efficient labour.

J. S. Hecht.

August 1*st*, 1918.

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THE BRITISH SCIENTIFIC PRODUCTS EXHIBITION.

From the electrical standpoint the British Scientific Products Exhibition, which opened at King's College, London, on August 12th, falls slightly below expectations, inasmuch as it has not been possible to make this section fully representative of developments since the outbreak of the war. The reason for this, however, is perfectly obvious, and after making due allowance for the circumstances which have tended rather to restrict the nature of the electrical exhibits, it must be admitted that the collection is indeed an impressive one. As to the exhibition itself, it is satisfactory to think that the aims which the promoters had before them have been realised in an adequate manner, and the collection of products and appliances of scientific and industrial interest, which, prior to the war, were obtained chiefly from enemy countries, but which are now produced in the United Kingdom, furnishes striking evidence of the awakening which has come over British industry, and of the growing appreciation on the part of manufacturers of the *rôle* of science in industry.

The aim of the exhibition was admirably stated by Prof. R. A. Gregory in the course of an address which he delivered on the opening day, August 12th. To Professor Gregory, as chairman of the Exhibition Organising Committee, the success of the exhibition is in no small measure due, and he, together with his colleagues, deserves the gratitude of the industry for their achievement.

Industrial advance depends upon three main factors, in all of which brain and hand are related. First, there is the creative investigator whose work reveals new properties and relationships; then comes the inventor or industrial researcher who seeks to apply knowledge to useful ends; and when a practical process or machine has been devised, the artisan is needed for its construction or technical use. Each of these three classes has an essential place in national life, and the correlation of their interests and activities should be the chief aim of statecraft. It is not too much to say that since the advent of the war much more intelligent attention has been paid to this problem of effective co-ordination than was given in earlier years. The spirit of distrust which formerly existed between scientific workers and manufacturers has been largely, but not entirely, dispelled, and an alliance is being formed which should go on increasing in strength for the benefit of each and the promotion of national prosperity. The man of science formerly confined himself too much to an academic atmosphere, and did not trouble to understand the problems of industry, while the manufacturer neglected to avail himself sufficiently of the potential industrial developments represented by the rich stores of scientific knowledge accumulated in the laboratory. During the last four years, however, science and industry have been brought into closer relationship, and some of the results of this *entente cordiale* are shown in the British Scientific Products Exhibition.

Professor Gregory, in the address to which we have referred above, explained that the aim of the exhibition "is to stimulate public interest and confidence in the capacity of British science combined with industrial enterprise to secure and maintain a leading place among progressive nations; and the object is the full development of our mental and material resources." It has been popularly assumed that original scientific work has been almost a prerogative of Germany, whereas a slight acquaintance with scientific history shows that most modern industries have originated with British science and invention. In purely scientific research of initiative quality we have been the pioneers; where we have been deficient is in the practical use of the results obtained, and the application of our natural scientific genius to the solution of industrial problems Under the stress of war, and protected from the dumping methods which strangled promising industries almost at their birth, the opportunity has arisen of proving the latent capacities of many of our scientific industries. The result of what has been accomplished in several notable directions is to be found at King's College.

One of the most important articles which used to be imported almost exclusively from Germany was the magneto. When the war broke out it became necessary for British makers to start up this industry under difficult and urgent conditions. Apart from suitable design there was the problem of producing good permanent magnets, but by persistent efforts all difficulties were overcome, and there are now nine British firms engaged in this work, with the result that during the past four years 300,000 magnetos have been manufactured for war service alone. What is equally important is that the home-made magneto is now as good as, and even superior to, the previously imported Bosch machine. Representative types are shown on the stand of the British Ingition Apparatus Association, which comprises the following companies: British Thomson-Houston Co., Ltd., Coventry; British L. M. Ericsson Manufacturing Co., Ltd., London; British Westinghouse Electric and Manufacturing Co., Ltd., Manchester; E.I.C. Magnetos, Ltd., Birmingham; Fellows Magnetos Co., Ltd., Park Royal, N.W.; M.L. Magneto Syndicate, Ltd., Coventry; Thomson-Bennett Magnetos, Ltd., Coventry; R. B. North and Sons, Ltd., Watford; and C. A. Vandervell and Co., Ltd., Acton Vale, W.

Another interesting feature of the exhibition is a display of insulating materials which were formerly almost exclusively supplied by German and Austrian producers. Varnished insulating cambrics, silks, and papers, and moulded insulation, suitable for the various kinds of electrical work, are now produced in large quantities in this country, and although we are not yet entirely independent of outside producers for this class of material, the manufacture of these has now been firmly established in this country, and there is every likelihood of the demands of consumers being satisfied by British producers. One of the reasons for the backward state of the magneto industry before the war was the lack of a satisfactory insulating material suitable for this class of high tension apparatus. Types are now shown at the exhibition having dielectric strength which withstands a pressure of more than 20,000 volts per mm. thickness, and does not carbonise under sparking. The latter is of supreme importance for running contacts as used in magnetos and rotary engine distributors.

It is not possible to do more than merely indicate briefly some of the outstanding features of the electrical section of the exhibition, and we must defer a detailed description for a future issue. But it must be said that the degree of progress indicated by the exhibits is surprisingly great, and even where no striking development has occurred in the way of new invention, there is a marked general improvement in apparatus constructed on the recognised lines of pre-war days. Satisfactory evidence of the development of the drawing of tungsten into wire of very small diameter for use as filaments in electric glow lamps is to be found in the fact that one firm alone is now exporting over 600,000 metres of tungsten wire per week to foreign markets which would otherwise be taking supplies from Germany. A development in electrochemistry shown at the exhibition is the electric furnace. Although electric furnaces made progress for some years past, it was the war that brought them into prominence. It then became evident that this type of furnace was exceedingly useful for dealing with the immense quantities of steel turnings obtained in the manu-

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facture of shells, and for making special steel alloys of great importance to aircraft. In this connection, reference may be made to "stalloy," an alloy due to Sir Robert Hadfield, which is remarkable for its low electrical losses. The reduction in losses by use of this alloy in transformers for electric power has probably effected a saving of some ten million pounds sterling per annum, and this saving is continually increasing.

In conclusion, it may be well to indicate some of the directions in which this country was dependent upon Germany before the war for various electrical products and the way in which these needs are being met. Apart from the magneto to which reference has already been made, another direction in which this country was largely dependent on Germany and Austria was in carbons for arc lamps. Fortunately, one British firm undertook the manufacture of such carbons, although subjected to ruthless price-cutting through dumping—the price falling from 40s. to 18s. for a certain quality and size. Still more fortunately, this firm did not fall a victim to our lack of national foresight, and so we are now in a position to be self-supporting in this direction also.

Reference has already been made to electric lamp filaments. Glass bulbs for glow lamps were also mainly imported. Although this is no longer the case, the position is by no means satisfactory, because it is very difficult to develop manufacturing of this kind, which is largely dependent upon carefully trained labour (*i.e.*, young men), which labour is necessarily in great demand by the military authorities. There is no reason, however, why we should not be in a position to supply our home requirements in this line also under proper conditions, and to manufacture on a large scale.

During the war much progress has been made in the manufacture of resistance wire, which was largely imported from Germany. The same is true of electromedical apparatus, of which, it is stated, 75 per cent. was of German manufacture. These examples are sufficient to show that British manufacturers are capable of supplying our needs, and of producing a thoroughly sound product. It will remain for the British public, after the war, to give the necessary support if this position is to be maintained.

(To be continued.)

WAR ITEMS.

Exports to China.—The "London Gazette" for August 8th contains a further list of persons in China to whom exports may be consigned.

Non-Ferrous Metal Industry Act.—In the Board of Trade Journal for August 8th, the eighth list of licences granted to firms under this Act is published.

Martial Law in E. Africa.—At Nairobi, East Africa, an electrician, formerly employed by the Magodi Soda Lake Co., Ltd., was fined by the resident magistrate five hundred rupees for having left his employment without permission, whilst another European was fined three hundred rupees for giving the electrician employment. The cases were brought under the Martial Law Regulations.

"End of the War": Select Committee's Definition of the Term.—The Select Committee on Emergency Legislation has decided that the date of the end of the war "in relation to the powers conferred by emergency legislation should be held to be the date when the Treaty of Peace is finally binding on the respective belligerent parties, that is, the date when ratifications of the Treaty are exchanged or deposited. This is on the assumption that the war is ended by a general treaty of peace between the United Kingdom and all the Powers with which the United Kingdom is at war." If this country were to make a separate treaty of peace with an individual enemy Power, the end of the war with that Power would be the date when the ratifications of the treaty were exchanged or deposited.

Radio-Active Substances.—The Minister of Munitions has issued an Order prohibiting the purchase, sale, or delivery of any radio-active substances, luminous bodies, or ores without a permit. Applications in reference to this Order should be addressed to the Controller of Optical Munitions, Ministry of Munitions, 117, Piccadilly, W. 1.

New Exemption Order.—The Ministry of National Service is about to issue a new list of certified occupations. In the meantime, men of certain specified trades are not to be called up even for medical examination. The new list will include public utility services and engineering trades; it will cover electrical engineers. Experience gained by the Ministry indicates that it is essential to maintain the efficiency of the trades concerned by exempting an adequate number of skilled workers.

Exemption Applications.—At Walthamstow, E. F. Cole, civil service messenger (41, grade 3, married), appealed because of his wife's health. For three years he had been doing part-time tramcar driving at week-ends. Four months was allowed.

At St. Albans, Wm. C. Millard (50, grade 2), electrical engineer, appealed, and said that he had been for over 20 years with Messrs. Smith, and had charge of 50 motors. He was given three months.

At Southport, the Birkdale District Electric Supply Co. appealed for the retention of their engineer (31, grade 2), they having failed to secure a substitute. It was stated that a discharged soldier had been engaged, but he had had no experience, and would have to be trained. The calling-up was delayed until November 1st.

At Bath, an appeal was made by Edgar Rudge (48, grade 1), electrical engineer and apparatus maker, who claimed to be in a certified occupation. He said that he maintained the X-rays installations at the local civil and military hospitals, and the Royal United Hospital secretary said that he was the only man in the city they could turn to if anything went wrong with the electrical apparatus. Three months was granted.

A National Service appeal against exemption held by E. H. Packman (44, grade 1), electrical engineer at Henley Park Hospital, Surrey, has been withdrawn.

At Maidstone, three months was conceded to W. Clement (38, grade 3), electrical fitter at the Corporation pumping station.

Windermere tribunal has granted conditional exemption to Jas. Thornborough (39), electrician.

High Wycombe Tribunal has granted six months' temporary exemption to E. H. Milner (40, grade 2), electrical engineer, of Oxford Street.

The Bourne End (Bucks) Electric Installation Co. appealed for Frank Wootten (45, grade 2), electrical engineer, stated to be supplying electricity to 90 houses in the district, including the residence of Sir Arthur Pearson. He was allowed six months.

BUSINESS NOTES.

Holidays.—Fleming, Birkby & Goodall, Ltd., Woodfield Mills, Liversedge.—Works and offices closed from August 31st to September 7th (inclusive).

Change of Address.—The Concordia Electric Wire Co., Ltd.—From August 17th all communications should be addressed to the company's new works:—Trent Mills, New Sawley, Derbyshire. Telephone No.: Long Eaton 249.

Fuel Economy.—The question how the householder shall calculate the amount of coal to which he is entitled, and draw up his requisition for electricity or gas in accordance therewith, has been conveniently answered for gas consumers by Mr. R. J. Angel, borough engineer of Bermondsey, who has prepared a comprehensive table showing all the possible proportions of coal and gas supplies for houses from 1 to 20 rooms. Unfortunately, the only reference to electricity is to the effect that ¼ ton of coal must be deducted for each 200 units of electricity, and the assumption is made that every user of the scale will take at least his minimum allowance of gas for lighting. No mention is made of the fact that no gas at all need be taken, a nominally equivalent allowance of electrical energy being substituted if desired. This defect greatly detracts from the value of the table for electricity supply consumers, but might be remedied by the addition of a printed slip. Copies of the table can be had from the *Contract Journal* Co., Ltd., 127, Temple Chambers, E.C. 4.

"Fuller" Safety Lamps Approved.—The Home Secretary has issued an order approving of the Fuller miner's safety electric lamp in all mines to which the Coal Mines Act, 1911, applies, subject to the conditions specified in the schedule of the order.

High-Duty Stokers for Low-Grade Coal.—The report of Mr. Magoris, acting electrical engineer for Hull Corporation, points out that a recent sample of the coal allocated to them by the Coal Controller contained no less than 30 per cent. of incombustible ash, as against about 8 to 10 per cent. of ash in the case of their pre-war coal. For boilers with furnaces 15½ ft. in width, the Hull Electricity Works' fourth order for Erith-Riley stokers is for the High-Duty pattern of this fully automatic stoker, 33 per cent. more capacity than previous ones, and suited for a normal duty of 3 tons of coal hourly. As nearly 1 ton will be incombustible ash, the continuous-cleaning feature of the Erith-Riley Stoker is invaluable, eliminating all manual labour.

Erith's Engineering Co., Ltd., are now delivering to the Bow power-house of the Charing Cross Co., Erith-Riley Stokers for a normal duty of 3 tons of coal hourly each.

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Catalogues and Lists.—The Davis Furnace Co., Diamond Foundry, Luton.—Circular DO/18, dealing with drying stoves for core drying, japanning, enamelling, armature drying, &c., and quoting current prices, weights, &c.

Dictograph Telephones, Ltd., 7, Southwark Street, S.E. 1. "Multiplying Efficiency," a pamphlet describing the Dictograph Interconversing system, which saves time and facilitates control, with the aid of a loud-speaking receiver and a very sensitive transmitter at the master station, and automatic communication with ordinary stations. Practically, the system brings the heads of departments instantly into the presence of the chief, who can talk to them and hear their answers as if they were sitting round his table, without holding a receiver or approaching the transmitter.

Book Notices.—*Selwyn's Metric Conversion Tables.* Edited by W. E. Dommett. London: James Selwyn & Co., Ltd. Price 2s. 6d. net.—This is an entirely new work, designed to meet the requirements of men engaged in various branches of engineering and science. In his introductory notes the editor makes a slip when he states that "the complete metric system is at times known as the c.g.s. system"; the latter is an off-shoot of the former, and forms the basis of the systems of units used in physics and electrical engineering. The metric system is based upon the metre and kilogram, and takes no account of time at all. The tables are of a very useful character, covering a wide range of requirements met with in practical work, and including a number of compound measures; they are clearly set out for ready reference, and our only criticism is directed to the old question of significant figures. Equivalents of millimetres in inches are carried to thousandths of an inch, and in the converse sense to hundredths of a millimetre, to which we raise no objection; feet and inches are expressed to single millimetres, of which also we approve. But the equivalents of metres (1 to 100) in feet are carried to six figures, and *vice versâ*, and many other tables are similarly meticulous in their supposed accuracy—we say "supposed," because the assumption is that if 73 lb. = 33·11229 kg., the former is known to be correct to at least 5 or 6 significant figures: in practice, however, it is not likely to be known more accurately than 3 or 4 figures would imply, and all ordinary requirements would be met if the value of 73 lb. were given as 33·11 kg. These useless strings of decimals in tables constitute one of the most serious obstacles to the adoption of the metric system, although the objection is based upon ignorance of practical physics and mensuration. Those who know what they are doing, of course, use only as many figures as they require; but the average clerk would laboriously fumble with the whole string of 6 or 7 figures—and curse the metric system!

If the authors of such tables would either preserve a sense of proportion in their equivalents, or use small type or italics for the ultra-accurate figures, pointing out that the latter need not be used except when extreme accuracy was essential, our criticism would be met. Thus we might have—

$$73 \text{ lb.} = 33{\cdot}11_{229} \text{ kg.}$$

In general, the equivalent need not be stated to more than four significant figures for practical purposes; the error cannot then exceed one part in 2,000, and the average error will be less than one in 10,000. Subject to this criticism, the tables appear to us to be admirably chosen and well arranged.

"The New Moon: a Romance of Reconstruction." By Oliver Onions. London: Hodder & Stoughton. Price 6s. net.

The Twelfth Annual Report of the British Science Guild can now be obtained (price 1s.) on application to the Secretary, British Science Guild, 199, Piccadilly, W. 1. The Report contains addresses by Lord Sydenham, Sir Henry Newbolt, and Sir Algernon Firth, delivered at the recent annual meeting of the Guild, together with particulars of the British Scientific Products Exhibition, and Memoranda on the British Dye Industry, the Introduction of the Metric System, Scholarships for Higher Education, the Teaching of Science, &c.

"The Education Act, 1918, Summarised and Explained." London: National Education Association. Price 6d.

"Tests of Large Bridge Columns." By J. H. Griffith and J. G. Bragg. "Ground Connections for Electrical Systems." By O. S. Peters. (Technologic Papers of the Bureau of Standards.) Washington: Government Printing Office. Price 30 cents. each.

"National Physical Laboratory: Report for 1917—18." London: H.M. Stationery Office. Price 2s. 6d. net.

"List of Electrical Undertakings in India." Compiled in the office of the Electrical Adviser to the Government of India. Calcutta: Superintendent Government Printing, India. Price Rs. 4, or 6s.

Liquidations.—Richard Hornsby & Sons.—Winding up voluntarily. Mr. W. Haynes (secretary to the company) and Mr. R. Smith (of Lincoln), liquidators. Meeting of creditors August 26th, at 75B, Queen Victoria Street, E.C.

Woods-Gilbert (British) Rail Grinding and Milling Co., Ltd.—Winding up voluntarily. Mr. J. Cameron Kelvin, Bridgefield Road, Sutton, and Mr. A. G. Conway, 170, Strand, W.C., liquidators.

Patents and Alien Enemies.—The Board of Trade has granted the application of Messrs. J. S. Highfield, A. A. C. Swinton, and P. D. Tuckett, for licences in connection with 34 patents granted to Schwerin, Ges. für Elektro-Osmose m.b.H., and Farbwerke vorm. Meister, Lucius & Bruning.

Plant for Sale.—Plymouth Corporation invites tenders for a 500-kw. 500/550-volt d.c. generator, direct-coupled to a triple-expansion engine. See our advertisement pages to-day.

LIGHTING AND POWER NOTES.

Bacup.—Extensions.—The T.C. has approved a draft agreement for the supply of electricity to Messrs. Taylor and Hargreaves' Irwell Mill and associated firms.

Barrow.—Year's Working.—The revenue of the T.C. electricity department for the past year amounted to £58,000, compared with £62,000 in the preceding year. This is accounted for by the receipts from Messrs. Vickers, who are now largely supplying their own requirements, decreasing by over £8,000. The income from energy supplied for heating, cooking, &c., increased by nearly £5,000. The net profit was £4,800; but as certain charges were met out of revenue, the actual figure is about £1,850. The output last year was 10¼ million units. The department has arranged for a considerable supply to the wire works, and expects new business at the graving docks, oil tanks, and ferro-concrete shipbuilding works.

Basingstoke.—Oil Fuel.—The T.C. has adopted a scheme drawn up by the electrical engineer, Mr. G. Broadhurst, providing for the fitting of Smitar's pulverisers to the Diesel engines, by which a considerable economy in crude oil is expected. Instead of each engine consuming a minimum of 12 lb. of crude oil per hour, they will be started on crude oil, and, after running five minutes, changed over to tar oil. In addition to an annual saving of at least £250, it will be possible to keep the engines running for longer periods; the present ring-type pulverisers have to be cleaned out three times per week, whereas with the new pulverisers this will only be necessary after the engines have run 800 hours, a net saving of 21 hours per week.

Belfast.—Price Increase.—The Corporation has increased the price of electricity by ·375d. per unit for lighting and by ·75d. for power, the advance to take effect from the end of the present quarter.

Birmingham.—Nechells Station.—The City Council, on August 6th, resolved to proceed with the amended scheme for the permanent generating station at Nechells, for the mains and sub-station equipment, and for the provision of a linking-up main between the Nechells station and the Smethwick boundary, at an estimated cost of £1,626,140.

Bolton.—Linking-up.—In order to secure a stand-by supply, the E.L. Committee has authorised the linking-up of its system with that of the Lancashire E.P. Co.

Brighton.—Year's Working.—The annual accounts of the electricity undertaking for the year ending March 31st last show that the total capital outlay to date was £845,957, an increase of only £1,467 on the previous year. The debit charges amounted to £37,937, being £16,904 interest and £21,033 sinking fund, and the amount provided for extinction of debt now stands at £466,735. The revenue from all sources was £119,003, again the highest on record. The working expenses were £76,026, or 64 per cent., and, after providing for capital and other charges, the net surplus for the year amounts to £2,887. During the year 10,242,007 units were sold as follows:—Private lighting, 3,098,313; public lighting, 32,086; power, 3,003,034; tramways, 1,907,537; bulk supply, 101,907; and special contracts, 2,099,130. The load factor was 25·3 per cent. and number of consumers 7,031.

Canterbury.—Price Increase.—The T.C. has advanced the price of electricity, from September 30th next, as follows:—Lighting, flat rate, to 6d. per unit; maximum demand rate, to 7d. and 3d.; outside arc lamps, to 6d.; motor-generators, to 3d.; gas compressors for lighting, to 6d.; power and heating, to 3d. Power consumers are to have a rebate of ½d. per unit if over 500 units are consumed per quarter, and 1d. if over 5,000.

Chesterfield.—Bulk Supply.—With the object of saving fuel, the T.C. has decided to take a weekly supply of electricity in bulk from the Staveley Coal and Iron Co., and to stop production at the electricity works during the time the bulk supply is available.

China.—Hydro-electric Scheme for Kobe.—The municipal authorities of Kobé, says the *London and China Telegraph*, contemplate undertaking a hydro-electric enterprise, and it is now reported that they have found a suitable source of power on a section of the Chigari, on the upper reaches of the Muko River, about 20 miles from Kobé. Mr. Kobori, director of the Electric Bureau in the Kobé City Office, says the site selected is a very suitable one, and application for permission to use the river will be shortly made to the proper authorities. It is proposed to obtain about 5,000 kw. on an average, with a maximum capacity of 10,000 kw., and it is estimated that the undertaking will cost about 3,500,000 yen. When the proposed enterprise has materialised, it will be possible to supply Kobé with about one-third of its present supply of electricity.

Clayton (Yorks.).—Prov. Order.—The U.D.C. has decided that an old resolution, deciding to apply for a prov. order to supply electricity within its area for lighting, be rescinded, and that it should now apply for a prov. order to supply electricity for all purposes. This, it was stated, would complete the satisfactory agreement which had been reached with the Bradford Corporation.

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Continental.—Spain.—At the annual meeting of the Sociedad Minera y Metallurgica, held in Paris, it was announced that a hydro-electric plant of 10,000 kw. capacity was being established to utilise certain waterfalls in the Veste d'Aure valley, and that contracts had been entered into with the French Government for the supply of the power required by a number of works in the district.

An application has been made for the use of 630,000,000 cb. metres of water yearly from the river Albercke (a tributary of the Tagus). A simple system of dams and canals will render available 40,000 h.p. It will be necessary to construct five power houses, all of which will be within 50 miles of Madrid.

Don José Barro Polo, of Vivero, has been granted the use of 1,000 litres of water per second in the dry season and 4,000 litres per second in winter, on the river Landro. This concession is in addition to those already exploited by Senor Barro on the same river, and will supply approximately 3,000 h.p.

Don José Galan has been authorised to make use of 12,000 litres of water per second from the river Genil, near Seville, for the generation of electrical energy.

The firm of Piccard Pictet & Co., Geneva, Switzerland, has under construction two water-wheels for La Catalona de Gas y Electricidad, S.A., of Barcelona. One, of 4,250 h.p., is for a fall of 45 metres; the other, of 2,800 h.p., is for a fall of 20 metres.

Sweden.—A small company has been formed at Gavie, with the title Hemlingby-Jarvat' Kraftoch Belysnings Aktiebolag, to supply the towns of Hemlingby and Jarvat with electricity.

Hungary.—The Government has appointed a Committee of experts to draw up regulations restricting the consumption of electricity for lighting and power purposes, with the object of economising in fuel consumption.

Dartford.—Price Increase.—The U.D.C. has advanced the price of electricity for lighting by 20 per cent., making 60 per cent. on pre-war rates, and for power by 20 cent., a total increase of 65 per cent., from October 1st next.

The West Kent. E.P. Co. has notified the Council of its intention to lay cables in the Council's area.

Derby.—Price Increase.—The T.C. has raised the increase on electricity charges from 20 per cent. to 40 per cent. from August 1st last.

Dublin.—Proposed Restrictions.—The Corporation Electricity Committee has received deputations from the Building Trades Employers' Association and the employés of the D.S.E. Railway protesting against the proposed restrictions in the supply of electricity to manufacturers. The chairman of the Committee states that the electricity undertaking requires 33,000 tons of coal per annum to furnish a normal supply, but has been notified by the Controller that it can only have 18,000 or 19,000 tons for the current year. If every domestic and office user were disconnected the saving would not be sufficient to meet the proposed reduction in the amount of coal available.

Supply to Dockyards.—The E.S. Committee has placed an order with the Workshops Committee for the erection of a sub-station at North Wall Docks, and has guaranteed that a supply of electricity will be available for the two Dockyards within a month of the receipt of the material for the building of the sub-station.

Eccles.—Price Increase.—The T.C. has decided to advance the price of electricity, from the end of the September quarter, by 16⅔ per cent., making 50 per cent. above pre-war rates.

Elland.—Loan.—The U.D.C. has approved of a loan of £2,000 for electricity extensions.

Ellesmere Port.—E.L. Order.—The U.D.C. has decided to apply to the B. of T. for a further extension of time for carrying out the compulsory works included in the Schedule of its Lighting Order.

Finchley.—Year's Working.—There was a net deficit of £2,887 on the past year's working of the T.C. electricity department. The gross profit was £8.210, of which interest absorbed £3,596, and sinking fund charges £7,130. Units sold increased by 551,000 over the previous year. The cost of fuel had increased by £7,800.

Glasgow.—Price Increase.—The charges for electricity have been increased by the Corporation, and are now as follows:—Lighting, maximum demand, 5½d. and 1½d. per unit; churches, schools, &c., 4½d.; power, maximum demand, 2½d. and 1½d.

Grantham.—Price Increase.—The Urban Electric Supply Co. has intimated that, from July 1st last, the charge for electricity for power and heating will be increased by a further 10 per cent., making 40 per cent. in all.

Guildford.—Electric Light Failure.—On Wednesday night, last week, the electric light failed for some hours owing to the illness of the only stoker at the local electricity works.

At Aldershot also the electric light failed on the same evening.

Hereford.—Price Increase.—The T.C. has increased the price of electricity by 5 per cent. as from September 29th next.

Heywood.—Price Increase.—The Electricity and Tramways Committee has decided that the charges for electricity for all purposes be increased by 10 per cent. from October 1st next, and that motor hire charges be increased by 50 per cent. from the same date.

Hornsey.—Fire.—A serious fire occurred at the electricity works on Saturday last, involving the loss of several hundred tons of coal. Spontaneous combustion in the coal bunkers is supposed to have been the cause of the outbreak.

Kirkburton.—Prov. Order.—The seal of the U.D.C. has been given to the application of Huddersfield Corporation to the B. of T. for a prov. order to supply electricity within the district for all purposes.

London.—St. Pancras.—The B.C. has decided to offer to the War Office, for £1,600, one of the Browett-Lindley sets now used as a stand-by.

Luddenden Foot (Yorks.).—Prov. Order.—The Electrical Distribution of Yorkshire, Ltd., has informed the U.D.C. of its intention to apply for a prov. order, before December 21st, to supply electricity within the Council's area. The Halifax Corporation has notified the U.D.C. of its intention to renew its application for a similar Order next session.

Maidstone.—Price Increase.—The T.C. has again increased the price of electricity, as from July 1st last, by 10 per cent., a total increase of 15 per cent., and by 2½ per cent. to contract consumers.

Proposed Loan.—A loan of £22,007 has been applied for.

Middleton.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to borrow £7,500 in respect of capital expenditure on new cable, plant, and alterations at the electricity works in connection with the conversion of the works into a transforming and distributing station to deal with a bulk supply from Manchester.

Mytholmroyd.—Proposed E.L.—The Halifax Corporation has informed the Mytholmroyd U.D.C. of its intention to renew its application to the B. of T. next session for a prov. order to supply electricity within the Council's area.

Newcastle-under-Lyme.—Year's Working.—The revenue of the Corporation electricity department for the year ended March 31st last amounted to £3,784, an increase of £369 compared with the previous year, whilst the expenditure increased from £1,972 to £2,414. After meeting capital charges the net loss was £293, against £253.

Price Increase.—The charges for electricity have been increased as follows:—Lighting, 6d. per unit, plus 40 per cent., less 5 per cent. for cash within one month; power 2d., plus 50 per cent. less 5 per cent.; heating 3d., less 25 per cent.; for kinemas, lighting 5d., plus 40 per cent., less 2½ per cent., for cash within 14 days: power 2d., plus 40 per cent. less 2½ per cent.

Newport (Mon.).—Price Increase.—The E.L. Committee recommends an increase of 5 per cent. in the price of electricity to all consumers, making 50 per cent. over pre-war rates, and of 10 per cent. to consumers in bulk.

Radcliffe.—Price Increase.—The T.C. has decided, from the end of the present quarter, to increase the charges for electricity as follows:—Private and public lighting, 10 per cent., making a total increase of 40 per cent.; small power users, 10 per cent., making 50 per cent., except consumers subject to a coal clause; power users on sliding scale and on maximum demand rates, the existing charges, plus operation of coal clause.

Rathmines (Dublin).—Strike.—The strike of the employés at the U.D.C. electricity works has ended on the Council agreeing to refer to arbitration the question of an increase of £1 per week on pre-war wages.

Salford.—Price Increase.—The Electricity Committee recommends the Council to increase, as from September 1st, the advances over pre-war rates for the supply of electricity as follows:—Lighting, from 20 per cent. to 30 per cent.; power and heating, including bulk supplies, 30 per cent. to 50 per cent.; traction, 15 per cent. to 35 per cent.

Salisbury.—Proposed Purchase.—With reference to the purchase of the E.L. and Supply Co.'s undertaking, the T.C. has ascertained that it has no option of purchase until within six months of the expiration of 42 years from 1895.

Sheffield.—Proposed Loan.—The Treasury has intimated that it has no objection to the proposed borrowing by the Council of £1,203,950, in connection with the power house and equipment for the main scheme at Blackburn Meadows.

Stalybridge.—Year's Working.—The Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board reports that in the electricity department for the year ending March 31st last, the gross profit amounted to £36,220, of which interest and special payments absorbed £10.138; the amount transferred to sinking fund was £14,311, leaving a surplus of £11,771.

Stockport.—Year's Working.—The annual report for the year ending March 31st last, shows that the output of the electricity undertaking has risen to 24,500,598 units, with an average selling price of 0·78d. per unit, on which the undertaking is yielding a gross profit of 14·1 per cent. on a total capital expenditure of £218,730 and a gross profit of 26·4 per cent. on the outstanding capital of £117,701. Of this total capital expenditure £16,361 was contributed from revenue account, and £87,057 has been expended during the last five years. From the profits a sum of £4,750 was set aside for relief of rates, and sums amounting to

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£7,114 have been set aside for depreciation of tramway plant. The balance of the electricity reserve fund was £2,884, and the total sinking-fund charges were £10,616. Total income for the year was £81,861 and the working expenses were £50,791: the gross profit being £31,070. Total works cost was 5d. per unit; maximum load on station was 8,400 KW.: and the number of consumers was 1,607. The units sold were:—Public lighting, 200,000; private lighting, 699,076; power, 20,934,871; and traction, 2,666,651; being a total of 200 units per head of population.

Swansea.—SUPPLY TO DOCKS.—Arrangements have been made for the supply of electricity by the Corporation to the King's Dock power house of the Harbour Trust.

Torquay.—PRICE INCREASE.—The T.C. has increased the charges for electricity for lighting from 6d. to 7d. per unit, and for power from 1½d. to 2d., as from the Michaelmas reading of the meters, and the town clerk is communicating with the Tramway Co. with regard to an increase in the charges paid for energy.

Whitstable.—OVERHEAD WIRES.—The Blean R.D.C. has consented to the E.L. Co. erecting poles for overhead wires for conveying energy to Whitstable-cum-Seasalter.

Wolverhampton.—PRICE INCREASE.—The T.C. has decided to increase the price of electricity, from June last, by 15 per cent. to ordinary consumers, and to further advance the charges by 10 per cent. for every increase of 2s. 6d. per ton in the price of coal.

TRAMWAY AND RAILWAY NOTES.

Australia.—STANDARD TRAMWAY RAIL.—A Conference of Electric Tramway Engineers was held (May, 1918), in Sydney, N.S.W., to consider the adoption of a standard grooved girder tramway rail for use by electric tramway undertakings in the Commonwealth. Owing to the difficulty—due to the war—of importing rails from overseas, the manufacture of rails in Australia becomes necessary.

The Broken Hill Proprietary Co., Ltd., which has steel works and rolling mills at Newcastle, N.S.W., has stated that it will consider the installation of a plant to roll grooved girder rails if a standard rail is adopted.

The Conference passed the following resolutions:—

1. That a standard girder rail be adopted for the tramways of the various States of the Commonwealth.
2. The weight of the girder rail for tangent track shall not be less than 90 lb. per lineal yard; the exact weight being subordinated to the design.
3. That the height of the girder rail be not less than 6 in.
4. That the width of the flange shall not exceed the height of the rail by more than ½ in.
5. That the Conference is agreed that the form of groove and guard of the rail should take the form of the present standard of the American Electric Railway Association.
6. That the tread of the proposed section of rail shall approximately conform to that shown in blue print No. 3,365 of the Adelaide Municipal Tramways Trust.
7. That Mr. Cowdery, engineer for permanent way, N.S.W. Government tramways, be asked to get from the manufacturers the chemical and physical tests of steel that they can guarantee for tramway purposes, and that it be left to him to design a rail in conformity with the resolutions of the Conference.

The tread referred to in resolution (6) is struck to a radius of 12 in., with a $\frac{1}{16}$ in. radius on the running edge, which the Conference believed would tend to give a longer life both to wheels and rails.

Blackburn.—SERVICE RESTRICTIONS.—The Tramway Committee has decided that the tramway service shall cease at 10 p.m. daily, and not start until 2 p.m. on Sundays.

Bolton.—INCREASED FARES.—The Tramway Committee has abolished workmen's fares on certain stages, and has increased other workmen's fares by 50 per cent. The service has also been reduced.

Continental.—AUSTRIA.—The conditions prevailing in Vienna are illustrated by the report submitted to the City Council on the electric tramway system, according to which tramways are practically the only means of transport in the city, and they have to convey soldiers and to transport coals, potatoes, and vegetables. In the past four months 1,900 dead bodies have been conveyed by the tramways to the suburban cemeteries. The number of cars running is reduced to 780, 20 of which have to be withdrawn each week for repairs, and there is no means of getting them repaired. There is no material with which to make the repairs, and the men in the workshops are so underfed that they have not the strength to do the work. More than half the employés are women, and those in the workshops are of very little use. The only material available for insulation in the motors is silk, such as was formerly used in making dresses, and this is extravagantly expensive. The company maintains that, in order to ensure a fairly normal service in winter, it is necessary at once to stop the running of cars at 9 p.m.—*Morning Post.*

Darwen.—SERVICE RESTRICTIONS.—The T.C. has decided that the tramway service shall not commence until 2 p.m. on Sundays, and shall cease at 10 p.m. every day.

Dewsbury.—FARE INCREASE.—In order to discourage short-distance travelling, the Tramway Committee has decided to increase the fare for the first mile to 1½d.

Halifax.—PROPOSED LINKING-UP.—The Tramway Committee has decided not to entertain the proposal to connect the mains of the Yorkshire E.P. Co. with the Corporation mains, in order to secure a stand-by supply. The estimated cost of the scheme was £3,000.

WAGES.—The Corporation has increased the wages of male tramway workers to 25s. per week over pre-war rates.

PRICE INCREASE.—The Electricity Committee has recommended that the charge for energy used in connection with the tramways be increased from 1½d. to 1½d. per unit.

Leicester.—WAGES.—The Tramway Committee has increased its employés' wages by 5s. per week, making 25s. over pre-war rates.

Liverpool.—FARE REVISION.—The Corporation has increased the 1d. tramway fares to 1½d., and has instituted shorter 1d. stages.

London.—L.C.C.—Only half a million copies, half the usual number, of the tramway map and guide are to be issued in 1918-19.

A tramcar burst into flames while proceeding along the Peckham Road on Saturday night. No one was injured, and the still burning car was pushed by another car to the depôt at Camberwell Green.

On Monday two tramcars became interlocked at the junction where Clerkenwell Road joins Rosebery Avenue, and traffic on the lines was stopped for some time. Meanwhile, both east and west-bound cars had to be diverted over other routes.

L.U.T.—A loose trolley head tore down the overhead wires on both roads of the system at Brentford, and disorganised the service during the week-end.

Monte Video.—STRIKE.—Collisions between the police and the tramway strikers have taken place, and there have been several casualties. The Trade Unions have declared a general strike.—*Financier.*

Newcastle.—FIRE.—Damage estimated at £150,000 was done by a fire which occurred on Sunday last in the electric train sheds covering five acres on the North-Eastern Railway. There were 97 self-propelled electric coaches under cover at the time, and the woodwork of many of them, also that of the platforms, was quickly involved. In all 38 of the coaches were burnt, together with a quantity of tools and almost the whole of the sheds. Steam trains were used to deal with traffic to the coast.

Nottingham.—SERVICE REDUCTION.—In order to economise energy, the T.C. has entirely discontinued the Sunday tramcar service.

Preston.—YEAR'S WORKING.—The receipts of the Corporation tramway department last year amounted to £63,097, an increase of £5,413 over the previous year, and expenditure increased by £7,463. The net profit was £4,158, against £7,581. After contributing £5,500 to the relief of rates, and paying £2,381 out of revenue to the new car-shed and offices, the credit balance of the revenue account stood at £1,738. The reserve fund was increased to £52,231, of which £43,375 has been invested in war securities and £7,734 used for capital purposes.

Radcliffe.—PRICE INCREASE.—The T.C. has applied to the Bury Tramway Committee for increased payment for energy supplied to the Radcliffe tramways.

Southport.—INCREASED FARES.—The Tramway Committee has recommended an increase of ½d. on all Army fares.

Stalybridge.—YEAR'S WORKING.—During the past year the income of the tramway department of the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board was £55,903 and the expenditure £40,186. Interest and special payments accounted for £11,804, and £8,862 was transferred to the sinking fund, leaving a deficit on the year's working of £4,949.

Wolverhampton.—YEAR'S WORKING.—The accounts for the year ended March 31st last of the Corporation tramway undertaking show that the gross profit for the year was £29,850, to which must be added £2,189 on motor char-à-bancs account, representing a total of £32,039, which was disposed of as follows:—Interest on capital, £5,616; income-tax on profits, £308; repayments of loans, £6,219; improvements, £198; reserve and renewals fund, £4,351; maintenance and repairs suspense account, £8,767; rate relief, £6,580. The expenditure was:—Operating costs, £28,946, an increase of £4,845; general charges, £5,635, an increase of £121; maintenance and repairs, £8,047, an increase of £912. The income was 16·67d. per mile run, or £76,193, an increase of £10,347. The car-miles run were 1,096,868, and passengers carried numbered 17,126,210; total working expenses per car-mile, 13·7d.; number of passengers per car-mile, 15·6.

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CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—September 4th. Victorian Railway Commissioners. 800 lighting transformers for signal system. A copy of the specification may be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence) in London.

Spain.—Tenders are invited for the supply, either new or second-hand, of one three-phase transformer, 9,600/220 volts, 140 KW., 50 cycles; one three-phase motor, 220 volts, 150 H.P., 1,000 R.P.M.: one D.C. generator, compound-wound, 100 KW., 500 volts, 1,000 R.P.M. Tenders to be sent, in duplicate, to the offices of La Sociedad Tranvia de Mondariz a Vigo, Calle Génova 16, Madrid.

August 23rd. The municipal authorities of Don Benito are inviting tenders for the concession for the electric lighting of the town: no specific period is mentioned.

Wigan. — Corporation. August 19th. Extension to engine room and switch room. Borough Engineer.

CLOSED.

Bridlington.—T.C. Coal for the Electricity Works. Bullcroft Main washed smalls. Mr. W. B. Wilson, York. £1 6s. 4d. per ton.

Carnarvon.—Electricity Committee. Conversion of the Diesel engine to run on tar oil, £107. Electric Construction Co., Ltd.

Sheffield.—City Council.

Steel chimney at Neepsend power house.—Mr. G. Cooper.

Salford.—Town Council.

William Muir & Co., Ltd.—8-in. stroke tramway slotting machine and accessories, £190.
Stewarts & Lloyds, Ltd.—16 steel elbow pipes, £195.

Swansea.—Harbour Trust.

Half a mile 7/12 aerial cable, £54; one mile 7/14 ditto, £65; one mile 7/18 ditto, £28.—W. Richard, Ltd.
Two miles No. 8 galvanised steel wire, 46s. cwt.—Richard Johnson, Clapham, and Morris.

NOTES.

National Electricity Supply.—A conference of representatives of publicly-owned electricity undertakings on the North-East Coast was held at Newcastle on August 4th, the Lord Mayor (Sir George Lunn) presiding, to consider the report of the Board of Trade Committee on Electricity Supply. The feeling of the meeting was not against the scheme, but was strongly opposed to bulk supply stations being in private hands, and a memorandum was considered with a view to representations being made to the Government in favour of such plants being controlled by a public Electricity Board. The proceedings were adjourned for a fortnight, without a decision being come to, in order that a pending report on the same subject from the Law Committee of the Municipal Corporations Association might be considered.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Corps Orders No. 34, by Lieut.-Colonel C. B. Clay, V.D., Commanding:—
Captain of the Week.—Capt. E. G. Fleming.
Next for Duty.—Capt. W. Hynam.
Monday, August 19th.—Demolition Lectures, 5.30 and 7.30. Signallers, 6.30.
Tuesday, August 20th.—No. 3 Company, Entrenchments, 5.30. Lecture: "March Discipline"—Officers and N.C.O.'s, at 6.30. Recruits' Drill, 6.30.
Wednesday, August 21st.—No. 1 Company, Entrenchments, 6.30. Recruits' Drill, 6.30.
Thursday, August 22nd.—No. 2 Company, Entrenchments, 6.0. Recruits' Drill, 6.30. Signallers, 6.30. Ambulance Section, 6.30. Band Practice, 7.
Friday, August 23rd.—Range, 5.30—6.30 and 7.30—8.30. Lecture: "Railway Transport"—Officers and N.C.O.'s, 6.30.

C. Higgins, *Capt.* R.E., *Adjutant.*

Guide to Wandering Airmen.—According to the *Times*, a Swiss Federal Cross, lighted with electricity and over 50 yards in dimensions, has been installed on a plateau near the Franco-Swiss-German borders for the guidance of belligerent aeroplanes.

Fatalities.—On the 7th inst., an inquest was held at Stourport, touching the death of Arthur Wilson (16), of Till Street, who was killed at the Portwood Spinning Co.'s works, where he was employed as a mechanic's apprentice. Evidence was given that on Tuesday, last week, the deceased and the electrician, Edgar Oldham, went to the top of the hoist to repair an installation. The current had been switched off. Whilst deceased was in contact with a terminal, he suddenly called out: "Oh! it's alive," and fell across the beam. Oldham prevented him from falling down the hoist well, and lifted him out on the roof. Artificial respiration was tried, without success. Oldham said that when on the roof, directly afterwards, the hoist man (William John Barrett) said: "I must have touched the switch with my shoulder." He had no recollection of touching it with sufficient force to put the current on. A verdict of "Accidental death" was returned, no one being to blame.

An inquiry was held at Newcastle-upon-Tyne, on the 7th inst., into the circumstances of the death of Stanley Dunn Bavin (17), an apprentice plater, of Wallsend-on-Tyne, who was killed at the Neptune Works of Messrs. Swan, Hunter & Wigham Richardson, Ltd., Walker, on Friday, 2nd inst. John Stanley College, an apprentice plater, stated that he and Bavin, with others, were engaged in punching a shell bar at an electrically-driven machine. The bar was held by an overhead crane, and Bavin was steadying the bar with a "dog" bar. Witness had hold of one of the chains by which the bar was slung, when he received an electric shock. Looking round, he saw Bavin on the ground. Anthony Vashkevich, foreman electrician, said he examined the machine after the accident, and found that the terminal wires, as a result of the vibration of the machine, had become bare and dropped on to the compensator-box, on which there were signs of burning. The only explanation he could give of the accident was that the earthing wire from the compensator-box to a water pipe had become defective; it was practically burned through, and came off in his hands when he touched it. The machine where the accident occurred had been working night and day for three months. It was overhauled in June. Witness, in answer to Mr. W. B. Lauder, factory inspector, said that if the machine had been properly earthed it would not have become charged in such a way as to give a shock to the man working it. He agreed that copper wire twisted round the tubes carrying the cable and twisted round the water pipe was not a proper way to earth a machine. A verdict of "Accidental death" was returned, and the jury expressed the opinion that the means used to earth the machine were defective.

In order that expert opinion might be obtained, the Dublin City Coroner (Dr. L. Byrne) adjourned an inquest respecting the death of Dennis White, electrician, which occurred at a munition factory where he was employed on rewiring work at a hooter. The evidence showed that deceased was seated on an iron girder, with his hands on an overhead electric wire, which happened to be alive, and he received a shock at 200 volts. When the current was switched off he fell 15 ft. on to the cement floor, his head striking a machine in the fall.

The works superintendent said the wire was dead on the morning of the occurrence, as the current had been switched off the night before. Witness, after the accident, found one of the wires partly cut, and the insulation was cut; the deceased was finding out whether the circuit was alive or not. It proved to be alive, and when he cut through it he received the shock. White's employer said the circuit did not comply with the Regulations of the Home Office or those of the Institution of Electrical Engineers or the Dublin Corporation; it should never have been connected in the way it was. The house surgeon at Stevens's Hospital, where White was taken, said that except for what had been stated he had no evidence that the man had received an electric shock. He had, however, sustained a depressed fracture of the skull.

Wood Pipe Line in New Zealand.—There has been completed at Oamara, New Zealand, a large wood pipe for the conveyance of water in connection with the borough electricity works. The pipe is 36 in. in diameter, and is continuous throughout its whole length of 1,635 ft. It has been laid in a trench. Its adoption was practically forced upon the Borough Council owing to the impossibility of procuring iron pipes of the dimensions required in connection with the hydro-electric undertaking. The pipe was made in Australia, and is intended to supply water to two Pelton wheels at a pressure of 105 lb. per sq. in., developing 650 H.P. continuously. It is a continuous stave wood pipe with steel clamping bands, and has a thickness of 1⅛ in.—*Board of Trade Journal.*

A 110,000-Volt Line to Berlin.—It is reported from Berlin that the supply of electrical energy from the great power station at Golpa-Zschornewitz to the German capital has recently commenced. The scheme has been carried out on behalf of the Raw Materials Department of the War Office, and in this way a proposal which occupied the attention of experts prior to the war has now been realised. The Raw Materials Department was induced to proceed with this undertaking owing to the necessity for ensuring a supply of energy particularly to works engaged on war contracts in Greater Berlin, and the electrical transmission of power is said to represent a saving of from 300 to 400 tons of coal per day in the supply of coal in Berlin. The length of the 110,000-volt overhead conductors is 81.84 miles; the three stranded cables are of aluminium, each of a cross section of 120 sq. mm. The conductors are arranged on Hewlett suspension and straining insulators attached to iron masts, and an iron earth cable of 50 square mm. is placed over the three conductors. The masts, which are erected at intervals of 250 metres, have been adapted for the accommodation of three further conductors. Wooden sleepers were selected as the foundation for the suspension masts and concrete for the stay and angle masts. The sub-soil, however, was in part so unsatisfactory that the use of iron concrete piles had to be resorted to for the foundation. It is possible to transmit 20,000 KW. over the line. The transformers at each end are of 16,000 KW., and have aluminium windings, and the distribution plant at Berlin is at 6,000 volts. The installation was begun in October, 1917, and most of the work had to be carried out during the winter.

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Institution and Lecture Notes.—Institute of Metals.—The autumn meeting will be held in the rooms of the Chemical Society, Burlington House, Piccadilly, W. 1, at 7.45 p.m., on Tuesday, September 10th, and 4 p.m. on the following day, concluding the same evening. Amongst the papers to be read are the following:—"The Effect of Progressive Cold-work upon the Tensile Properties of Pure Copper," by W. E. Alkins; "Grain Growth in Metals," by Z. Jeffries, D.Sc.; "Annealing Cold-Rolled Aluminium Sheet by Abbreviated Exposures at Various Temperatures," by R. J. Anderson, B.Sc., Met.E.

Royal Society.—At a special general meeting called to consider the proposed expulsion of enemy members, it was decided that the delegates of the Society should raise the question at the forthcoming conference with the representatives of the Academies of Allied nations in October.

Diesel Engine Users' Association.—At the July meeting the usual annual donation to the benevolent fund of the I.E.E. was voted. Correspondence was reported with the Board of Trade in regard to exempting from the operation of the Lighting, Power, and Heating Order, so far as electricity supplies are concerned, consumers in areas in which electricity is generated by means of Diesel oil engines, on the ground that such electrical undertakings had already effected an important economy in the use of coal.

There was a short discussion on the subject of a recent alteration in the nature of certain lubricating oils used by members of the Association, and some criticism in connection with the supply to certain undertakings of a substitute oil in place of the lubricating oil formerly supplied. A discussion took place on the paper on "Atomisation and Turbulence," which had been presented at the previous meeting of the Association by Mr. P. H. Smith, who, in his reply, gave information concerning the advantages and disadvantages of the different systems of burning tar oil in varying conditions of loading and size of cylinders. Referring to questions that had been asked concerning mixtures of petroleum fuel oil and tar oil, Mr. Smith stated that he did not think mixed oils satisfactory, and that he would much prefer to run an engine on a straight oil.

Inland Water Transport.—Mr. Bonar Law has informed Mr. F. W. Fryer that his plan for the development of inland water transport by continuous cable haulage is to be considered by the Select Committee of the House of Commons on Canal Development.

Electric Annealing.—Electric annealing is being used at Brea, California, for restoring crystallised oil-well casing and rotary drill-pipes, particularly the latter. One joint is treated at a time. It takes about 15 minutes to heat a 6-in. pipe by electricity to the required temperature. A pressure of 600 lb. per sq. in. is applied to the ends of the pipe during this period.

Appointments Vacant.—Shift engineer, for the Borough of Rawtenstall Electricity Works; assistant charge engineer, 50s. + 20s. + 12½ per cent., for the West Ham Corporation Electricity Supply; junior mains assistant engineer, £170 p.a., for the Fife Electric Power Co.; shift engineer, 65s. + 12½ per cent., for the Leigh Corporation Electricity Works; charge engineer for the Bury St. Edmunds Corporation Electricity Works. See our advertisement pages to-day.

A Tribute to Central-Station Men:—

Some are doing their bit on shore,
And some on the mighty sea,
Some in khaki, some in blue,
But such as the likes of we
Are doing our bit from day to day,
But never a soul can see
That we are serving our home and King
With loyal fealty.

No stripes, no chevrons or ribbons gay
Adorn our arms or chest.
We might be slackers or shirkers, but
If it is put to the test,
You'll find that most of us wanted to join
The forces with the best
Red blood of Britain's manhood who
Have gone to their last long rest.

We couldn't. We're told that we must stop
At home and defeat the Hun,
By running the central stations from
The set to the set of sun,
So that the great munition works
Can turn out shells by ton.
But never a word of praise to say*
Our duty is well done.

We do not ask for a medal of bronze,
Or yet for an O.B.E.,
But in the wheel of munitions we
Are really the hub, you see;
So when you speak of aeroplanes, guns,
Just think of the likes of we,
Who toil and slave 'mid the turbines' war
Is a central-station man's plea.

P. Gordon Hieatt, Derby.

* This must be poetic licence; the immense importance of electricity supply in the national service has been cordially recognised by Cabinet Ministers and other prominent men, and we have often drawn attention to the facts in our own columns.—Eds. Elec. Rev.

The Home Front.—Shorter working hours, without a wages reduction, are demanded by the engineering trades, and the Employers' Federation has been asked to arrange a conference to discuss the question.

The Plantation Rubber Industry.—In the *Times* Trade Supplement for August, Mr. J. S. M. Rennie gives interesting particulars of the plantation rubber industry. The following data are given in regard to the location and domicile of all the known rubber plantations:—Domiciled in the United Kingdom, 1,189,328 acres; in Straits Settlements, 98,095 acres; in Federated Malay States, 118,348 acres; in Ceylon, 57,000 acres; in Shanghai (British), 30,000 acres; in Holland and N.E.I., 260,000 acres; in France and Belgium, 100,000 acres; in U.S.A., 55,000 acres; and in Germany, 3,400 acres; or a total planted area of 1,911,171 acres. It will be seen that, based on domicile, the British Empire holds control of very nearly 80 per cent. of the whole planted area. If we rely on situ or place where planted, the control will be vested as follows:—

British.

F.M.S. and Johore	807,491 acres
S. Settlements	159,500 ,,
Ceylon	229,695 ,,
South India	41,820 ,,
B. Borneo	29,880 ,,
B. Burmah	26,399 ,,
South Sea Islands	5,000 ,,

A total of 1,299,786 acres, or 67 per cent.

Dutch and Others.

Sumatra	352,455 acres
Java	238,830 ,,
Dutch Borneo	10,100 ,,
Cochin-China	10,000 ,,

A total of 611,385 acres, or 33 per cent.

When in or about the year 1920 the above planted areas are wholly mature the resultant annual crop will be about 380,000 tons, and will be under control in the following manner:—British, 290,000 tons; Dutch and others, 90,000 tons.

Mr. Rennie estimates that in 1920, if Peace had come, unless some restriction on the supply of raw materials to our enemies were enforced, present enemy and neutral countries would consume 55,000 and the United Kingdom and Allies 325,000 tons. That is to say, they would obtain nearly 15 per cent. of the crop at the same price per lb. as those who have, by foresight and patience, brought the industry to its present position. The existing average market value of an acre of planted rubber is £135, and with a cost of production of, say, 1s. all in, a normal selling price of 2s. per lb., and an output per acre per annum of 375 lb., the resultant profit per capital unit of £135 is £18 15s., or, say, 14 per cent. on capital invested.

Using up Old Dry Cells.—In *Annales des Postes, Télégraphes, et Téléphones*, Messrs. Reynaud-Bonin and Houdas give particulars of investigations made by the French Telegraph and Telephone Department, with a view to utilising dry cells which have been exhausted. They find that, as a rule, only one-eighth of the manganese peroxide is decomposed; the old zinc is useless, the electrolytic paste is dried up, and crystals of ammoniacal zinc chloride pervade the paste, &c. By taking the cell apart, washing the bag which contains the positive electrode, cleaning off the crystalline incrustation, and putting the bag to work again with a new zinc and a new electrolytic paste, the cell thus rebuilt is capable of giving quite a considerable percentage of its original output. A further improvement can be made by pulverising the depolariser and immersing it in a 10 per cent. solution of hydrochloric acid for 24 hours, to remove the zinc, ammonia, reduced manganese oxide, &c., and using the purified peroxide in the construction of new cells.

Wireless Station.—The Telefunken Co., of Berlin, is to construct a wireless station near Kootwyk (Holland) to the order of the Dutch Minister of Waterways, for communication between Holland and its East Indian Colonies.

Educational.—University of London Engineering College.—Session 1918-19.—The next session commences September 30th. Particulars of the electrical engineering day and evening courses are given in our advertisement pages to day.

Italian Combine in Electrical Industry.—H.M. Consul at Milan states that a limited liability company has been formed with a capital of 64 million lire (to be increased to 80 millions) to absorb Messrs. Franco Tosi, of Legnano, the Officine Insubri (ex Langen & Wolff), and the Soc. Elettrotecnica Galileo Ferraris (ex Thomson-Houston).

A Science Conference.—At the invitation of the Royal Society, a Conference of representatives of Allied nations will be held in London on October 9th to discuss the future conduct of scientific work hitherto carried out by international organisations. Amongst the subjects to be dealt with are standards of measurement, in which the foremost place is held by the metric system; the investigation of scientific problems in which co-ordination of observation is essential; the economical division of work; international scientific congresses; and the International Association of Academies, which aims at co-ordinating the activities of international undertakings.

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OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—The Stafford T.C. has increased the salary of the electrical engineer from £337 10s. a year to £387 10s.

Nelson Town Council has increased the salary of Mr. NAYLOR, electrical engineer, by £25 per annum.

Southport Corporation Tramways Committee recommends that the salary of Mr. KENDREW, general manager, be increased from £300 to £400 per year.

The Peterborough T.C. has advanced the salary of Mr. T. ROWLAND, acting electrical engineer, from £278 to £330 a year.

The Maidenhead T.C. has increased the salary of the electrical engineer, Mr. MILTON, by 20 per cent.

Mr. WRAGG, A.M.I.E.E., the municipal electrical engineer, Paarl, Cape Province, has been appointed engineer to the Koffyfontein Mines, Ltd., Orange Free State.

Mr. H. H. LINCOLN, assistant engineer and draughtsman to the Sheffeld Tramways Department, has been granted three months' leave of absence for health reasons.

General.—Mr. H. G. WILLIAMS, M.Sc., who was formerly on the engineering staff at Messrs. Siemens Brothers Dynamo Works at Stafford, has been approved as Conservative and Unionist candidate for the Combined Universities Parliamentary Division. He was at one time President of the British University Students' Congress.

Mr. LYDALL, the well-known electrical engineer, who has been visiting South Africa to report on behalf of Messrs. Merz & Co. on the electrification of the S. African railways, has completed his investigation and is returning to England.

Mr. JOHN BRABY is leaving Wimbledon Corporation electricity works to take up the position of engineer-in-charge with the Woking Electric Supply Co., Ltd.

Roll of Honour.—Private H. T. DEVENISH, Cheshire Regiment, formerly in the general office of the India-Rubber Co., Silvertown, and Private E. SPOONER, Northants Regiment, who was in the instrument department of the same company, are prisoners of war in Germany. Corporal T. PURCHASE, R.F.A., who was in the cashier and buyer's office of this company, has been wounded in Italy.

Lieutenant (Acting-Captain and Adjutant) V. C. RUSSELL, Suffolk Regiment, younger son of Mr. Stuart A. Russell, works manager of the India-Rubber Co., has been awarded the D.S.O. for the following act of gallantry and devotion to duty in the field :—

"At a period when the situation was critical, the front having been forced in and the flank in the air, he took charge as the parties fell back and organised a fresh defence line, under heavy fire, which he held for several hours. Later, when forced again to withdraw, he was the last to leave, and then only when the enemy were within 40 yards."

Lieutenant Russell was awarded the Military Cross in November, 1917, and a bar in March, 1918. He has also been twice mentioned in dispatches, and twice wounded.

Corporal D. CLARK has received a commission, and is proceeding to Ripon for training. Previous to enlisting in the L.N.L. Regiment he was on the staff in the Darwen Tramway Manager's office.

Gunner W. R. PEERLISS, Anti-Aircraft Service, who has died of illness, was an electrician with Mr. Hunt, of S. Croydon.

Lieutenant (Acting Captain) R. B. WILMSHURST, Lincs. Regiment, who has gained the Military Cross for gallantry and devotion to duty by subduing a fire amongst ammunition, is the youngest son of Mr. T. B. Wilmshurst, electrical engineer for the borough of Derby. He has risen from the ranks.

Sapper R. T. JACKSON, who joined the Royal Engineers from the Rugby Works of the British Thomson-Houston Co., Ltd., has been drowned whilst on active service.

Private J. HOLT, died of wounds, was formerly employed by Messrs. Charles Macintosh & Co., Ltd., electric cable manufacturers, Hulme, Manchester.

Gunner P. HOUGHTON, R.F.A., wounded for the second time, and now in hospital at Gloucester, was an apprenticed electrician with Messrs. Heyes & Co., electrical engineers, of Wigan.

Acting Captain J. H. SEMPLE, Gordons, reported wounded, is a son of Mr. and Mrs. Robert Semple, Kirkburn, Tanzieknowe, Cambuslang. He joined the army on the outbreak of the war, and received his commission on the field at the battle of Loos, September, 1915. He has been Acting Captain since November. Prior to the war he was with Messrs. Mavor & Coulson, electrical engineers, Glasgow.

CHARLES SAUNDERS, A.B., Royal Navy, who was in the employment of the Central Electric Supply Co at Grove Road generating station prior to enlistment in 1914, died of acute neuritis on July 26th, whilst on active service.

Second-Lieutenant R. A. JAMESON, Royal Scots, who was formerly on the staff of the telegraph department of the G.P.O. at Edinburgh, has been killed in action.

Captain J. B. JAMISON, Royal Irish Rifles, whose death in action has been confirmed, was employed in the Belfast Corporation's electricity department for some eighteen years.

Lieutenant J. GRAY, 2nd/4th Queen's Royal West Surrey Regiment (son of Mr. James Gray, managing director of the Electric Construction Co., Ltd.), has been awarded the Croix de Guerre (1st class) with palm leaves.

Obituary.—MR. FRANK GARRETT.—The death occurred on August 2nd of Mr. Frank Garrett, head of Messrs. Richard Garrett & Sons, the well-known agricultural engineers, and makers of the Garrett patent electric wagon, of Leiston Works, Leiston, Suffolk. He was 74 years of age.

O. HENRICI.—The death is announced of Prof. Olaus Henrici, LL.D., F.R.S., Emeritus Professor of the Central Technical College, aged 78. Prof. Henrici was justly loved and respected by the many students who attended his lectures, and by his former colleagues, and occupied a prominent position in British mathematical circles.

NEW COMPANIES REGISTERED.

Brown Bayley's Steel Works, Ltd. (151,000).—Registered August 1st. Capital, £800,000 in £5 shares (100,000 pref.). To take over the business of Brown Bayley's Steel Works, Ltd., registered in 1888, and to carry on the business of manufacturers of iron and steel, gas and coke, electric light and heat; chemical manufacturers, refiners, distillers, dye makers, shipbuilders, mechanical engineers, &c. The subscribers are :—R. Armitage, M.P., Farnley Hall, Leeds, ironmaster, 200 shares; W. Armitage, Dore Moor House, Sheffield, Major in H.M. Army, 200 shares; Lord E. Hamilton, Carlton Club, S.W., director, 200 shares; H. Brearley, Elmwood, Old Whittington, near Chesterfield, manager of steel works, 200 shares; M. R. Maniprice, Norwood, Dore, Sheffield, manager of steel works, 200 shares; T. Hagon, 33, Main Road, Handsworth, near Sheffield, secretary, 1 share; H. Ashford, 39, Waterloo Street, Birmingham, chartered accountant, 1 share. The first directors are : R. Armitage, M.P., W. Armitage, Lord E. Hamilton, H. Brearley, M. R. Maniprice (all British). Minimum cash subscription : Seven shares. Qualification, £1,000 shares or stock. Registered office : Attercliffe, Sheffield.

Fabric Rubber Co., Ltd. (151,073).—Private company. Registered July 30th. Capital, £25,000 in £1 shares. Manufacturers of india-rubber goods, waterproofs, airship proofing, leather goods, electric cables, and general contractors to Governments, States, railroad, shipping, and other companies, &c. The subscribers (each with 100 shares) are :—M. F. Frankenburg, 4, Park Lane, Higher Broughton, Manchester, rubber manufacturer; S. T. Rowe, Dunoon, Wilbraham Road, Chorlton-cum-Hardy, Manchester, buyer; H. Standring, Brueside, 221, Urmston Road, Stretford, incorporated accountant. The first directors are : M. F. Frankenburg, S. T. Rowe, and H. Standring.

East London Mica Co., Ltd. (151,149).—Private company. Registered August 8th. Capital, £1,000 in £1 shares. Manufacturers of and dealers in mica and talc, &c. The subscribers are : C. G. Grout, 7, Eastfield Road, Walthamstow, mica merchant, 400 shares; P. H. Butler, 10, Connaught Road, Chingford, mica merchant, 400 shares. Permanent directors : C. G. Grout and P. H. Butler. Registered office : 17a, Edinburgh Road, Walthamstow, E. 17.

Pneumatic and Electric Syndicate, Ltd. (151,145).—Private company. Registered August 8th. Capital, £50 in 2s. shares. To acquire the option to purchase patents for improvements in pneumatic and electrical appliances, &c. The subscribers are :—R. Warner, 10, Walbrook, E.C., accountant, 9 shares; Alethea Warner, same address, clerk, 1 share. Table "A" mainly applies. Solicitor : W. Sparks, 32, Walbrook, E.C.

A. M. T. Syndicate, Ltd. (151,149).—Private company. Registered August 9th. Capital, £5,000 in 4,500 10 per cent. pref. shares of £1 each and 10,000 def. shares of 1s. each. To acquire the patent rights in an instrument for automatically teaching the Morse Code, &c. The subscribers (each with one pref. share) are :—C. F. Gold, 465, London Road, Isleworth, land agent; H. Whitwell, 49, Fontayne Road, Stoke Newington, advertising agent. The directors are to be appointed by the subscribers.

Domestic Electric Co., Ltd. (151,091).—Private company. Registered August 1st. Capital, £100 in £1 shares. To sell, deal in, and manufacture combustion engines and other machinery, &c. The subscribers (each with one share) are :—H. A. Orme, Newbridge, Wolverhampton; C. Smith, 3, Salter's Hall Court, Cannon Street, E.C. 4, solicitor. The first directors are : W. Paul and H. Orme.

Howard Electrical Co., Ltd. (151,085).—Private company. Registered July 31st. Capital, £5,000 in £1 shares. Electrical engineers and contractors, carriers of passengers and goods, suppliers of electricity, &c. The subscribers (each with one ord. share) are :—M. Howard, 86, Loughborough Road, West Bridgford, Notts., electrical engineer; H. E. Crammond, 126, Radcliffe Road, West Bridgford, Notts., electrical engineer; J. T. Kemp, 19, Highfield Road, West Bridgford, Notts., electrical engineer; S. G. Leach, 26, Artillery Lane, E.C., electrical engineer. The first directors are not named.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

T. H. Brooker & Co., Ltd.—Memorandum of satisfaction in full on July 24th, 1918, of debentures dated March 22nd, 1911, and May 9th, 1917, securing £250 and £1,100 respectively.

Urban Electric Supply Co., Ltd.—Mortgage or charge dated July 4th, 1918, to secure advances not exceeding £75,000, charged on all the undertaking, property, and assets, present and future, including uncalled capital (floating charge), ranking immediately after the charges already created to secure the first mortgage debenture stock issued and to be issued. Holder : Minister of Munitions.

Laing, Wharton, Ltd.—Memorandum of satisfaction in full on July 16th, 1918, of mortgage debentures dated January 4th, 1918, securing £700, has been filed. Also registered : Mortgage debenture dated July 26th, 1918, securing £500, charged on all real and personal property, present and future, including uncalled capital. Holder : Minister of Munitions.

Maxim Lamp Works, Ltd.—Particulars of £4,000 debentures created April 8th, 1918, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £3,000. Property charged : The company's undertaking and property, present and future, including uncalled capital. No trustees.

Harry W. Cox & Co., Ltd.—Issues on September 1st, 1913, of debentures securing £100, part of a series. Satisfaction in full on June 20th, 1918, of debentures dated September 1st, 1913, securing £100, has also been filed.

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CITY NOTES.

Westinghouse Electric and Manufacturing Co., U.S.A.

The report for the year ended March 31st last shows $15,405,681 surplus income after charges, including all taxes, a decrease of $2,674,208. This surplus was equal to $10.29 a share on $74,812,650 capital stock outstanding, against $15.10 earned the year before, when the capital stock outstanding was $59,855,500 up to February, 1917, at which time $15,000,000 new common stock was issued. Gross earnings, $96,735,407, against $89,225,442; sales cost, including taxes and adjustments, $80,225,937, against $72,077,752; manufacturing profit, $15,509,470, against $17,461,690; other income, $1,325,263, against $1,386,547; gross income, $16,834,733, against $18,848,237; interest, $1,429,052, against $768,348; surplus, $15,405,681, against $18,079,889; preferred dividends $229,902, against $279,909; common dividends, $5,310,946, against $3,750,000; balance, $9,794,833, against $14,049,980 Gross earnings (sales billed) include shipments since June 15th, 1917, from the machine works (formerly Westinghouse Machine Company); also $4,536,000 for munitions. The volume of sales billed for the regular products of the company was greatly in excess of any previous year. At April 1st the value of unfilled orders in hand was $147,857,580, of which $110,185,007 was for the company's regular products. No facilities heretofore employed on regular products are engaged on munition work. In addition to the regular quarterly dividends at the rate of 7 per cent. per annum on the preferred and common stock, a special "Red Cross" dividend was paid, making a total of $5,610,848 for all dividends during the year. Net surplus is $26,404,694, an increase of $8,299,396 over 1917. The chairman reports: In the latter part of 1916 a proposal was submitted to the directors for the purchase of a small portion of the holdings in the British Westinghouse Electric & Manufacturing Co., Ltd., in order that a controlling interest might be transferred from the United States to England. After careful consideration the directors concluded that the commercial position of the British Westinghouse Electric & Manufacturing Co., Ltd., would be improved if the control of that company were owned in England instead of the United States, but decided that the sale of the entire holdings was the only satisfactory solution of the situation. Accordingly negotiations were concluded under which the holdings of 4 per cent. debenture stock and preference and ordinary shares in the British company were sold to a syndicate formed in London (Electric Holdings, Ltd.) and payment therefor has been received in 5 per cent. prior lien debenture bonds maturing in 10 years. These bonds are secured by the pledge of all the said securities sold and certain other additional collateral. This change in the investments was made without change in book values, and has therefore not affected the balance-sheet.

Carbide Amalgamation.—The directors of the Alby United Carbide Factories propose to purchase the Nitrogen Products and Carbide Company. The latter owns the cyanamide works at Odda, Norway, to which the Alby Company supplies a large proportion of its output. It is proposed to capitalise and distribute a portion of the reserve by allotting one additional ordinary £1 share for every eight held. It is proposed to increase the capital of Alby United to £2,350,000 by the creation of 1,625,000 new ordinary shares of £1 each, ranking *pari passu* with the existing ordinary shares. Treasury sanction has been obtained to the issue of the necessary capital and its use for the purposes of this scheme. Nitrogen Products will go into liquidation and its assets and liabilities will be taken over by Alby United, which will give in exchange shares in its own capital. Alby United, as the holder of 500,035 shares of Nitrogen Products, is not to be entitled to claim any allotment of shares nor to be liable to pay any sums unpaid in respect of its holding in Nitrogen Products.

W. T. Henley's Telegraph Works Co.—Dividend on the preference shares at the rate of 4½ per cent. per annum, less income tax, for the half-year ending June 30th last, payable on the 31st inst. Also an interim dividend on the ordinary shares, to be paid on the 31st inst., of 2½ per cent., less income tax.

South Metropolitan Electric Light and Power Co., Ltd.—The transfer register and register of members will be closed from August 19th to 31st (both days inclusive), for the preparation of warrants for dividends payable the 31st inst. on the 7 per cent. cumulative first preference shares and 6 per cent. cumulative second preference shares for the half-year ended June 30th, 1918.

Electro-Bleach & By-Products, Ltd.—Interim dividend in respect of the current year of 3½ per cent., less income-tax at 5s. 6d. in the £, on the preference shares, such dividend being payable on September 1st next to the registered holders of the preference shares on August 9th.

Blackpool-Fleetwood Tramroad Co.—Interim dividend of 4s. per share, free of tax, the same as a year ago.

Lanarkshire Tramways.—7 per cent. per annum (7s. per share), less tax, for half-year (interim), payable 17th inst. Last year, 6½ per cent. per annum.

London & Suburban Traction.—It is not proposed to pay an interim dividend on preference shares on 15th inst. Last year, no interim dividend was paid.

Brompton & Kensington Electricity Supply.—7 per cent. per annum (3s. 6d. per share), less tax, on ordinary shares for half-year (interim). Last year, 8 per cent. per annum.

Leyland Motors (1914).—Interim dividend on ordinary shares, payable September 10th to holders registered 30th inst.

Hong-Kong Tramway.—7d. per share, less tax (interim), payable in Hong-Kong 21st inst. Last year 5 2-5d. per share.

Stock Exchange Notices.—Applications have been made to the Stock Exchange Committee to allow the following to be quoted in the Official List:—

Callender's Cable & Construction Co., Ltd.—40,000 additional ordinary shares of £5 each, fully paid.

Chili Telephone Co., Ltd.—Further issue of 22,000 shares of £5 each, fully paid (Nos. 66,001 to 88,000).

Lancashire Dynamo & Motor.—Final dividend of 6d. per share on the fully-paid £1 ordinary shares for 1917, and an interim dividend of 1s. per share for the year 1918 on the same class of shares, both free of income tax.

STOCKS AND SHARES.

Tuesday Evening.

At this holiday season of the year, it has been customary to "seize the opportunity" in this column of comparing the day's quotations with those that ruled at the beginning of the year. But with remembrance of the war's anniversary so shortly passed, it would appear more appropriate to match the current prices with those prevailing at the end of July, 1914, on the eve of the outbreak of war, and accordingly the tables which follow will point the differences that remain as a net result of the period.

Taking first the Ordinary shares of electricity supply companies, this is the comparison:—

Share.	July 27th, 1914.	August 7th, 1918.	Fall.
Brompton and Kensington ...	9⅛	6½	2⅝
Charing Cross	5¼	3⅛	2⅛
Chelsea	4⅞	3¼	1⅝
City of London	16	11⅜	4⅝
County of London	12	10⅛	1⅞
Kensington	7½	5¼	2¼
London	1 1/16	1	1/16
Metropolitan	3½	3⅛	⅜
St. James'	9⅛	6⅜	3¼
South London	3 1/16	3	1/16
Westminster	8⅛	6	2⅛

It is to be noted that whereas securities paying fixed-interest have fallen heavily during the period, shares of a speculative nature have in many cases improved. London Electricity Supply shares are mostly of a sound investment quality; and although dividends have fluctuated mildly during the period, the shares have little claim to be called speculative in any sense. Moreover, the industry has been hardly hit by such peculiar circumstances as, for instance, "Summer Time," and the falls in prices are not surprising, considering all things.

Electric Railway issues present the following changes:—

Stock.	July 27th, 1914.	August 7th, 1918.	Fall.
Central London	83	62½	20½
Metropolitan	37½	23¾	13¾
District	21¾	21¾	—
Underground Income ...	88	86	2
ditto "A" ...	7/6	6/6	1/-
ditto £10 paid ...	2½	2½	—

Heavy falls have occurred in some of the colonial and foreign stocks and shares, as, for instance:—

Stock.	July 27th, 1914.	August 7th, 1918.	Rise or fall.
British Columbia Def. ...	107	40½	— 66½
Brazil Traction	66	46½	— 19½
Canadian General	99½	111	+ 11½
Kaministiquia	126½	117½	— 9
Melbourne Electric	192	160	— 32
Mexican L. and P.	46½	21	— 25½
ditto First Bonds ...	81½	49	— 32½
Monterey Fives	50½	42	— 8½
River Plate Electric... ...	240	135	—105
Victoria Falls Pref.	13/9	23/9	+ 10/

Mexicans have suffered heavily because of the long-protracted chaos in the country. Canadian investments, after a bad time, began to improve as one and another of the industrial companies

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started making munitions. A "good" group is that of the Telegraph and Telephone list, as these prices show :—

Stock.	July 27th, 1914.	August 7th, 1918.	Rise or fall.
Anglo-American Pref. ...	108¼	96	− 12¼
Direct U.S. Cable	5⅞	6½	+ ⅝
Eastern	130½	158½	+ 28
Eastern Extension	12¾	15½	+ 2¾
Globe Telegraph	11¼	14⅜	+ 3⅛
Great Northern	32½	37½	+ 5
Indo-European	59	58½	− ½
Marconi	1⅛	4¼	+ 2 1/16
West India and Panama ...	1¼	1 1/16	+ 1/16
Western	13⅝	16	+ 2⅜

Manufacturing shares make the most interesting group, but comparisons are difficult, owing to the number of share bonuses and other gifts which the fortunate proprietors have received. We must make shift accordingly with a list that is obviously inadequate :—

Share.	July 27th, 1914.	August 7th, 1918.	Rise or fall.
Babcock & Wilcox ...	2¼	3⅞	+1⅝
British Aluminium ...	1	1⅞	+ ⅞
B. Westinghouse Pref. ...	1¾	2 1/16	+1 1/16
Callenders	11⅞	19½	+7⅝
Edison "A"	2/-	45/-	+43/-
India-Rubber	9	16¼	+7¼
Telegraph Con.	38½	44½	+6

This is a very brief summary of the movements of prices in shares connected with the electrical industry, but it helps to show clearly the trend of business over the last four years.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Aug. 6. 1918.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6½	—	£7 13 16
Charing Cross Ordinary	5	4	8¼	— ⅛	6 8 0
do. do. do. 4½ Pref...	4½	4½	8¼	—	6 18 6
Chelsea	3	5	3¼	—	7 13 10
City of London	8	8	11⅜	+ ⅛	7 0 3
do. do. 6 per cent. Pref. ..	6	6	9⅛	—	6 0 4
County of London	7	7	10⅛	—	6 17 7
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	*6	7	5½	—	6 13 4
London Electric	Nil	Nil	1⅜	—	Nil
do. do. 6 per cent. Pref...	4	5	3½	—	7 13 10
Metropolitan	3	4	3⅜	—	6 8 0
do. 4½ per cent. Pref. ..	4½	4½	3½	—	6 18 6
St. James' and Pall Mall	8	9	6⅝ xd	—	7 1 2
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6	— ⅛	7 10 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	96	—	6 5 0
do. Def.	1½	1½	22⅜	+ ½	6 11 10
Chile Telephone	8	8	7½ xd	+ ½	4 1 7
Cuba Sub. Ord.	7	7	10	—	*7 0 0
Eastern Extension	8	8	15⅛	—	*5 3 3
Eastern Tel. Ord.	8	8	158½	+ 1	*5 1 0
Globe Tel. and T. Ord.	7	7	14⅜	—	*4 17 5
do. do. Pref.	6	6	10	—	6 0 0
Great Northern Tel.	24	22	87½	—	5 17 4
Indo-European	13	—	58½	—	5 11 1
Marconi	15	20	4⅛	+ ⅛	4 17 1
Oriental Telephone Ord.	10	10	3 xd	—	3 6 8
United R. Plate Tel.	8	8	7½	—	*5 6 8
West India and Panama	6d.	9d.	1 1/16	—	*3 6 8
Western Telegraph	8	8	16	—	*5 0 0
Home Rails.					
Central London Ord. Assented ..	4	4	62½	—	6 8
Metropolitan	1	1	23⅜ xd	—	4 4
do. District	Nil	Nil	21⅛	—	Nil
Underground Electric Ordinary..	Nil	Nil	2⅜	+ ¼	Nil
do. do. "A" ..	Nil	Nil	6/6	+ 9d.	Nil
do. do. Income ..	6	4	86	+1½	*4 13 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref. ..	6	6	4⅜	—	6 6
Anglo-Arg. Trams. First Pref. ..	5½	5½	8⅜	—	—
do. do. 2nd Pref. ..	5½	—	2⅜	—	—
do. do. 5 Deb... ..	5	5	65⅛	—	7 12 8
Brazil Tractions	—	—	46½	— ½	—
Bombay Electric Pref.	6	6	9¼ xd	—	6 9 9
British Columbia Elec. Rly. Pfce.	5	5	61½	—	8 2 8
do. do. Preferred	Nil	Nil	45	—	Nil
do. do. Deferred	Nil	Nil	40½	—	Nil
do. do. Deb. ..	4½	4½	60⅝	—	7 0 6
Mexico Trams 5 per cent. Bonds..	Nil	Nil	44⅛	—	Nil
do. 6 per cent. Bonds..	Nil	Nil	30½	—	Nil
Mexican Light Common	Nil	Nil	21	—	Nil
do. Pref.	Nil	Nil	39	—	Nil
do. 1st Bonds.. ..	Nil	Nil	49	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅞	—	3 16 2
British Aluminium Ord.	10	10	1¾	—	5 6 8
British Insulated Ord.	20	20	2	—	5 0 0
British Westinghouse Pref. ..	7½	7½	2⅛	+ 1/16	5 6 9
Callenders	20	25	19⅛	—	6 11 7
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	3 1/16	—	5 16 0
Edison-Swan, fully paid	—	—	3½	+ 1/16	Nil
do. do. 4 per cent. Deb. ..	4	4	75½	+1	5 6 0
Electric Construction	7½	10	1 1/16	—	7 12 4
Gen. Elec. Pref.	6	6	10¼	—	6 5 4
do. Ord.	10	10	18⅛ xd	—	*5 8 1
Henley	25	25	2⅛	—	5 17 8
do. 4½ Pref..	4½	4½	3⅞	—	5 12 2
India-Rubber	10	10	16½	—	*6 3 0
Telegraph Con.	20	20	44½	—	*5 7 8

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, August 14th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£80	..
a Ammonia, Muriate (large crystal)	,,	£75	..
a Bisulphide of Carbon	,,	..	..
a Borax	,,	£43	..
a Copper Sulphate	,,	£65	..
a Potash, Chlorate	per lb.	2/6	..
a ,, Perchlorate	,,	2/-	..
a Shellac	per cwt.	£17 5/-	..
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers ..	,,	£35	..
a ,, Lump	,,	£25	..
a Soda, Chlorate	per lb.	1/1	..
a ,, Crystals	per ton	170/-	..
a Sodium Bichromate, casks ..	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2' to 12' basis)	per lb.	..	..
c ,, Tubes (solid drawn) ..	,,	..	..
c ,, Wire, basis	,,	..	..
c Copper Tubes (solid drawn) ..	,,	1/8½ to 1/9	
g ,, Bars (best selected) ..	per ton	£161	..
g ,, Sheet	,,	£161	..
g ,, Rod	,,	£161	..
d ,, (Electrolytic) Bars ..	,,	£137	..
d ,, ,, Sheets ..	,,	£152	..
d ,, ,, Wire Rods ..	,,	£145	..
d ,, ,, H.C. Wire	per lb.	1/5⅜	..
f Ebonite Rod	,,	3/-	..
f ,, Sheet	,,	2/6	..
a German Silver Wire	,,	2/6	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	3/-	..
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£37	..
g Lead, English Pig	,,	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small ..	per lb.	6d. to 8/-	..
e ,, ,, ,, medium	,,	8/6 to 6/-	..
e ,, ,, ,, large ..	,,	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/8½	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	,,	..	..
n ,, Wire, Nos. 1 to 16	per lb.	5/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

An Electrically-Operated Shipyard.—On July 25th the first keel-plate was laid by Sir Wm. Gray, at the new Egis Shipbuilding Yard and Works. The project was embarked upon to help in anticipating the steps required to maintain British shipping supremacy in commercial competition after the war. The chief promoters of the undertaking were Sir John Ellerman, Bart., and Sir Wm. C. Gray, Bart., and the management was entrusted to Messrs. W. Gray & Co., Ltd. A site was acquired on the banks of a river, which covers nearly 16 acres, and the sanction of the Admiralty to proceed with the lay-out of the yard and the erection and equipment of the shops was granted on August 29th last year. The shipyard is driven throughout by electricity—electric power and lighting are taken down between each berth—supplied on the three-phase system by the County of Durham Electrical Power Distribution Co., Ltd. The company has laid a special high-tension cable from its main cable system into the shipyard; this main terminates in a transformer sub-station situated in a central position in the shipyard, adjacent to both the compressor-house and the platers' shed, where the bulk of the electricity will be used.

Of the motors, which number about 80, more than half were supplied by the British Westinghouse Electric and Manufacturing Co., Ltd. The distributing boxes for the power system throughout the yard, as well as the main switchboard in the sub-station, which is of the ironclad type, were supplied by Messrs. A. Reyrolle & Co., Ltd. The transmission system between the sub-station and the various distributing centres in the yard consists of paper-insulated, three-core, wire-armoured cables, manufactured and laid by the British Insulated & Helsby Cables, Ltd. There are no overhead wires in the yard. The wiring between the distributing boxes and the individual motors and starters is of the open type, supported on insulators, protected in steel tubing where necessary, and has been carried out by Messrs. Falconer, Cross & Co.

With a view to securing continuity of operation and easy replacement in case of breakdown, everything has been standardised throughout as far as possible. Consequently, the number of different sizes of motors and other apparatus used in the yard is very small.

The system of lighting, both in the yard and the offices, is of the most modern type and exceedingly generous, since it is realised that good lighting brings ample return in good work.

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THE POSITION OF THE ELECTRO-TECHNICAL INDUSTRY OF THE WORLD DURING THE WAR.

The course of the electrical industry of the world during the war is fully treated by M. Gurewitsch in the *Bulletin* of the Association of Swiss Electrical Engineers. Among the industries, he says, which have undergone great development, not only in belligerent but in neutral countries, the electrical industry takes an important place. From the outset of the war, the electrotechnical works in Germany, France, England, and the United States were able to adapt themselves quickly to the manufacture of munitions, and to realise large profits thereby. Let us take, for example, that establishment which is in the forefront of the German electrical industry, the Allgemeine Electricitäts Gesellschaft. According to the last annual report, electrical installations actually under construction had fallen in value from 48,000,000 to 46,600,000 marks. Notwithstanding this, the amount of business transacted was very considerable, which is explained by the extensive orders from the military authorities; the gross profit realised had allowed of the making of large extensions to the works. If a portion of these extensions was principally due to the needs connected with the manufacture of munitions, there remained no inconsiderable portion available for employment after the war, which would thus strengthen the financial position of the company. The net profits realised in 1916-17 were below those of 1912-13 by 2,470,000 marks (30,370,000 against 27,900,000 marks). Other electrical works in Germany, as well as in the other belligerent countries, achieved similar results. But the manufacture of electrical material generally had much increased, as the thousands of works supplying war requirements created an enormous demand for electrical machinery and plant. The rolling mills in America during 1916 made calls for electric motors of a total power of over 200,000 H.P. (among which were units of 6,000 and 10,000 H.P.), while from 1905 to 1916 the yearly increase in the same industry was only between 40,000 and 60,000 H.P. The following table gives (in millions of dollars) an idea of the growth of electric production in the cases of three of the chief American companies:—

	1912.	1914.	1916.
General Electric Co. ...	90	90	120
Western Electric Co. ...	73	60	105
Westinghouse Co.	37	32	80

It may be remarked in passing that the first-named company increased its capital in 1917 by $20,000,000.

In the above figures war material is not included. Furthermore, only 7 per cent. of the output was destined for exportation; all the remainder was absorbed by the home market of the States. Nevertheless, as an outcome of the stoppage of German exports (which in 1913 totalled 467,500,000 fr., against 189,000,000 fr. for England and 146,000,000 fr. for the United States) the exports of the American electrical industry considerably increased. Hence the total exports of electrotechnical products rose from $28,200,000 in 1913, $19,960,000 in 1914, and $24,340,000 in 1915, to $40,240,000 in 1916. Thus the exports of 1916 exceeded to the extent of 43 per cent. the already fine figures of 1913.

Not only the American electrotechnical industry but that of Sweden likewise showed excellent results. That country was not only able to supply its own home markets, but also furnished large quantities of electrical products for exportation, especially to Russia. The largest Swedish electrical concern, the Allmänna Svenska Elektriska Aktiebolag at Västeras (A.S.E.A.) realised in 1916 a net profit of 12,400,000 kr., against 4,600,000 and 2,200,000 kr. in the two foregoing years. This company has increased in capital from 26,000,000 to 33,000,000 kr., and acquired a number of works—the Nya Förenade Elektriska A.B., the Svenska Turbin Fabriks A.B., the Liljeholmens Kabelfabrik, &c. Besides this, it has set up a foundry and a porcelain insulator works. The increase of the company's export business is shown in the following table (in millions of kroner):—

	1912.	1914.	1916.
Home market	13·9	20·6	39·4
Exports	3·8	6·2	10·9

Exports for 1916 were thus threefold those of 1912. The branch companies of the A.S.E.A. in Denmark, England, and Russia also did good business. During the war the company's position was so strengthened that it no longer had any fear of foreign competition in Sweden. For example, while imports of electrical machinery from Switzerland in 1913 were 316,000 fr., and in 1914 694,000 fr., the figures in 1915 and 1916 fell to 57,000 and 101,000 fr. respectively.

The English industry was too much occupied with war supplies to pay attention to the normal market. English exports consequently fell off, as the table below shows (in thousands of pounds sterling):—

	1913.	1915.	1916.
Exports of electrical machinery	2,275	1,391	1,552
Other electrical goods... ...	5,405	3,169	4,107
	7,680	4,560	5,659

In consequence of the enormous demands and the difficulties of manufacture, even for the home market, imports of electrotechnical products into England showed only a small reduction, namely:—

	1913.	1915.	1916.
Electrical machinery ...	1,345	1,522	1,088
Other electrical goods ...	1,587	1,096	1,653
	2,932	2,618	2,736

The most important supplier to England was the United States. Switzerland supplied machinery principally, exports rising from 1,234,000 fr. in 1913 to 2,014,000 and 1,798,000 fr. in the two following years. On the other hand, Swiss exports fell in 1916 to 642,000 fr., and in the first nine months of 1917 to 452,000 fr. It must be remarked that the manufacture of electrical machinery in England before the war was fairly well developed, machinery figuring as 30 per cent. of the total electrical exports. It must be believed, therefore, that after the war electrical construction works, enlarged and strengthened by supplying the military requirements, will be in a position to satisfy all the wants of the Empire. The manufacture of electrical machinery has, indeed, attained such a development in England that the Government, on November 16th, 1917, forbade imports as unnecessary. (Besides, Swiss industry, in the matter of machinery, can hardly struggle against that of England, as the former is 10 per cent. dearer.)

On the other hand, Swiss exports of measuring appliances to England greatly increased during the first three years of the war, as the figures below show (in thousands of francs):—

	1913.	1914.	1915.	1916.	Jan.—Sept. 1917.
Control and measuring appliances	181	332	387	402	89
Various...	118	307	473	297	176
	299	639	860	699	265

The prospects of the exportation of installation material into England should in general be favourable, for English manufacture of this material was very little developed before the war, insomuch that Germany exported to England in 1913 goods of this kind to the value of 9,752,000 marks. In reality, however, English works at the present moment are in a position to meet home wants, and to such a degree that the Government has, for example, forbidden the importation of meters.

France had greatly reduced its imports of electrotechnical products; these had fallen from 37,500,000 fr. in 1913 to 24,100,000 fr. in 1914, and to 24,400,000 fr. in 1915. But as since then the military calls for electrochemical and electrometallurgical products have enormously increased, a very intense constructive movement in the domain of hydraulics has begun. In consequence, French imports of electrical plant in 1916 rose to a value of 61,300,000 fr., subdivided as follows:—

	Fr.
Electrical machines	15,100,000
Apparatus and measuring instruments ...	15,400,000
Cable and leads	14,000,000
Armatures and machine parts	7,500,000
Various apparatus	9,300,000

French exports fell from 37,200,000 fr. in 1913 to 28,000,000 fr. and 26,300,000 fr. in the two following years: on the other hand, they rose in 1916 to 46,300,000 fr. This rise is chiefly explained by the large exports of electrodes, which varied as follows:—

	Fr.
1913	8,560,000
1914	6,320,000
1915	12,090,000
1916	25,760,000

From the point of view of quantity the export of electrodes in 1916 was only 10 per cent. more than in 1913, but the value was trebled. In the case of Switzerland, French exports of electrodes sank to a third in the same period: 765,000 fr. in 1913 and 244,000 fr. in 1916. We said previously that France imported electrical machines to the extent of 15,100,000 fr. A little less than half of these imports came from Switzerland, which exported machines to France in 1916 to the value of 6,900,000 fr. (30 per cent. of the total exports). In 1917 (January to September) exports to France reached the figure of 4,800,000 fr., whereas for the whole of 1913 the figures were only 4,170,000 fr. The considerable augmentation in the figures of Swiss exports of electrical machines to France is not explained merely by the increase in the price, but also by the larger quantity—namely, 16,432 machines in 1913, against 22,822 in 1916. In 1914 and 1915 exports fell to 3,000,000 and 3,500,000 fr. respectively. Swiss exports to France of "sundry apparatus" likewise increased after suffering a decline in 1914 and 1915. Thus the total rose from 1,461,000 fr. in 1913 to 1,975,000 fr. in 1916, and to 1,666,000 fr. in 1917 (January to September only). In the same period exports of Swiss glow lamps to France rose from 323,000 fr. to 1,269,000 fr., and in 1917 to 712,000 fr. for the first nine months only. Exports of batteries from Switzerland likewise advanced from 33,000 fr. in 1913 to 664,000 fr. in 1916; while, on the other hand, control apparatus and measuring instruments suffered a fall from 634,000 fr. to 348,000 fr. As a matter of fact, the manufacture of measuring apparatus is highly developed in France—to such a pitch that in 1913 that country was able to export these articles to the value of 14,600,000 fr. In 1914 and 1915 these exports fell to 9,100,000 fr. and 6,800,000 fr. respectively, rising, however, in 1916 to 12,100,000 fr.

The author believes that in the future France will be compelled to import electrotechnical goods, particularly when it is remembered that, according to American estimates, an expenditure

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of 500,000,000 fr. on these articles will be needed in the work of reconstitution of the invaded provinces. According to the statistics of the president of the Syndicat des Industries Electriques, the yearly output in France of electrical goods before the war reached the total of 221,000,000 fr., which amount is subdivided as under:—

	Fr.
Dynamos, transformers, and electric cranes ...	66,000,000
Electric apparatus and lamps	67,000,000
Cables and leads	40,000,000
Telegraph and telephone apparatus	26,000,000
Sundry appliances	22,000,000

According to other estimates, the French output would be 300,000,000 fr. (against an output of 1,550,000,000 fr. in Germany in 1913, and 1,900,000 fr. in America in 1914), of which 100,000,000 fr. stand for electric machines and transformers, and 60,000,000 fr. for cables and leads. In any case, the French industry cannot suffice for itself. As regards Switzerland more particularly, the situation will be very favourable in view of the difficulty which Germany will meet with in the resumption of trade, her exports to France totalling, before the war, 18,000,000 fr. Switzerland will, however, have to reckon seriously with English and American competition.

Italy is unable, any more than France, to supply her growing requirements of electrotechnical products, and the more so, because her industry is less developed. Even in pre-war days she was obliged to have recourse to foreign industries (particularly those of Germany); in 1913, for example, Italy imported to the extent of 32,000,000 lire. Italian exports were unimportant, and only amounted to 10,300,000 lire. Three-fourths of the exports were made up of cables, shipped, for the most part, to South America. After the entry of Italy into the war, Switzerland occupied the position of Germany as the supplier of Italy. Swiss exports to Italy were as under (in thousands of francs):—

	1913.	1914.	1915.	1916.	(Jan.—Sept.) 1917.
Electrical machines ...	934	1,158	1,089	873	677
Control apparatus and measuring instruments	355	276	373	959	949
Telegraph and telephone apparatus	14	17	84	1,055	603
Glow lamps	276	252	1,420	2,589	3,113
Sundry appliances ...	489	507	215	579	395
	2,060	2,219	3,211	6,055	5,737

As in all the other belligerent countries, electrotechnical works in Russia have done good business, and dividends have been much greater than in peace times. Almost all the works have doubled their capital. The Russo-German A.E.G. Co., whose dividend for 1916 was 10 per cent., has been reconstituted, after its liquidation on July 1st, 1917, under the style of the General Electric Co. (A.E.K.), with a capital of 24 million roubles, one third of whose shares have been acquired by the Russian Government. According to the latest reports, this company (in which the American General Electric Co. has interest to the extent of 4,000,000 roubles) has raised its capital to 36,000,000 roubles. The Russian Siemens-Schuckert Works and the A.G. Siemens & Halske (whose dividends in 1916 were 7·5 and 12·5 per cent. respectively) have likewise been liquidated, and towards the end of 1917 were to be transformed into a new Siemens company with a capital of 25,000,000 roubles, in which the Russian State would take a share.

The third Russian electric company—the Dynamo—in which the English and American Westinghouse companies take a considerable share, doubled its capital in 1917, raising it from 10,000,000 to 20,000,000 roubles. Similarly the Basins of the Donetz Electricity Co., founded in 1916, proposed to build extensive electricity works near the Donetz coal fields, and by utilising the anthracite deposits there furnish Southern Russia with cheap electricity. The company has secured authority to raise its capital from 7 to 14 million roubles. Other new companies are:—The Donetz Electric Power Co., 5,000,000 roubles; Electrification of the Grosny-Naphtha District Co., 4,600,000 roubles; and South Russia Electric Installations Co., 30,000,000 roubles. The two related companies—the Petrograd Electric Lighting Co. and the Baku Electric Power Co.—have also increased their capital from 9 to 13 million roubles. Its internal disorganisation has hindered Russia from undertaking the utilisation of its many waterfalls, although in 1917, 32,000,000 roubles were allocated to deal with the fall on the River Wolchow. As an outcome of the coal deadlock, many new electric railway schemes have been planned, such as the Crimea railway, that of Trans-Caucasia, and the Kars line. All these schemes are hung up owing to the internal state of Russia.

Japan's electrical industry has undergone an enormous expansion during the war. So recently as 1913, Japan was obliged, on account of the undeveloped state of her own industry, to draw upon oversea countries, principally Germany and England. German exports of merchandise to Japan in 1913 were to the extent of 15,000,000 marks; electric machines, about 45,000,000; cables, 3,000,000; high-tension apparatus, 1,700,000; measuring instruments, 660,000 marks, &c. England exported to Japan in the same year to the value of £286,000 (electrical machines, £188,000). Japan's total imports in 1912 reached 35,000,000 yen, 50 per cent. from Germany and 30 per cent. from England.

Since the war the position has completely changed, and Japan's electrical industry has not only been able to supply its own home wants, but also to intervene in the markets of the world. Before the war, that country's output of electrical machines was between 30,000,000 and 35,000,000 yen; in 1916 it reached a value of 85,000,000 yen. This brilliant showing is owing, first, to huge war exports; and, in the second place, and chiefly, to her possession of ample copper resources available at small cost. This advantage which the Japanese industry enjoys over that of the European industry will subsist after the conclusion of peace, for, on account of the dearth of tonnage, European countries, and especially Germany, will be able to import copper only with the utmost difficulty. Thus in the Far East the European electrical industry can hardly hope to compete with that of Japan.

The Swiss electrical industry has suffered much from the war; this is especially so as regards the wholesale industry. The manufacture of electrical products has had to struggle against enormous difficulties—such as the want of raw materials and labour, and the difficulties of transport. These last have completely paralysed exportation to certain countries, notably to Russia. The influence of the war on Swiss exports of electrotechnical products is clearly shown by the following table:—

Swiss Exports in Thousands of Francs.

	1913.	1914.	1915.	1916.	(Jan.—Sept.) 1917.
Electrical machines ...	20,353	15,578	15,245	22,681	16,618
Control apparatus and measuring instruments	2,307	2,037	2,904	4,304	2,609
Glow lamps	850	577	2,369	4,691	4,465
Accumulators	115	85	818	1,131	390
Telegraph and telephone apparatus	150	107	144	1,120	615
Cables and leads... ...	1,403	974	451	510	428
Lamp carbons	143	184	562	478	151
Sundry apparatus ...	4,996	5,740	2,960	5,877	5,033
	30,357	23,283	25,454	40,742	30,307

It should be noted that if the total of exports is larger for 1916 than for 1913, the number of machines exported is less. One thing that must be said is that the retail industry has grown at the expense of the wholesale. In 1916 one-half of Switzerland's exports of accumulators and batteries went to France; likewise, the whole of the glow lamp exports, which had practically quadrupled, went to France and Italy. Of the Central Powers, Germany held first place as recipient, more especially of electrical machines, owing to their abnormal dearth there, due to that country's inability to furnish itself with copper.

Lastly, the Dutch market has undergone considerable development since the war, as has also that of Spain. The wants of the latter country will be still larger after the war, for the growth of the Spanish industry has been very rapid.

A few words in conclusion as to the future of the electrical industry of the world. We said above that the Americans, who were much interested in the reconstitution of the invaded countries, had estimated the requirements of France in the matter of electrotechnical products at 500,000,000 fr. They estimated, furthermore, those of Belgium at 250,000,000 fr. On these bases the reconstitution of all the invaded lands would demand fully 1,000,000,000 fr. Nothing short of this will be needed to occupy the electrical industry of the world for many years to come. On the other hand, the normal calls for electrical products will greatly increase after the war. The general lack of coal, which will continue long after the war, will everywhere lead to the utilisation to a greater extent than formerly of water-power, &c. Furthermore, the scarcity of foodstuffs, cotton, &c., will give a new spurt to the realisation of irrigation schemes in Italy, Russia, Asia, and other countries, and all such schemes imply huge hydro-electric installations. In lands lacking great water resources, small installations will have to be superseded by big generating stations erected near coal mines. Finally, the fact must not be lost sight of that the extensive electrochemical and electrometallurgical establishments which have grown up during the war will need after the war an enormous amount of electrical energy. Moreover, the call for electric power in all industries will be enlarged to an extraordinary degree after the war; for electricity tends daily to become the basis of industry in all its branches. Its more rational production, enabling energy to be supplied at a much lower rate, will raise it from the position of a mere accessory to that of the very essence of all industrial production.

Electric Railway Furnishes Steam for Industrial Firms.—In addition to supplying electricity to businesses and factories, the Rochester Railway and Light Co., of Rochester, N.Y., is now also giving steam to a number of factories. Two years ago the steam line was extended across the river, but on account of the demand for added heat, it was found necessary to install a new steam feed line. The pipe line which has been constructed is somewhat of a novelty in that it extends about 2,000 ft. without a single joint. It is practically a solid metal pipe line, which, although it came in sections of 20 ft. each originally, has been welded together by the oxy-acetylene process. The method of assembling the parts adopted in this case is a new departure, and eliminates the use of all screw joints and flanges, thereby ensuring the least possible amount of leakeage. It has been found by experiment that the welded part is stronger than any other portion of the line. The new pipe will be covered with heat-insulating materials, and the line has been run across the river by means of the recently-constructed pipe bridge. The line is to be used for industrial purposes, as well as for the heating plants to which it runs.—*Electric Traction.*

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REVIEWS.

Aviation Engines. By V. Page. London: Crosby Lockwood and Sons. Pp. xiii+589; figs. 253. Price 15s.

Like many others with long experience in motor-car work, Mr. Page, now a lieutenant in the United States Aviation Corps, has passed on to aeronautical work, and in this present book has written an elementary treatise on petrol engines to which he has added descriptions of existing aviation engines.

The book is well printed, and is provided with a very large number of good line diagrams. It should prove valuable to users of aviation engines, but will not add anything to the designer's knowledge. On practically all things appertaining to engines the author is sound, as is to be expected from the editor of the foremost automobile journal in America; but on aeronautical matters he is sometimes inaccurate. As a point of minor criticism, one regrets the habit that permits the use of different descriptive terms in reference to particular things; for example, although the title is "Aviation Engines," other terms are also used in the text, such as "aerial motors," "aircraft motors," and again, "airplanes" and "aeroplanes" are indifferently employed. The various terms peculiar to America should present no difficulty to the English reader owing to the clear references to the drawings.

Naturally, Chapter VI, which deals with ignition systems and apparatus, and the latter part of Chapter XII, dealing with electric starting, claim first attention. In no other book on engines is the subject treated so fully, ranging from elementary principles to full descriptions of existing types. There are no design formulæ, nor are there any points which are of value to manufacturers of electrical apparatus. On the latter point there is a distinct void in our literature, although two papers with a small amount of such information have been read before technical societies recently. When war broke out practically all our magnetos were imported, the exception being the Thomson-Bennett, and when we started to manufacture, difficulties innumerable cropped up. The three chief difficulties consisted in obtaining (1) a non-bulky insulating covering for the high-tension winding, (2) an effective magnet steel, and (3) an insulating material for the distributor which, in addition to being an effective insulator, had to possess the same rate of wear as the brass segments, and which did not take up a brassy face under the continuous rubbing of the rotating distributing brush. These difficulties have now been overcome, and research and experimental work have resulted in further advances in design, and evolution of new types, of which the Dixie, described at page 184, is one form. Judging from the statements at pp. 569 and 570 on electric starting and battery ignition, America is far behind England, but it would be inexpedient to discuss this further. Attention may be drawn at this stage to the very clear diagram of the ignition system of the Gnome engine at fig. 208.

The opening chapter considers the requirements of aviation engines, but it is so much amiable matter, and should not be read seriously. The description of the three classes of dirigibles on page 18 is utterly misleading, and the statement at p. 21 that "The airplane is supported by air reaction *under* the planes or lifting surfaces" shows how little real knowledge the author has of aeronautics. Chapter II deals with the principles of two- and four-stroke engines, which are clearly defined. The development of the two-stroke engine is not given a fair share of attention, and the conclusion that for large powers it cannot compete with the four-stroke should not be accepted.

In Chapter III the efficiency of petrol engines is comprehensively considered, and in Chapter IV is described the method of working of petrol engines, together with a general account of the various kinds of multi-cylinder engines.

Chapter V deals with fuels and carburettors, and Chapter VII covers lubricating systems, and air and water-cooling systems. These two chapters are very clearly written, and illustrated by excellent diagrams.

Chapter VIII. Cylinder construction, valves and valve arrangement, and valve timing are dealt with at length in an illuminating manner; the reader should note, however, that in addition to the advantages of the offset crankshaft set out at page 243, such an engine has a less overall height and weight than an ordinary engine, and allows a valve setting which results in a greater volumetric efficiency.

In Chapter IX are described pistons, connecting rods, cam and crankshafts, and crank cases. Chapter X deals with complete power plants and their installation in aeroplanes. This is a very comprehensive chapter, and, together with the specific descriptions of American engines given in Chapter XII, covers the whole field of aeronautical engines. The latter part of Chapter X deals very well with defects and troubles, and the locating and remedying thereof.

Chapter XI gives the processes of dismantling and reassembling engines, and the tools to be used in these operations, which are described at length, and again one must comment favourably on the clearness and large number of illustrating diagrams.—W. E. Dommett.

The Electron: Its Isolation and Measurement and the Determination of some of its Properties. By Prof. R. A. Millikan. Pp. xii+268. Chicago: The University Press. Price $1.50.

This book, by the well-known Professor of Physics of the University of Chicago, is one of the Science Series established by the trustees of the university—a series which has owed its origin "to a feeling that there should be a medium of publication occupying a position between the technical journals with their short articles and the elaborate treatises which attempt to cover several or all aspects of a wide field." This particular volume is of great interest, as it details in a thorough manner the work done on the electron right up to 1916. Passing over the first few chapters, which have to do with the various aspects of early views of electricity and conduction in gases, we come to an account of first attempts at the direct determination of e. Townsend's work is described, then Sir J. J. Thomson's, Wilson's, and finally the author's. Up to 1906 the result obtained for e had been quite variable, and no reliance could be placed on any one figure; and in view of the extreme importance of an exact and reliable determination, the author spent much time in research work upon this question. His account of his early experiments is extremely interesting. Those who have been engaged upon original work of the same or a similar kind will recognise its difficulty, and the care that has to be taken to allow for all the factors concerned—such a small thing, for instance, as an infinitesimal amount of evaporation from a water droplet may affect a result out of all seeming proportion to the cause. The later and exact determination of e was one of the triumphs of physics, and the author describes in Chapter V how this was accomplished. He first deals with the failure of Stokes's Law, which is concerned with the rate of fall of a spherical drop under gravity, and the corrections that have to be applied to the law due to want of homogeneity in the medium, and he then goes on to describe experimental work undertaken on this basis. The final result was $e = 4{\cdot}774 \times 10^{-10}$ electrostatic units.

Even then Prof. Millikan was not satisfied, and he spent the better part of another two years on further experiment with new apparatus and with a completely new determination of all the factors involved; but the result thus obtained in 1916 came out to the fourth place exactly the same as the value published in 1913 stated above.

Prof. Millikan is a bit of a humorist, and sometimes supplies a touch of lightness to what otherwise would be fairly concentrated reading. Thus: "Perhaps these numbers (referring to e and N) have little significance to the general reader who is familiar with no electrical units save those in which his monthly light bills are rendered. If these latter seem excessive it may be cheering to reflect that the number of electrons contained in the quantity of electricity which courses every second through a common sixteen candle-power electric lamp filament and for which we pay one hundred thousandth of one cent, is so large that if all the two and one-half million inhabitants of Chicago were to begin to count out these electrons and were to keep on counting them out each at the rate of two a second, and if no one of them were ever to stop to eat, sleep, or die, it would take them just 20,000 years to finish the task."

An important section is that dealing with the evidence for the existence of a sub-electron. It is conceivable that there are electric charges smaller than the electron, and a certain amount of experimental work has even been done which seemed to point to this conclusion. The author, however, after a review of this and careful analysis of his own work thinks the evidence so far adduced is not satisfactory.

The reader will perhaps find Chapter IX, on the structure of the atom, the most interesting and suggestive in the book. There are some good photographs of α-particles and β-particles shooting through air, and of the tracks of β-particles ejected by X-rays from molecules of air. A study of these teaches one something of the relative sizes of atoms and electrons. For instance, "the α-particle being an atom of helium eight thousand times more massive than a negative electron, could no more be deflected by one of the latter in an atom through which it passes than a cannon ball could be deflected by a pea. Yet the figures show that toward the end of its path the α-particle does in general suffer several sudden deflections. Such deflections could be produced only by a very powerful centre of force within the atom whose mass is at least comparable with the mass of the helium atom." Such results as this strongly support the theory that the atom consists of a heavy positively charged nucleus about which are grouped a sufficient number of electrons to render the whole atom neutral.

Says the author, "The notion that an atom can appropriate to itself all the space within its boundaries to the exclusion of all others is then altogether exploded by these experiments. A particular atom can certainly occupy the same space at the same time as any other atom if it is only endowed with sufficient kinetic energy. Such energies as correspond to the motions of thermal agitation of molecules are not, however, sufficient to enable one atom to penetrate the boundaries of another, hence the seeming impenetrability of atoms in ordinary experiments in mechanics."

This work is one of the most suggestive appearing in recent years, and every student of this branch of physics should have it on his bookshelves.

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FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AUSTRALIA.—Full particulars regarding the new invoice requirements of the Commonwealth Government have been published in the *Board of Trade Journal*, including the full text of the combined form of declaration of value and certificate of origin. A concession has been made regarding the basis of valuation for duty purposes. During the period of the war, and for six months afterwards, the basis for duty is to be the home consumption value of the imported goods at the date of the invoice relating to them, instead of at the date of their export to Australia, as was formerly the case. A separate column is to be included in the invoice, showing the actual price at the date of the declaration of equal quantities of identically similar goods to any purchaser for home consumption in this country. The column should be headed: "Domestic value f.o.b. port of export (or factory) at date of invoice, subject to ..... per cent. discount for cash, including (or excluding) cost of outside casing." In the case of goods which are not identically similar to any sold in the domestic trade, the special column referred to must show prices which would be required if selling for home consumption. Such prices should return a percentage of profit on the cost of production and marketing equal to that received in the domestic trade in similar lines.

ARGENTINA.—By a recent Ministerial Resolution, when goods in transit through Argentina are handed over from the Custom House to the railway company for transport to the country of destination, and such transport is effected under the responsibility of the carriers, without the intervention of the owners of the goods, the bonds (for the due arrival of the goods in the country of destination) otherwise required from the interested parties under the Argentine Transit Regulations are to be dispensed with.

ECUADOR.—A number of amendments have recently been made in the Tariff Law of the Republic, which took effect on January 1st. Electrical goods are not specifically affected, but the following provisions of the amending law are of interest:—

A warehousing charge of 6 centavos per cubic foot will be levied on packages in Customs premises for every month, or fraction thereof, up to the date when request for clearance is presented. For each 50 kilogs. of lead, iron, and other metals the charge will be 15 centavos. A discount of 50 per cent. is accorded to importers who clear their goods within 15 days after their arrival; goods not cleared within two months are subject to a surcharge of 25 per cent., which is increased to 50 per cent. if the goods are not cleared within three months.

NEW ZEALAND.—Information has been received at the Department of Overseas Trade to the effect that the New Zealand Government has issued the following notification modifying the basis to be adopted in future in levying import duties on goods assessable at an *ad valorem* rate:—

"Claims are not to be made against importers for increased duty on account of rise in price of merchandise as between the date of invoicing or order and the date of shipment where it is satisfactorily shown that the invoice price is the genuine purchase price as between a buyer in New Zealand and an exporter. This does not apply to house-to-house invoices or to cases where there is no real purchase as ordinarily understood."

It is understood that this has been adopted *as a temporary measure only*, owing to the price fluctuations which occur under present abnormal conditions.

TONGAN ISLANDS.—Under the Customs and Tariff Act, 1917, the import duty leviable upon dutiable articles unspecified in the Tariff (including electrical goods) has been increased from 10 per cent. *ad val.* to 12½ per cent. *ad val.*

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

12,306. "Non-accumulative electric signalling indicator for colliery shafts, &c." H. BROWN & J. H. EVANS. July 29th.

12,313. "Control of dynamo-electric machinery." J. C. WILSON. July 29th.

12,315. "Electro-magnetic speed-changing gear." MENCO-ELMA SYNDICATE. July 29th. (U.S.A., September 22nd, 1917.)

12,322. "Electro-pneumatic braking systems." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.) July 29th.

12,327. "Friction drive for electric switchgear." E. N. BRAY. July 29th.

12,353. "Electric lampholders." J. BLAYMIRES. July 30th.

12,367. "Electric time transmitter or master clock." J. J. LIVERTON. July 30th.

12,369. "Sparking plugs for internal-combustion engines." J. K. WHITE. July 30th.

12,382. "Electric signalling lamps." O. LUCAS. July 30th

12,413. "Electrically-locating submarines." W. H. BRAGG & H. L. CALLENDAR. July 30th.

12,414. "Devices of the vibrated-diaphragm type for giving audible signals." J. F. MONNOT. July 30th.

12,443. "Actuating signals on, and communicating with, trains." H. A. THOMPSON. July 31st.

12,449. "Sparking plugs for internal-combustion engines." W. A. HOPKINS & F. TURNER. August 1st.

12,470. "Control of dynamo-electric machinery." J. C. WILSON. July 31st.

12,477. "Direct-current starting switches for electric motors." J. S. MACINTOSH. July 31st.

12,480. "Ignition sparking plugs for internal-combustion engines." F. L. RAPSON. July 31st.

12,486. "Spark plugs." E. O'CONNELL. July 31st.

12,487. "Electric cells." E. H. EXLEY & H. LEITNER. July 31st.

12,488. "Operating electric switches from a distance." A. H. FRANCKS, AND TELEPHOS DOMESTIC & STREET LIGHTING CO. August 1st.

12,490. "Electric internal tube heaters." H. GUTZWILLER. July 31st (Switzerland, August 8th, 1917.)

12,507. "Electric speed governor." T. N. C. KORESSIOS. July 31st.

12,510. "Valves for generating electric oscillations, amplifying electric currents, or rectifying same." A. G. BLOXHAM (Russische Akt. Ges. L. M. Ericsson & Co.). July 31st.

12,545. "Instantaneously varying photo-electric resistance." F. TAVANI. August 1st.

12,551. "Sparking plugs for internal-combustion engines." J. E. BARROWS. August 1st.

12,554. "Telephone exchange systems." WESTERN ELECTRIC CO. (Western Electric Co., U.S.A.) August 1st.

12,555.—"Electric hand lamp." ACCUMULATOR SERVICE, S. T. JOLLEY AND A. H. KNIGHT. August 1st.

12,567. "Electrolytic apparatus." E. C. BENJAMIN. August 1st. (U.S.A., August 1st, 1917.)

12,593. "Constant-current dynamos." S. SMITH & SONS, V. A. TRIER, AND TRIER & MARTIN. August 1st.

12,600. "Electric terminal connectors, &c." C. E. TINSON. August 1st.

12,601. "Electric connectors, &c." C. E. TINSON. August 1st.

12,642. "Feeding polyphase-current circuits with monophase current." T. BUESS & H. GUTZWILLER. August 2nd. (Switzerland, August 6th, 1917.)

12,643. "Electric heating elements, and means of conveying heat therefrom." J. A. COLQUHOUN. August 2nd.

12,650. "Means for preventing rapid exhaustion of ormiary batteries." T. McLEOD. August 2nd.

12,653. "Secondary electric batteries or accumulators." W. E. SPENCER AND TUDOR ACCUMULATOR CO. August 2nd.

12,656. "Electrical transmission applicable to radio-telegraphy and telephony, &c." L. LEVY. August 2nd. (France, August 4th, 1917.)

12,659. "Apparatus for controlling electric circuits." J. PALIN. August 2nd.

12,661/2. "Carbons for electric arc lamps." H. B. GRYLLS & W. HEAPE. August 2nd.

12,664. "Electric generators and motors." L. COLLETTE. August 2nd.

12,668. "Electric machine operating as motor or dynamo." A. TRICOCHE. August 2nd.

12,669. "Constant-current dynamos." S. SMITH & SONS, V. A. TRIER, AND TRIER & MARTIN. August 2nd.

12,670. "Centre-rail electric traction." G. N. FELL. August 2nd.

12,672. "Construction for electric dynamos and motors for aircraft, &c." L. MURPHY. August 2nd.

12,707/8. "Ignition systems for internal-combustion engines." A. H. MIDGLEY AND C. A. VANDERVELL & Co. August 3rd.

12,709. "Electric heating apparatus." I. SORDI. August 3rd.

12,711. "Production of ammonia gas or ammonia hydrate by electro-decomposition of water and atmospheric air." J. T. DIXON & J. HARVEY. August 3rd.

12,717. "Quick-break switch." W. J. KING. August 3rd.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

6,805. ELECTRICAL SWITCHES FOR MOTOR-CARS AND OTHER PURPOSES. R. H. Rogers and S. Smith & Sons. May 12th, 1917. (Cognate application, 15,688/17.) (117,279.)

7,943. WIRELESS SIGNALLING SYSTEMS. British Thomson-Houston Co. (General Electric Co., U.S.A.) June 2nd, 1917. (117,283.)

8,100. X-RAY APPARATUS. British Thomson-Houston Co. (General Electric Co.) June 6th, 1917. (117,284.)

8,147. ELECTRICAL APPLIANCE FOR THE INSPECTION OF THE INTERIOR OF CASKS, JARS, OR OTHER VESSELS OR CHAMBERS. W. Downs & J. M. Fitt. June 7th, 1917. (117,285.)

9,960. ELECTRIC MOTORS. T. L. R. Cooper. July 10th, 1917. (Addition to 17,292/16.) (117,296.)

10,033. CONTROL OF ELECTRICALLY-OPERATED SWITCHES. A. West & Co. and W. L. Wise. July 11th, 1917. (117,298.)

10,073. METHOD OF REFINING METALLIC ZINC-BEARING MATERIALS BY THE ELECTROLYTIC PROCESS. Electrolytic Zinc Co. July 26th, 1916. (108,312.)

11,287. ELECTRICAL COUPLINGS OR CONNECTIONS. K. E. I. Guinness. August 4th, 1917. (117,325.)

11,983. ELECTRIC TRANSFORMING AND CONVERTING APPARATUS. British Thomson-Houston Co. (General Electric Co., U.S.A.) August 21st, 1917. (117,330.)

12,125. IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. A. E. White (Remy Electric Co.). August 23rd, 1917. (117,332.)

12,479. PHASE CONVERTERS FOR POLYPHASE DISTRIBUTING SYSTEMS. British Westinghouse Electric & Manufacturing Co. (Westinghouse Electric and Manufacturing Co., U.S.A.) August 30th, 1917. (117,336.)

12,721. INTERRUPTERS FOR ELECTRIC CIRCUITS. H. W. F. Ireland. September 5th, 1917. (117,339.)

15,069. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. L. S. Clarke October 17th, 1917. (Cognate application, 2,095/18.) (117,362.)

17,080. LIGHTING DEVICES FOR MOTOR VEHICLES. Benjamin Electric, Ltd. November 27th, 1916. (111,669.)

18,201. TELEPHONE RECEIVERS. Soc. Francaise Radio-Electrique. December 7th, 1916. (Addition to 100,281.) (112,433.)

1918.

3,617. STARTING SWITCHES FOR ELECTRIC MOTORS. W. P. Thompson (Officine Elettro-Meccaniche). March 1st, 1918. (117,418.)

8,290. ELECTRO-MAGNETICALLY-CONTROLLED SIGNAL REVERSER FOR USE ON RAILWAYS. Sykes Interlocking Signal Co., W. R. & R. W. Tarrent. May 17th, 1918. (117,435.)

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MOTOR PROBLEMS.

OUR article on this subject, as we expected, has elicited some useful information, but we are not prepared to admit that the problems we propounded are appreciably nearer a solution. We are interested to observe that both of them are receiving attention, and we hope that eventually they will be satisfactorily solved. Lieut. Durtnall's letter held out hopes of the introduction of an A.C. induction motor capable of continuous variation of speed, which we shall be glad to see fulfilled; and Mr. Mould drew attention to a simple device which his firm had developed to meet the difficulty which we described, besides imparting interesting and practical information on the stopping of motors and machinery. To what extent the vibrating relay satisfies the conditions of simplicity and cheapness, combined, of course, with efficiency and reliability in operation, is a question which we are not in a position to answer; but if it is satisfactory in these respects, we shall gladly award the palm to this device.

It may be of interest to add to our previous remarks that experiments have been made by an engineer who is deeply interested in this matter, from the user's point of view, to investigate the phenomena which take place under the conditions which we outlined. On connecting five or six 230-volt lamps in series across the terminals of the motor, it is frequently found that when a quick stop is made with the motor running at full speed, these lamps flash up to full brilliance. This applies both to motors controlled by means of starters of the ordinary radial type, with a separate lever for shunt control, and to those provided with a drum controller fitted with substitutional resistances. In the case of a 75-H.P. motor driving a calendar, the armature insulation was pierced; there was a clean puncture through the tapes and mica, but little arcing was noticed, probably because by the time the puncture had taken place the speed of the motor was rapidly falling and the generator effect was dying out. This, we understand, is by no means the only instance of a motor breakdown from this cause within the experience of our informant. Impregnation of the armature windings appears to afford no real remedy for this trouble—nor, indeed, is it intended for that purpose—but the nature of the risk emphasises the importance of making a thoroughly sound job of the insulation of variable-speed machines.

Our reference to the possibility of the E.M.F. of a 460-volt motor rising to more than 2,000 volts was based upon the view that when the supply circuit was interrupted, under the stated conditions, not only would the field be excited to the full normal value, but owing to the high armature E.M.F. being applied to the shunt terminals, the field excitation might be increased considerably above the normal maximum value, thus producing a cumulative effect on the armature E.M.F. This was a speculative assumption on our part, but we were interested to learn from our experimenting friend that after reading our remarks he put the matter to the test, and found that in the case of a 20-H.P. motor, of which the normal full field current was 0·5 ampere, if the controller handle was brought to the off position when the motor was running on load, the current in the shunt winding rose to 0·8—1·2 amperes, the actual value depending on the speed with which the controller handle was moved. This result was entirely in accordance with our supposition. While the magnetisation of the field magnets would, of course, rise to a far less extent, depending upon the degree of saturation of the iron, it is obvious that a 100 per cent. increase in the shunt current is bound to produce a considerable effect upon the armature E.M.F., and this reaction tends materially to prolong the duration of the high-voltage period, whilst the armature is falling in

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speed. The rise in the shunt current depends largely upon the loading of the motor; if the moving parts possess much inertia, and the motor speed is maintained for an appreciable period, the shunt current attains a correspondingly high value; if the speed falls quickly, the increment in the shunt current is less, but apparently there is always an increase to some extent.

Clutches, brakes, &c., are all good in their way, but add to the cost of installation and maintenance. The cost of the controlling apparatus of electric motors has always seemed to form an unduly large percentage of the total cost. What we had in mind was the ideally simple regulator handle of the steam locomotive, the nearest approximation to which is the drum type of controller, which stands rough usage and is said to be preferred to the radial type by machine minders or operators. Our information is that, apart from the merits of the devices at present on the market to meet the conditions which we described, their cost is a serious consideration. The push-button type of control, for example, is ideal, and can be carried out to meet any set of conditions; but it must be admitted that it is expensive, and while the ordinary works electrician can keep a plain drum controller in order, some of the more highly developed "automatic" systems call for the services of a highly skilled technical expert.

The solution to our problem should be mistake-proof, and capable of being handled in one way only, without fear of any undesirable result. In these days of piece-work and relatively high output, the number of manual operations required to start and stop motor-driven machinery must be reduced to a minimum. What is needed is the simplicity of the tramway controller—one operating handle only, capable of being moved forward as quickly as safe loading of the motor will permit, and backward as quickly or as slowly as the needs of the machinery require, and, above all, cheap and reliable.

Electrical Power Engineers.

We note with pleasure that the turbulence which has lately reigned in the breasts of power station engineers has subsided, and is being followed by a holy calm. The E.P.E.A., fortified by the fact that possession is nine points of the law, has secured official recognition as the representative Association for the protection of the interests of the technical staffs in power stations, public and private, and peace reigns once more. Without discussing the merits of the rival movements, we may express ourselves entirely satisfied with the essential feature of the matter—namely, the survival of *one* representative body, and no more. From the very first, knowing the strength of the position held by the E.P.E.A., we have urged that rivalry should be avoided, and that some means should be sought of securing co-operation in this sphere. In June the situation became serious, and it was evident that unless some drastic step were taken there would be a most regrettable division of forces which would result in the permanent weakening of the Associations concerned. Fortunately, the President of the I.E.E. saw the danger, and had the moral courage necessary to cut the Gordian knot; he frankly recognised that a mistake had been made, and promptly rectified it before it became irreparable. Nothing is more difficult than to tackle such a situation and to deal with it entirely from the point of view of the greatest good for the greatest number, without regard to one's own interests or to the susceptibilities of individuals; but Mr. Wordingham was equal to the occasion, and succeeded in averting a calamity.

We now learn that the Chief Technical Assistants' Association is working in hearty co-operation with the E.P.E.A.; its members will become members of that Association, but the C.T.A.A. will retain its separate identity for the purpose for which it was established—namely, the exchange of information among the senior men in electricity works—so that if, for example, a member makes a new departure in any branch of power-station practice, he will be fortified with the accumulated experience of his brother engineers, and will not have to make all their mistakes over again. That is as it should be; it is the spirit which must pervade the whole of our industries in the future, for only by the aid of whole-hearted co-operation can we hope to triumph in the trade war.

The E.T.U. and the E.P.E.A.

Since writing the above notes, we have realised with regret that the peace which reigns is not complete—there is still a certain amount of animosity between the E.P.E.A. and the E.T.U. The latter (as will be seen from our "Notes") refuses to recognise the *bona fides* of the E.P.E.A. as a Trade Union, objects to its representing the power station engineers in official conferences on wages, and, in effect, claims for itself alone that privilege.

We may point out (1) that the E.T.U. recognised the eligibility of the technical staffs for membership of a Trade Union, and indeed welcomed them into its ranks with open arms; (2) that any body of men whatever has an inalienable right to combine for its own purposes; (3) that the power-station men have elected to follow this course, and being eligible for membership of a Trade Union, they have duly formed one (the E.P.E.A.), and registered it as such. Hence, the E.T.U., in opposing the attendance of delegates from the E.P.E.A. at Conferences, has not a leg to stand on—it is throwing overboard the fundamental principles of Trade Unionism, and denying to others the rights and privileges which its own members enjoy.

This policy is bound to fail. We have always given the E.T.U. a fair field in our pages, and we have received official acknowledgments to that effect both publicly and privately; in this instance we do not hesitate to condemn its attitude towards a brother Trade Union as un-English, unsportsmanlike, and unjustifiable, and we trust that its leaders will speedily realise that selfish manœuvres designed to magnify the importance of the E.T.U. at the expense of the E.P.E.A., and entailing the sacrifice of goodwill and collaboration, not only are unpatriotic at this time, but also, being opposed to unity of purpose, weaken both parties.

Electrical Development in Holland.

According to an article published in a Dutch economic journal, Holland will be confronted with a serious problem after the war in the matter of the supply of coal, which will be very difficult to obtain, and very costly, so that the Dutch industries will be placed at a disadvantage as compared with those in other countries. The author states that previously to the war many Dutch industries were indebted for their development to the low prices of German coal, but the conditions will be quite different after the conclusion of peace, as Germany will know how to prevent the delivery to Holland of coal at such low prices as to create an unpleasant competition in industry and shipbuilding, apart from the necessity for levying taxes of all kinds, including one on the export of coal, in order to raise revenue. The author considers, too, that it will be impossible to procure cheap coal from Great Britain, and that this country also will impose a tax on the export of coal. Taking all the points into consideration, it is argued that the Dutch Government must do everything to support the native industries, and that these efforts will not be in vain. In this connection it is suggested that the use of electric power has a great future. The total production in Holland is stated to have increased from 135,000,000 KW.-hours in 1913 to 161,000,000 in 1914, 196,000,000 in 1915, and 260,000,000 KW.-hours in 1916. The State Commission of 1911 on the supply of electricity estimated the consumption at 321,000,000 KW.-hours per annum, but this quantity is now considered to be too low, as the Association of Managers of Electricity Works is of opinion that a demand for a minimum of 1,000,000,000 KW.-hours will arise in the near future. The question whether the business should be undertaken by a public or a private concern has already been decided in favour of the former system. The problems remaining to be settled are whether the works should be owned by the State or by combinations of the provincial authorities, and whether the works should be carried on by the owners or by companies in which the majority of the shares would be held by public authorities.

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THE PORT ELIZABETH ELECTRICITY WORKS, SOUTH AFRICA.

Port Elizabeth being the venue for the next Convention of the Municipal Electrical Engineers' Association (Union of South Africa), some particulars of the Municipal electricity undertaking may be of interest to readers both in South Africa and elsewhere.

The supply was officially started on Tuesday, May 1st, 1906, by the Mayor of Port Elizabeth, Mr. Alexander Fettes, as a three-wire, direct-current supply at pressures of 500 and 250 volts, and the first installation of plant consisted of three Babcock & Wilcox marine type water-tube boilers, three Brush-Parsons 400-kw. turbo-generators with surface

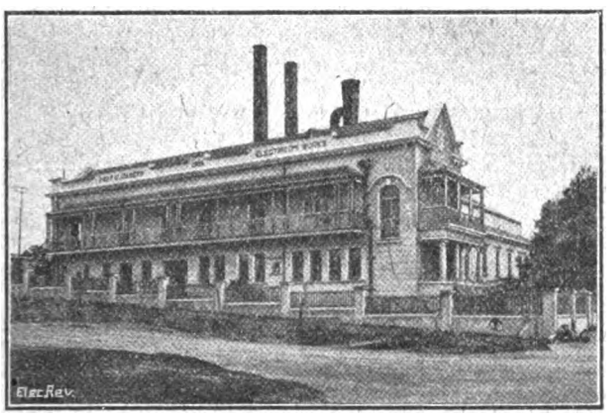

Fig. 1.—Port Elizabeth Electricity Works.

condensers and electrically-driven auxiliaries, an E.P.S. storage battery, and main switchboard supplied by Spagnoletti & Co.

The buildings were designed by the late City Engineer, Mr. A. S. Butterworth, and the original scheme by Mr. Pape, the first City Electrical Engineer, Messrs. Robert Hammond & Son being the consulting engineers. Mr. Pape was succeeded in 1907 by Mr. H. J. Holder. During the succeeding years steady progress was made, and in December, 1912, Mr. Holder reported that further extensions would be required, in connection with which Mr. Holder, early in 1913, came to England. In May, 1913, Mr. Holder, whilst on leave, met with a serious accident, and Mr. B. Sankey was appointed assistant electrical engineer, and arrived at Port Elizabeth in October, 1913, to carry on during Mr. Holder's absence, and to proceed with the preparation of the scheme of extensions. In January, 1914, Mr. Sankey was appointed City Electrical Engineer, Mr. Holder being unfortunately incapacitated from further service, and in February, 1914, the new scheme, estimated to cost £50,000, was presented to the Council and finally adopted, with the approval of the consulting engineers, Messrs. Robert Hammond & Son.

The new plant involved an extension of the main buildings, designed and carried out by the city engineer and his staff, and the installation of the following machinery :—

Boiler-House Plant.—Two Babcock & Wilcox marine type water-tube boilers, each complete with superheaters, economisers, and chain-grate stokers, and having a normal evaporative capacity of 15,000 lb. of steam per hour; working pressure, 200 lb. per sq. in.; one B. & W. coal conveyor, having a capacity of 40 tons of coal per hour, and four overhead coal bins; main and branch steam and feed piping. The whole of this plant was erected and set to work by Messrs. Reunert & Lenz, of Johannesburg, the S.A. agents of Messrs. Babcock & Wilcox.

Engine-Room Plant.—Two 1,000-kw. Fraser and Chalmers steam turbines, with Worthington condensers and rotary pumps driven by 40-h.p. B.T.H. three-phase motors direct-coupled to Dick, Kerr alternators, 6,600 volts, three-phase, 50 periods, supplied and erected by Messrs. Fraser & Chalmers, Ltd.; one remote mechanically-controlled h.t. switchboard, supplied by the British Thomson-Houston Co., Ltd., and erected by their S.A. representatives, the S.A. General Electric Co. This board contains three machine panels, one summation panel, one converter panel, and four feeder panels, and stands on the switchboard gallery some 4 ft. above the engine-room floor level, the switchgear cubicles being housed in the basement below.

Sub-Station Plant.—One 500-kw. Bruce Peebles-La Cour motor-converter at the power station; one similar 250-kw. set at the Town Hall sub-station. These were supplied, erected, and set to work by Mr. J. W. Saaler, the S.A. representative of Messrs. Bruce Peebles & Co.

In addition to the above plant supplied under the extension scheme, it was found necessary to replace the main storage battery, and it was decided to substitute therefor one 450-b.h.p. Browett-Lindley compound engine direct-coupled to one 250-kw., 6,600-volt, three-phase alternator and one 200-kw., three-wire dynamo and exciter supplied by the Electric Construction Co., Ltd., of Wolverhampton. This set was fortunately secured prior to the main machinery, and has proved invaluable, having on two occasions run for six weeks without a stop. It is now used regularly for night work and week-ends, and beyond one general examination and a few minor adjustments, has cost nothing for repairs after two years' hard work, all bearings, piston rings, packings, &c., being in perfect order and commutation or slip-ring troubles being unknown.

Mains and Sub-station Switchgear.—The high-tension and telephone cables were supplied by Messrs. W. T. Glover and Co. through Messrs. Davis & Soper, London, and were laid, jointed, and tested by the municipal staff under the supervision of Mr. L. F. Bickell, the assistant engineer, the whole of the sub-station switchgear, transformers, &c., being similarly erected, tested, and set to work. The new

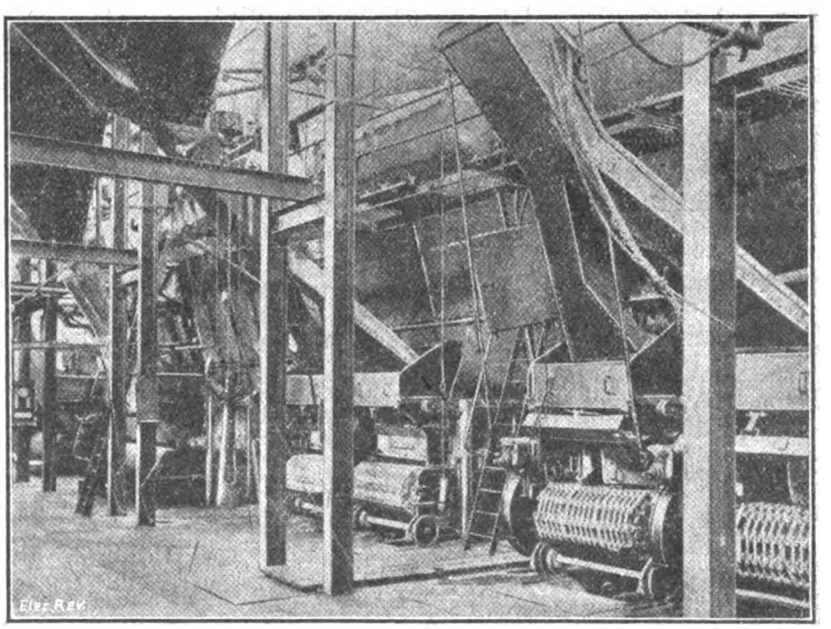

Fig. 2.—Boiler House; Two original Boilers in Foreground and two new ones beyond.

h.t. mains system includes several features worthy of note. Port Elizabeth stretches for nearly five miles along the shore of Algoa Bay and inland towards the centre of the town some 2½ miles. The main business portion of the town is in the centre, and this portion will continue to be supplied on the three-wire d.c. system, the original supply being supplemented by the 250-kw. motor-converter at the Town Hall sub-station. The rest of the town is being divided into districts, each to be

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fed by a static transformer sub-station as follows: Humewood, the seaside portion at the extreme south of the Bay; South End, Cape Road, the inland district; and North End, the factory area adjacent to the works. In this latter area sub-stations are now being erected to supply 500-volt, three-wire, three-phase general power supply to overhead lines, and one large factory is already supplied from its own transformers. Consumers now using 500-volt D.C. in this area are being changed over to 500-volt three-phase supply, the existing D.C. mains being seriously overloaded.

In the other districts, which are mainly residential, single-phase transformers are being used to transform down to 500 and 250 volts, single-phase, three-wire, and the existing D.C. distributors are being changed over to single-phase, three-wire; 500 and 250-volt D.C. motors are being changed to Century single-phase commutator motors suitable for either 250 or 500 volts. It is interesting to note that on the sea front, where constant troubles were experienced through the corrosion and breakage of overhead-line wires, with an A.C. supply the trouble has almost entirely ceased. On all H.T. cable routes a Key fibre conduit has been laid to provide for future duplication, and also all sub-stations are interconnected *via* the power station by underground telephone cables, which are also used to operate a time clock system. This private telephone system has proved a great boon, especially in cases of interruption of supply, when the public telephone lines are immediately blocked by consumers.

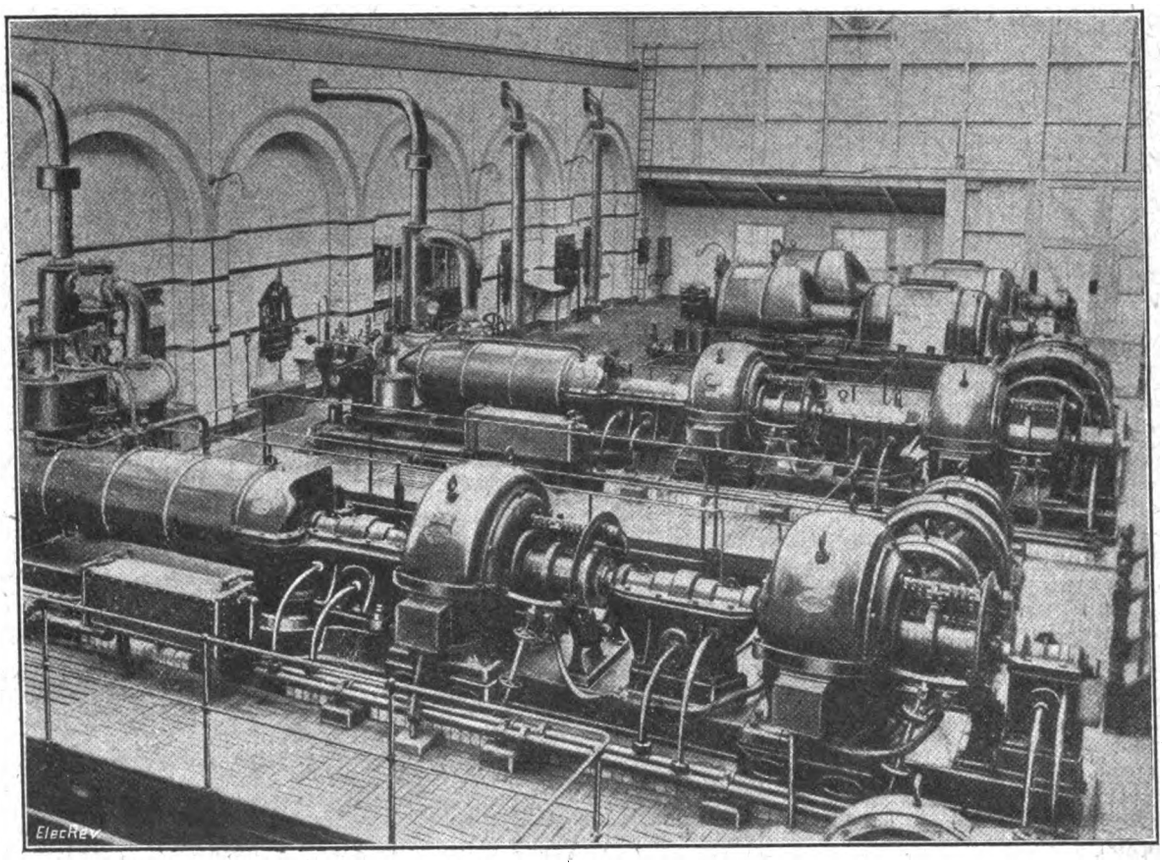

Fig. 3.—Engine Room; Two Original D.C. Sets in Foreground, Two New Turbo-Alternators Beyond, and 500-kw. Motor Converter to the Right.

Tariffs.—The tariffs for power are:—£2 per annum, or 3s. 4d. per month per H.P. of average maximum demand, and 1d. per unit for the first 4,000 units per month, ¾d. per unit above.—Three-phase A.C.: For the first 5,000 units per month, 1¼d.; all above, ¾d. There are no restrictions as to hours of use.—Private lighting: the charge is 8d. per unit, and 1d. on the Norwich system based on the valuation of the house, and it is hoped in time to extend this system to all classes of lighting supply.

These rates are considered very reasonable out there, where coal averages 20s. per short ton of 2,000 lb., of which 14s. 2d. consists of railage charges over some 800 miles of line, and salaries and wages are higher than at home. With power and heating supply available at 1d. per unit, the demand has rapidly increased, and there is a big future for electric cooking and heating when apparatus is available. With an output for the year ending December 31st, 1917, of 2,854,907 units sold, the total cost per unit, exclusive of capital charges, amounted to 1·54d., which it is hoped materially to reduce now that the new plant is in full service, and with an anticipated output in the neighbourhood of five million units. Several large factories are contemplating changing over from steam to electric drive, but have been held up owing to the difficulty of obtaining plant. It should be noted that the tramways are in the hands of a private company which has its own generating station, consequently the undertaking has not the advantage of a tramway supply as in most other large towns in South Africa.

The London agents for the Municipality are Messrs. Davis & Soper, whilst Messrs. Preece, Cardew, Snell and Rider are the present consulting engineers.

This article would not be complete without some mention of the war. In South Africa there is as yet no compulsory military service, but, on the other hand, there are no indispensables. Every man of the department, from the chief engineer downwards, who is of military age has volunteered for active service, and all fit men to the number of 10 are now away on active service, one of whom has been killed. The rest are all badged as unfit for military service, and are carrying on to the best of their ability.

Concrete Tests.—As the result of experiments carried out in the Structural Materials Research Laboratory of the Lewis Institute, Chicago, it is stated that the ratio of water to cement is found to have a more important effect on the strength of concrete than the quantity of cement or the grading of aggregates. This is brought out by a series of compression tests of about sixteen hundred 6 × 12 in. concrete cylinders. The mixtures used covered a wide range, as also did the grading of aggregate and consistency. The importance of any method of mixing, handling, placing, and finishing concrete which will enable the work to be done with a minimum of water, is at once apparent. It now seems that practically all faulty concrete work can be traced to the use of too much water.—*Engineering News Record*, May 2nd, 1918.

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SOME NOTES ON PUBLIC FIRE-ALARM SYSTEMS.

By G. W. STUBBINGS.

The importance of public fire-alarm systems, and the urgent need of simplicity and reliability in their general design and lay-out, are too obvious to receive more than passing mention. Several systems have from time to time been proposed and have been in use, many combining a number of ingenious devices and apparent conveniences, such conveniences, however, only being obtained at the expense of simplicity. Although there are still a number of systems in use throughout the country, modern opinion seems to favour the utmost simplicity that can be obtained. Modern fire-alarm apparatus is characterised by excellence of workmanship, and a high standard is usually attained in the constructional work. The maintenance of such a system is, therefore, largely a matter of methodical routine, and is frequently carried out by a man who has had considerable experience in the telephone service. The average all-round electrical engineer has usually very little to do with public fire-alarm systems, and a few notes describing the principal features of such systems may not be out of place.

The mode of action of the usual system may first be described. To call the fire brigade a handle in the head of the street post is pulled. This rings a bell in the watch room of the fire station, drops an indicator flap showing the point from which the call has come, and also rings a small bell in the head of the street post, to indicate to the person giving the alarm that his call has been registered. The ringing of the two bells is continued till the fireman on duty presses a button or operates a switch. In the head of the post is also a socket, into which a hand telephone set can be plugged, thus enabling the brigade, whilst out, to be in telephonic communication with headquarters. In order that the fire station may be called without giving the alarm signal, there is in the street instrument a small push, frequently in a more or less concealed position, by which the bell at the fire station can be rung without the continuous action of the alarm handle, thus enabling any prearranged system of calling to be used.

The technical details of the system may now be touched upon. The instruments are connected up on the central battery system, an earth return being frequently used. Battery power is now nearly always obtained from accumulators, the voltage of the ringing battery being of the order 80, and the speaking voltage being correspondingly lower. Normally the high voltage is on the line, and the act of pulling the alarm handle puts the bell at the fire station and the bell in the post in series through the line to earth. and also operates a relay coil which keeps the circuit closed. When the small push is used this coil is cut out of circuit, and the ringing of the bells corresponds with the movement of the push. The switch at the fire station for stopping the alarm bell cuts the voltage off the line, and the relay coil in the post becomes de-energised. To receive a telephone call, the telephone at the fire station is plugged into an ordinary jack. Earths on the line can be differentiated from calls by the fact that the ringing of the alarm bell cannot be permanently stopped by the switch in such cases. If an earth should develop the line is disconnected, and the fire-alarm point booked "out of order." This method of differentiating between calls and earths, although seemingly efficient and reliable, is not found satisfactory in practice, as usually the person giving the call, when he hears the bell in the post stop ringing, imagines that his call is being ignored, and immediately pulls the alarm handle again, thereby producing the earth indication. This so frequently happens that fire brigades will usually turn out for a continuous call, it being considered better to risk a false alarm than to incur the possibility of passing over a genuine one.

It is customary for all lines to be tested frequently, usually daily, owing to the urgent need that a faulty alarm be immediately marked out of order. This being the case, the system in which the continuity of the line can be tested at the fire station becomes of doubtful utility. The method used in this system is to connect a condenser in each street post, and to ring a bell through the condenser by a magneto at the fire station, such magneto being plugged into each line in turn. Were it not for the possibility of instrument faults, this would be a great advantage, but as the frequent test from the post is considered essential, the extra complication and expense is hardly justified.

Little need be said regarding constructional work in fire-alarm systems, as such work follows the lines of standard telephone practice. The importance of keeping written information enabling each line to be identified may, however, be mentioned. Each line should have a number, and all cable leads at distribution poles should be labelled with their appropriate numbers. Information regarding open wires on pole lines should be also at hand. In this connection it may be mentioned that the standard method of counting the wires is to begin from the top left-hand insulator, facing away from the distribution pole, taking each arm in turn. Great care should be given to the connection between the open wire and the instrument. Underground leads should be avoided if possible, and fire-alarm posts planted near tramway poles or arc-lamp columns, to which the open wire is attached, and to which the fire-alarm post is connected by a short length of barrel. Failing this, it is advisable to plant a small pole near the post, to avoid the necessity of running a lead underground. Attention to this point will not only lessen the possibility of faults, but will also render the renewal of the insulated lead an easy and inexpensive matter. Where an earth return is used, the earth connection must be made with care. A water service pipe, to which the earth wire should preferably be soldered, makes the best job; but failing this, a length of barrel should be driven down into the ground as far as possible, the earth wire being attached by means of a set screw. The earth wire should be stout, and if it runs any distance from the post, might well be covered by a warning board to prevent its being damaged or severed during subsequent excavations by other people.

Faults on fire-alarm systems can be classed under three heads: Open circuits, earths, and instrument faults. An open circuit, usually known as a "dis," is, as a rule, due to a broken cable lead on a pole, or to a wire being down. As the line is alive up to the break, such faults are easily tested for by an ordinary detector. After thunderstorms, it is always advisable to inspect the protective devices at the fire station. This is usually done by earthing the fuse terminal connected to the line, when the alarm bell will ring if the fuse and heat coil be intact.

Earths are due usually either to broken wires or to faulty underground leads. Such faults are usually localised by sectioning the line at convenient points and testing each section with a detector and battery. For such faults it is most important to be able to identify the required line, in order that the insulated leads at distribution or cross-arm poles may be cut without delay. A very convenient battery for such testing can be made from three ordinary flash-lamp batteries. These can be put up in a very small box, and if the box be provided with a pair of terminals, the battery will be found very convenient and portable; as it is used but seldom, and then required to furnish but a small current, the cells will last a long time.

Instrument faults can usually be located with little difficulty, owing to the simplicity of the apparatus. To those who are unaccustomed to these instruments, adjustments to bells are likely to give some trouble. Being designed to work in series with the alarm bell at the fire station, the usual construction has to be somewhat modified. When the magnet coils of the bell are energised, the vibrating contact is made, and not broken, as in the case of an ordinary bell; this contact short-circuits the magnet coils, and consequently de-energises them, when the contact is broken. When the instrument is disconnected the contacts should therefore be separated.

A fault that is sometimes met with is a feeble ringing of the alarm bell whilst the speaking is satisfactory. This is, of course, due to a high resistance in the circuit, and in such a case the trouble will almost always be found due to a faulty earth connection or to a defective earth. It is better then to renew the earth connection, or, should this be good, to seek a fresh earth. The current required to ring the alarm bell at the fire station is considerable, and, if satis-

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factory service is required, it is essential both that an efficient earth be found, and also that the earth connection be securely made.

Two batteries of accumulators are usually installed, one of large cells for normal use, and another of smaller cells as a stand-by whilst the large cells are being charged. These batteries are rather liable to be neglected, or, at all events, not to receive the methodical care required to keep them in good condition. It may, however, be remarked that since motor-driven fire appliances have come into such general use, this state of affairs has largely improved, as there are now usually in the brigade one or two men at least who have the necessary technical knowledge to attend to the cells, and also to realise the need of the care that has to be taken of them.

THE NATIONAL PHYSICAL LABORATORY.

The report of the Laboratory for 1917-18 has just been issued; it is now published by H.M. Stationery Office, in consequence of the transfer of the Institution to the Department for Scientific and Industrial Research.

The present report contains an outline of the history of the Laboratory from its inauguration in 1902. During the war heavy demands have been made upon its resources, and new buildings have been erected for the testing of gauges; further extensions in this connection are now in progress, and the accommodation for aeronautical research is also being extended. The staff has increased from 187 in July, 1914, to 532 at present, in addition to 25 Superintendents and Senior Assistants. While the Committee of the Privy Council for Scientific and Industrial Research has assumed responsibility for the finance of the Laboratory, the control of its scientific work and researches will remain in the hands of the Royal Society. In future, each year a report will have to be submitted to the Research Department in December. The site of the Laboratory has been extended by the purchase of additional land and buildings. One of the new buildings under construction will be devoted to the testing of glass volumetric apparatus, which was formerly procured from Germany. The foundry in the Metallurgical Department has been doubled in size to provide space for the increased work on light alloys, and for the optical glass research. Several other departments are in need of increased accommodation.

Hitherto the primary electrical standards have been in the custody of the Board of Trade, whose Laboratory has been in close co-operation with the N.P.L. The new position of the latter has made it possible to transfer to it the functions of the Board of Trade Laboratory, and arrangements are in progress with a view to this being done.

Amongst other researches which are being carried on are experiments for the Engineering Standards Committee on the efficiency of electric heaters and hot plates, the heating of the sockets of Goliath lampholders, and (for the Institution of Electrical Engineers) the heating of buried cables and the corrosion of lead-covered conductors.

The magnetic disturbances at the laboratory which have occurred since the electrification of the London and South-Western Railway have been referred by the Office of Works to arbitration, and the award of the arbitrator is to the effect that the disturbances exceed in magnitude the limits laid down in the Act under which the electrification was carried out. Further steps are under consideration with a view to giving effect to the award.

The services of the director and members of the staff on numerous Committees, in addition to their work in the laboratory, have been in great demand and have been recognised by the grant of the O.B.E. to Dr. J. A. Harker and Messrs. G. S. Baker, C. C. Paterson, and F. E. Smith; the M.B.E. has been awarded to Messrs. S. W. Attwell, B. P. Dudding, and R. Wolfenden. Mr. F. E. Smith has been elected to the Fellowship of the Royal Society. There are now 49 members of the staff on active service.

The Electrical Standards Division has been almost entirely occupied with confidential work. Much attention has been given to investigations of magnet-steel and methods of testing magnets. A standard inductometer, with a range to 1 MH., has been constructed to supplement the larger one, ranging to 10 MH., which is in constant use. In the Electrotechnics Division, researches have been in progress on insulating materials, magnetos, searchlight carbons, &c. The Heat Division has carried on high-temperature test work, especially in respect of the testing of optical and total-radiation pyrometers, work "of the highest importance in connection with the industries."

Tests made during the year ending March 31st, 1918, attained to the following numbers:—Electrical measurements, 272; electrotechnical apparatus, 7,408; photometry (mainly luminous dials), 16,993; radium preparations, 81; pyrometry, 213. The total for the Physics Department was 233,869.

The income of the Laboratory from January 1st, 1900, to March 30th, 1914, was £282,545, of which £166,633 was payments for work done; expenditure amounted to £283,041. The income for the year was £103,979, an increase of nearly 50 per cent. over 1917 gauge testing for the Ministry of Munitions accounted for £36,610. The expenditure was £100,785, and the credit balance £3,194. Salaries amounted to £78,282.

The report of the *Electricity Division*, Section A, of the Physics Department (Mr. F. E. Smith and Mr. Napier) states that most of the time of the Division has been occupied with work of a confidential nature, partly wireless telegraphy. The Laboratory standards of E.M.F. have been compared with those of Japan through the intermediary of some Weston cells brought to Teddington by Dr. Yokoyama; there was a mean difference of four parts in a million, a very gratifying result. Magnetograph records have shown coincidences between the running of electric trains on the L. & S.W. Railway system and magnetic disturbances at the Laboratory, and incidentally have demonstrated the excellent aperiodic qualities of the magnetograph. In Section B (Mr. Campbell and Mr. Dye), a standard mutual inductometer for a maximum of 1 millihenry has been constructed; on the lowest range the whole scale will be equal to the microhenry, extended to 100 times this amount by dial coils. Means of accurately testing precision search coils with the aid of the magnetic fields of solenoids were investigated, and an accuracy within one part in 1,000 was found to be attainable. Various tests were carried out in connection with magneto condensers, compass magnets, search coils for horse-shoe magnets, &c.

The *Electrotechnics Division*, Section A (Messrs. Paterson, Kinnes, Walsh, and Dr. N. Campbell), has also been engaged on confidential work. Mr. Paterson is serving on the Electrical Research Committee and several Sub-Committees of the Engineering Standards Committee, and is chairman of the Sub-Committee on electrical parts of aircraft. Insulating materials for magnetos have been under investigation, as well as the heating of Goliath lamp sockets, luminous compounds, gun sights, &c., and work in connection with the Paterson-Walsh height-finder has occupied a good deal of time. In Section B (Messrs. Melsom and H. C. Booth and Miss Cockburn) Admiralty work has been dealt with, and the buried-cable research has made good progress. It has been found that the rise of temperature of a cable drawn into a stoneware duct is twice that of a similar cable armoured and laid direct in the ground; cables laid solid in bitumen occupy an intermediate position. A special motor-generator has been designed for this work and for the heavy test work of the Laboratory; it consists of two D.C. generators, each fitted with two commutators. Each commutator is arranged for a current of 1,250 A. at 6 V., and the commutators can be put in series or parallel as required. The set is driven by a three-phase 3,000-volt motor, and excitation is provided by a separate motor-generator set with automatic speed control.

In the *Heat Division*, Section A (Dr. Griffiths and Mr. Schofield), the use of tungsten arc lamps as a comparison source for calibrating optical pyrometers has been extended with advantage, and the Edison Swan Co. has constructed special lamps covering a range of apparent temperatures from 900 to 2,400° C. Much work has been carried on in connection with high-temperature scales, and the direct calibration of optical pyrometers against the melting points of palladium and platinum. It has been found possible to standardise total radiation pyrometers against the melting points of gold and palladium wires, and it is hoped to extend the method to platinum. A considerable amount of work has been done on the efficiency of electrical hot-plates and cooking stoves.

In the department of Metallurgy (Dr. Rosenhain) the foundry has been extended, with gas and electric furnaces. An electric furnace provided for high-temperature thermal curve observations has made it possible to take thermal curves up to the highest temperatures that thermocouples can withstand, with the same ease and accuracy as at moderate temperatures; in this furnace the hottest portion is at the top, and the specimen is pushed up from below, so that the supports and the wires of the thermocouple do not pass through the hottest region.

Colour of Transformer Cases as affecting Capacity.—Mr. H. M. Daman, in the *Electrical Review*, N.Y., considers that, with the larger capacities coming into vogue and the greater use of out-door installations, because of their lower unit cost and simplicity, the choice of colour of transformer casings, metering houses, &c., might to good advantage be given more consideration than it apparently receives.

Theoretically, the output of a transformer, as governed by internal temperature, should be influenced by the colour with which the external surface of the case is painted. A black body more readily radiates heat from within than does a light body. But it also absorbs heat more readily than a body of light colour. It seems that under certain circumstances it might be preferable to employ a light coloured paint rather than a dark one, depending upon the climatic conditions and the load, whether occurring during the night or the day.

In intensely hot climates, with transformers exposed to the sun's rays for long periods daily, the author has encountered a number of transformer burn-outs from no apparent cause, that later were found to be due to the continuous maintenance of excessive temperatures, although the load was by no means continuous or constant. The explanation advanced was that the heat absorbed by the black cases was responsible for the high temperature.

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NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Electric Lighting and Power Sets for Farm Use.

One of the features of the electrical business in the United States at the present time is the large amount of attention which is being devoted to the production and sale of compact plants for electric lighting and power purposes on farms. Among the concerns which have entered this branch of trade is the Edison Storage Battery Co., of Orange, N.J., which, however, is only supplying the dynamo, battery, and switchboard, leaving the purchasers to use an existing oil, gas, or petrol engine, or to purchase one suitable for the electric plant and to their own local requirements.

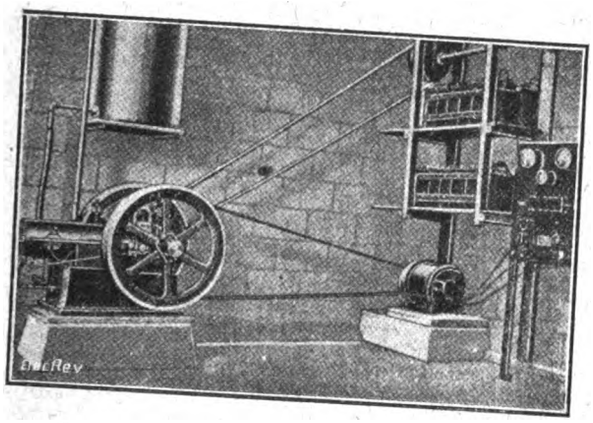

Fig. 1.—Edison Electric Set for Farm Use.

The Edison Co. is supplying the sets mentioned in two-voltage capacities—30 and 110-volts—the 30-volt outfits being furnished in four sizes and the 110-volt sets in five sizes. The generators supplied with the sets are of standard design, and call for no special description. The batteries are of the Edison alkaline pattern in solid steel containers, giving 1·2 volts per cell. They are similar to the Edison batteries used for other purposes, except that they have a high amperage rating, and have additional space above the plates, so that they only require refilling with liquid at infrequent intervals. The switchboards are mounted on slate panels, and are equipped with a charging rheostat to control the current from the generator, an underload cut-out to prevent the battery discharging through the generator should the engine stop, a switch, and ammeters. The wiring to the switch is so arranged that lamps can be run from the generator alone, from the generator while the battery is being charged, or from the battery alone.

Accumulator Repairing Appliances.

There is a steadily advancing call on electrical engineers and motor repairing firms for repairs to batteries. A concern which is specialising on useful appliances for this work is the American Bureau of Engineering, of 1018, South Wabash Avenue, Chicago, U.S.A., whose steaming arrangement for softening the sealing

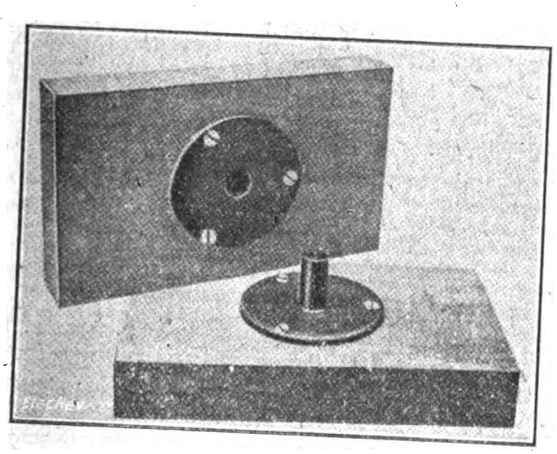

Fig. 2.—Battery Turntable.

compound used on starting and lighting batteries, to enable them to be readily opened out, was illustrated in a recent issue of the Review.

In addition to this device, the company named has also lately introduced the handy battery repair shop appliance shown in fig. 2; as will be seen, it takes the form of a bench turntable to facilitate the work of the repairer. It consists simply of a couple of pieces of well-seasoned hard wood, 10 in. long, 6 in. wide, and 2 in. thick, a hole being drilled centrally in one, and provided with a cast-iron disk, the other being fitted with a pivot, also of cast-iron; the two blocks thus fit over each other, enabling the battery to be moved about with no more force than that exerted by the finger. The turntable is not secured to the bench, the weight of the battery being sufficient to hold it in position.

Another battery repair appliance made by the same concern is the plate press (fig. 3), intended for use in pressing battery plates when dismantled for cleaning and repair.

Many battery repairers press plates in an ordinary bench vice; this is, however, hard on the vice, as acid drops from the plates on to the iron parts, which in time become badly corroded and rusted. The plate press illustrated has been specially designed for the work, and is so constructed that there is no metallic part which can be reached by acid dripping from the plates. A trough is so

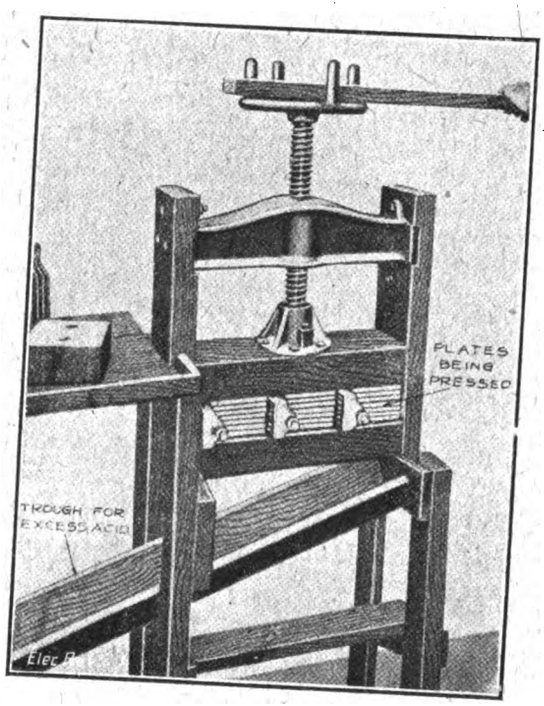

Fig. 3.—Battery Plate Press.

arranged that the acid which is squeezed out of the plates is carried off into a drain, and there is consequently no rotting of the floor beneath the press, and no wet, acid-covered floor to ruin shoes and clothing. In pressing plates, "transite" boards of the proper thickness are placed in each space between successive plates, with two boards on the outside of the end plates. The group of plates is then put under pressure, either to straighten the plates or to force the active material into the grids flush with the surface of the latter. Three groups of plates may be pressed at one time in the press, this resulting in a considerable saving of time. The press measures 2 ft. 4 in. in height, and 2 ft. 2 in. in width, and is provided with a 14-in. handwheel, and is supplied with twenty-one

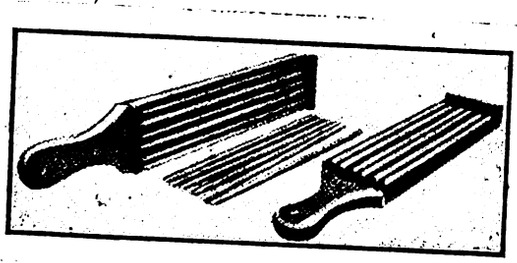

Fig. 4.—"Ambu" Burning-lead Mould.

$\frac{1}{8}$-in. and twelve-$\frac{1}{8}$ in. transite boards. Finally, reference may be made to the "Ambu" burning-lead mould (fig. 4). In every battery repair shop there is an accumulation of scrap lead from post drillings, old connecting straps, plate straps, and plates; these should be kept in a special box provided for the purpose, and when a sufficient amount has accumulated, the lead should be melted and run off into moulds for making burning-lead. The mould illustrated, which has been introduced for this purpose, consists of a sheet-iron "form" pressed into six troughs or grooves into which the melted lead is poured, and is conveniently mounted on a block of wood with handle, making it possible to handle the mould while hot without danger of the user being burned. A sheet of asbestos separates the iron from the wood, thus protecting the wood from the heat of the melted metal. The grooves in the form will produce bars of burning-lead 15 in. long, $\frac{5}{16}$ in. thick, $\frac{3}{4}$ in. wide at the top, and $\frac{1}{2}$ in. wide at the bottom.

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BOILER AND OTHER REPAIRS BY ELECTRIC WELDING.

By R. S. KENNEDY.

(*Abstract of paper read before the* Institute of Marine Engineers.)

The tests of electric welded specimens carried out to the instructions of Mr. Boyle and Mr. Carleton in 1909 and 1910 were of great value in connection with the Board of Trade. These tests were made not only with the object of getting at the tensile strength of the weld, but of finding out if the process of welding affected the neighbouring material. Numbers of specimens were tested, and some of these were annealed, but it was found that annealing made no difference to the results, and the material immediately adjacent to the weld behaved in a normal manner. These tests gave a tensile strength of about 17 to 18 tons per square inch, but since then improvements in the materials and methods have increased the tensile strength of welds in boiler steel to about 27 tons per square inch. In practice, however, the writer would not recommend that a tensile strength of more than 20 tons per square inch be worked to, this giving a sufficient margin for possible small defects in workmanship. In no single case has the writer known an electric weld to give way suddenly; failure has always been preceded by a small crack, which has gradually developed.

Electric arc welding is primarily a form of autogenous welding. It is, however, found in practice that the application of even the moderate amount of pressure produced by a hand hammer increases the tensile strength and tenacity of the weld from 5 to 10 per cent. It is essential that this work should be put into the material when it is at welding heat or, at any rate, above the black heat. The iron wire used is of the very best material, with preferably a small percentage of manganese. This iron wire has been very heavily worked in the process of manufacture, and subsequently annealed, and as used by the writer's firm shows a tensile strength of 28 tons with an elongation of 50 per cent. Somewhat similar results are obtained in another field with cast iron, which has several times been remelted.

In electric arc welding with a metallic electrode one great advantage is that, with the exception of the atmosphere, there are no impurities to guard against, except such as are introduced in the materials. The source of heat is pure, and we have to see that the job is properly cleaned and the metallic electrode of suitable material. Still, to provide against oxidisation and also to increase the fluidity of the metal a flux is necessary for good work in arc welding, and the heated metal is protected from oxidisation by an inert gas given off by the flux. The most convenient method of applying the flux is to coat evenly the metallic electrode, thus providing a constant and uniform supply.

It is quite a common practice to weld over a riveted seam; rivets in the area dealt with should be completely welded over, and not left half covered. After welding a seam it is necessary to caulk the landing edge for some 6 in. at each end of the welded portion. Work can be carried out directly overhead, or in any position that is accessible to the welding pencil, and where the operator can see what he is doing. As the work requires constant attention on the part of the operator, it is advisable, in order to get the best job, to make it as accessible as possible, and that the operator should be reasonably comfortable. In common with hand welding, a good job depends on the conscientious work of the man. The writer's firm has always trained its own welders, and keeps them in constant employment. A full report is made of each job, and the name of the welder recorded; the whole object of the training is to inculcate a sense of responsibility.

The materials at present dealt with on a commercial scale are wrought iron, steel, and cast steel, and occasionally cast iron. The range of temperature of the welding heat is the determining factor in the adaptability of a substance for welding. Much successful work has been done with cast iron, notably with castings of considerable age, which have not been subjected to corrosive action, and with the good mixtures of more modern times. It is probable that there is a welding temperature of cast iron, but the range of this temperature is very small, something of the order of 10 deg.

The voltage across the metallic arc is about 22 to 25, and the writer adds an equal steadying resistance, which makes the voltage at the terminals of the dynamo about 45. A substitutional resistance is employed which is put in circuit by an automatic switch, when the welder breaks his arc, thus keeping the load on the machine constant. The amperage actually employed is about 175, but in practice a 200-ampere machine is necessary, while the writer's firm uses machines designed for 250 amperes. In the big passenger liners it is the practice to weld from the ship's dynamo, suitable welding and substitutional resistances being provided.

The preparation of a job for electric welding is a matter of considerable importance, as the presence of impurities is likely to be detrimental to the weld. In dealing with the external or fire surfaces of a boiler it is usually sufficient to use an ordinary chipping hammer, and then thoroughly wire-brush the metal to be dealt with; but some superintending engineers prefer to have a light chipping taken over the surface, which is, of course, the ideal preparation. When it comes to dealing with the water surfaces of a boiler greater care is necessary, especially if zinc plates have been freely used. The welder, if a properly trained man, would at once recognise this difficulty and apply the only remedy, which is to chip down till pure metal is reached.

Arc welding being a building-up process, cracks are dealt with by veeing out at the line of fracture, the vee being made wide enough to ensure that the welder can reach with his pencil to the bottom on either side with a certainty of striking his arc at any required position. As the welder is a highly skilled man, it is usual for the boilermakers to prepare the work to instructions, and the welder himself puts in the finishing touches. The welding-in of new backs to combustion chambers or tube plates, or work of that kind, is dealt with in a precisely similar manner, although here certain allowances have to be made for the work drawing together as the welder proceeds. It should be mentioned that in dealing with cracks it is absolutely essential that the whole of the fractured portion be cut away, and a very good guide is to cut away till a solid chipping is obtained, and then go a bit deeper to be on the safe side. If welding is carried out over a partially cut-away fracture it is certain that sooner or later it will work to the surface. One of the most unsatisfactory matters we have to deal with is the welding of a crack in the original weld of a furnace, as it is most difficult to say where the defective weld ends, and a further defective portion some short distance along may work back into the part dealt with.

The writer recalls an incident when we were called in to weld a crack, apparently about one inch long, in the back of a combustion chamber of a Swedish vessel. Our man started to cut out the crack when with a loud report the chamber back split right across, showing a fracture a full sixteenth open. This caused great alarm at first, and we were charged with using undue vigour, but on veeing out the fracture for welding it was found that the back was grooved right across on the water side, so we were exonerated. Owing to its higher temperature the electric arc is more suitable for dealing with the heavier sections than oxy-acetylene or oxy-coal gas; on the other hand, for thicknesses of 3/16 in. and under, one or other of the gas systems is preferable.

The writer claims that arc welding, where carried out by skilled operators with suitable materials, is absolutely reliable, and can point to some 20,000 jobs, some of a very big nature, while the percentage of even partial failures would, at any rate, be on the right side of the decimal point. These partial failures would be mainly accounted for where the work was carried out under unfavourable conditions, and often in the nature of a forlorn hope. Great difficulties are met with in hurried repairs to the lower portions of the hulls of vessels in dry dock, where water is constantly dripping from the leaky portion, and owing to the cement inside it is often impossible to stop it in the time available.

The question of the resistance of welds to rapidly alternating stresses and shocks is somewhat obscure. Some year or two ago the writer's firm was asked to weld the broken piston rod of a 10-cwt. steam hammer, which had already been twice welded in the fire. This was carried out, and it is now running satisfactorily.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Trade Unions: Past, Present, and Future.

Having stated, in no uncertain terms, that the principles of trade unionism must undergo a great change, it is to be expected that the writer should be prepared to indicate some general outlines at least on which such reforms should be based, and he takes this opportunity of suggesting some ideas, which might well form the foundation for the development of the new trade unions, or, better still, the reconstruction of the old, particularly those relating to the electrical industry, hoping that among the existing unions many men will be found to give thorough consideration to the proposals, with the object, not of destroying, but of co-ordinating all present effort, and producing a form of trade unionism worthy of the name.

Into what he will call the Electrical Trade Union the writer would admit everyone engaged in the electrical industry, with the possible exception of tramway workers, who would have their own union, and he would divide it into four sections—Grade 1 (skilled men), Grade 2 (semi-skilled), Grade 3 (unskilled), and Juniors (lads under, say, 18 years of age, whether serving a recognised apprenticeship or not).

On reaching the age of 18, if that were the appointed age, the lad should pass automatically into either Grade 2 or Grade 3, according to his ability and qualifications, but on no account would he be admitted immediately into Grade 1. Yet, no matter which grade he was placed in, he should be given the opportunity of showing his value, and of being

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elected later into the higher grade. In fact, it should be instilled into every man that his union looks to him to qualify himself for a better grade, and it must be made worth his while to exert himself in this direction.

This can best be done by a reasonable control of wages, and it should not be possible for a junior to earn as much for an ordinary working week as an unskilled man even, while the maximum for unskilled labour should be below the minimum for semi-skilled, and the maximum for semi-skilled below the minimum for skilled labour. Thus will there be every inducement for intelligent and steady men to make themselves skilled men.

But, as Mr. J. S. Hecht points out in his excellent remarks on the problem of reconstruction in the ELECTRICAL REVIEW, "if a skilled man does not produce greater value per hour than an unskilled, what would be the use of skill?" The trade union must see that only those who are really efficient workmen, in the sense that they produce in a fair proportion, are elected to Grade 1, and they must also have, and use, the power to relegate a man who, having reached a higher grade, thinks he can relax his efforts and generally have a slack time.

The habitual bad timekeeper must be dismissed the union, after a fair trial before a jury of his fellow-members. If dissatisfied with their verdict he should have the right of appeal to a central tribunal consisting of representatives of all trade unions.

For the promotion of "real uplifting qualities and education," as mentioned by Mr. J. A. Tasker, special committees should be set up, but in the case of the Electrical Union these committees should be constituted of electrical men only. In fact, it would be a good thing for trade unionism if it insisted that the whole management of its affairs should be in the hands of men with actual experience in the particular trade which that union represented.

The special educational committees should promote lectures and demonstrations, and be able to find an instructor for any member on any point connected with his calling. They should encourage invention, and should, moreover, undertake that the ideas of inventors in their union should be thoroughly investigated, and that the members should reap the rewards of their inventions.

For the juniors, a good number of trade union scholarships should be awarded, which should be tenable for at least three years, and which should provide the deserving lad with instruction not only in the workshop, but in the technical schools as well, his time being equally divided between the two.

Many other details will have to be considered, such as the subdivision of Grade 1 into technical and non-technical sections, subscription rates, employers' representation, &c., but these are the general principles on which the unions should be established, and the writer is certain that the adoption of them would lead to more understanding and happier relations between the employer and the employed. If the existing unions will not move of their own accord, then all reasonable men must join hands to make them.

The Writer of the Article.

August 17th, 1918.

Instruments for Central-Station Switchboards.

I have been away owing to severe personal bereavement, and have only just heard of Mr. Jepson's letter on the above matter. I do really think it is a pity that the representatives of the Aron Company should adopt the tone they do; one is reminded of the old adage, "No case, abuse defendant's attorney." I am not going to waste your space with a "paper war" with Mr. Jepson, but as he directly charges me with breach of faith, I am bound to clear myself. The meters I tested were the type normally recommended for heavy switchboard work, and so used as I know in several cities; it therefore seemed very relevant to Mr. Stubbings's article, which, as "A.M.I.E.E." put it, placed Aron first and the rest nowhere, to point out one serious drawback. And to his ingenious attempt to discredit my impartiality I simply say: (1) The idea of using Aron meters for this particular war job (26 meters) originated with me and not with them. In the early days my experience with Aron meters was most unfavourable, but meters are capable of improvement, and in view of the particular requirements (to run together closely) I honestly thought, in view of the theory of the meter, they ought to do better than anyone else. Equally honestly I say I am disappointed they do not, and I do not know how I can put it fairer. (2) No tests with the carbon rheostat below the meters were taken into account—but I could not trace any effect to that. All tests considered were in a special temperature chamber. (3) Much as it may disappoint Mr. Jepson, it is a fact that the competing meter has no patent of mine on it, nor is it proposed that it shall. In conclusion, I am quite content to leave it to those who trouble to read this correspondence to judge the merits of the matter.

E. Fawssett.

Buttermere, *August 19th*, 1918.

[We think the prolongation of this regrettable controversy would serve no useful purpose; in closing it, as entirely unbiased (and uninvited) umpires, we may be allowed to sum up the matter as it appears to us. On the one hand, we have every reason to believe that Mr. Fawssett in conducting the tests had no object in view but to obtain the most suitable meters for the particular purpose for which they were required, and that he neither had nor has any but friendly feelings towards the makers of the Aron meter. On the other hand, in view of the reputation and theory of the meter, we do not believe that these particular tests should be interpreted in a general sense as constituting an indictment against the type. It is obvious that two meters of exactly the same pattern and constructed of the same materials ought to run well together under varying temperatures; it is admitted that the makers took this for granted, and did not put the matter to the test before delivering the meters, a precaution which evidently was very necessary. *Hinc illae lachrymae*. In normal times, no doubt, the mishap would not have occurred.—Eds. Elec. Rev.]

Tar Oil as Motor Fuel.

In your account in this week's Electrical Review of Mr. Wilkinson's invention, where you describe how to run a petrol engine on tar oil, you say: "The whole secret of it is a piece of ½ in. copper pipe taken through the exhaust pipe, which is Mr. Wilkinson's patent." My patent No. 106,379, of which a full account appeared with drawing in the *Autocar* of February 3rd, 1917, appears to cover this, as I show how to run on crude paraffin, and the point in my patent is the fact that I take my hot air inlet, which I describe as a ½ in. copper pipe, through the exhaust pipe, as you will see by the sketch. I enclose a leaflet which is a reprint of the article in the *Autocar*.

E. O. Walker & Co.

Manchester, *August 14th*, 1918.

[Messrs. Walker's letter arrived too late for inclusion in our last issue. Mr. Walker's invention includes, as stated, an air pipe passing through the exhaust pipe, at right angles to it, together with an arrangement for admitting a small proportion of water in the form of steam to the cylinders with the air. Mr. Wilkinson's hot-air pipe traverses the exhaust pipe longitudinally from end to end.—Eds. Elec. Rev.]

THE BRITISH SCIENTIFIC PRODUCTS EXHIBITION.

(*Continued from page* 156.)

Among the "optical and mechanical instruments" is a display of magnetos and dissociated parts of magnetos shown by the British Ignition Apparatus Association, which provides one of the most attractive features of the exhibition. All the associated makers are represented there, while the well-known B.L.I.C. magneto is shown on the stand of Messrs. Vickers, Ltd., of which the British Lighting & Ignition Co., Ltd., is a subsidiary company. The B.L.I.C. was formerly the well-known Bosch machine, and it is as popular as its predecessor. This and other magnetos are made in various forms, each specially designed for some particular purpose, but they are all variations of one general plan. The magnets are horse-shoe shaped, and in the larger machines the magnet has a second set of steel bars outside the first. On the inside of the horse-shoe two pole-pieces are bored to receive the armature, which consists of an iron core wound over with a coil of insulated copper-wire, either silk covered or enamelled. One of the chief differences between the different magnetos lies in the winding of the armature coil. In the case of low-tension magnetos the armature has about 150 turns of wire wound on it, the wire being about 1/20 in. in diameter. In the case of a high-tension machine, the magneto may have much finer wire and about six thousand turns. Modern high-tension magnetos have two windings, a thick wire followed by a thin wire, the latter having many more turns. High-tension magnetos use the momentum of a low-tension current to reinforce the voltage of a high-tension coil, producing an excellent spark in this way.

It would be an advantage if the British Ignition Apparatus Association, which is responsible for the exhibition of magnetos produced by its members, could arrange for someone to be in attendance at its stand to explain the construction and action of the apparatus used for electric ignition, and to give the public an idea of the meaning of the various machines displayed, for the exhibit is indeed a striking one, and a most promising augury of future trade.

Closely associated with the production of the magneto is the supply of varnished insulating cambrics, silks, and papers. A selected range of samples of these is shown on the stand of the British Ignition Apparatus Association, but only one British producer of these materials is exhibiting, as far as we have been able to ascertain.

This is Messrs. Abbott, Anderson & Abbott, Ltd., London, who show the "Abbott brand" of all-British varnished insulating cambrics and silks which are extensively used for electrical apparatus, including magnetos. The specimens shown are typical of the materials manufactured at the company's works at Harpenden, and indicate how successful the company has been in overcoming the initial difficulties which

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beset the production of such insulating materials when their manufacture was first undertaken in this country. Before the war varnished silks, cloths, papers, &c., were produced chiefly in Germany and Austria. Large supplies of these materials have been coming in from America, but the British products are in every way as good as the products formerly obtained from Central Europe and now obtained from the United States.

The British Central Electrical Co., Ltd., London, are showing a number of multiple fuses, watertight fuse boards, insulated hand-lamps, lampholders, adapters, &c. These exhibits are designed to afford protection against accidents from misuse or otherwise of all electrical fuses, hand-lamps, wall plugs, and similar apparatus. The chief feature of the design of these appliances is that all metal parts that could possibly come into contact with the user's hand are covered by a shield or handle specially designed and made of insulating material. All parts forming the case or non-carrying current portions of the apparatus are efficiently earthed, arrangements for earthing having been provided where designs have not permitted the accessories to be fitted with insulating protection.

The Damard Lacquer Co., Ltd., of Birmingham, are exhibiting specimens of "Formite" products showing their application for electrical insulation. In the initial state "Formite" is a fusible, amber-coloured resin, soluble in alcohol, ether, acetone, fusel oil, &c., with a melting point of about 150 deg. F. When heated to 250 deg. F. it changes, by a chemical reaction known as polymerisation, into a hard, homogeneous, amber-like product, which is no longer soluble or fusible at any temperature, exhibits high insulation, and is hard, with good tensile strength. On account of its exceptional properties, "Formite" is an excellent material for electrical and heat insulation.

Messrs. Fleming, Birkby, & Goodall, Ltd., of Liversedge, are also showing special moulded insulation suitable for all kinds of electrical work. Certain grades manufactured by this company will stand temperatures up to 2,000 deg. F., and the dielectric strength is 550 to 600 volts per mil. This firm also specialises in the manufacture and supply of all other kinds of electrical insulating materials, mica and micanite, fibre, presspahn, leatheroid, insulating cloth, silk, tape, &c., and every type and kind of electric traction overhead line fitting for round, grooved, or other section of trolley wire, trolley heads, wheels and bushes, and general electrical accessories.

What is claimed as a substitute for the German product "Stabilit" is "Hightensite," a high tension electrical insulating material, manufactured by "Hightensite," Ltd., London. Before the war the magneto industry in this country was restricted partly by the lack of a satisfactory insulating material suitable for this class of high-tension apparatus. "Hightensite" gives perfect insulation, has a dielectric strength which withstands a pressure of more than 20,000 volts per mm. thickness, is non-hygroscopic and non-inflammable, does not carbonise under sparking, and has a wearing surface equal to that of brass. The latter points are of supreme importance for running-contacts as used in magnetos and rotary engine distributors. Its high insulating and weatherproof properties make it invaluable for wireless apparatus. Metal inserts can be moulded in position, thus allowing greater strength and better finish than in built-up articles. This material is shown by the Park Royal Engineering Works, Ltd., London.

The Igranic Electric Co., Ltd., London, are showing an improved pattern of self-supporting coils for electrical purposes, wound by "Leesona" universal machines. These machines automatically count and stop at any predetermined number of turns, prevent kinking, entangling, or stretching of the wire, and enable one operative to control several machines. The latest form of machine interposes a cross winding of cotton between parallel turns of wire, binding the whole into a self-supporting mass which is easily impregnated, and when finished becomes practically indestructible. Another machine cross-winds the turns of wire, and can make a self-supporting coil as narrow as 3/16 in. and several inches in diameter with practically zero capacity between the layers.

Messrs. Isenthal & Co., Ltd., London, are showing resistances of the sliding contact type which are based on German models, with such improvements as experience has proved to be necessary. They are used in connection with experiments and tests in laboratories, for charging accumulators, regulating small generators, to control the various circuits in wireless work, and as regulators for electric furnaces. Two classes of resistances are made: in one of these the resistance wire is wound on slate supports, and in the other oxidised wire is wound on steel tubing with a vitreous enamel coating, or on mica tubing.

A hand automatic electric welding machine for welding iron and steel wires from 0.05 in. to 0.2 in. diameter, and copper wires from 0.05 in. to 0.175 in. diameter is shown by the Electric Welding Co., Ltd., London. The welder is electrically automatic, and has two clamps, one of which is stationary, while the other is movable towards the fixed clamp by means of an adjustable pressure spring. The clamps are also adjustable for wires of different sizes, and are fitted with renewable steel cheeks. The wires being properly clamped in position, the circuit is closed by an external switch, and the button switch on the top of the welder is pressed. The wires immediately heat and are forced together by the pressure spring, the circuit being opened by an automatic cut-out device, adjustable by means of a quadrant scale and set-screw. In making the weld the metal is upset, leaving a swelling or burr around the weld, the size of which depends upon the tension of the spring, and the setting of the cut-out device.

Messrs. Everett, Edgcumbe & Co., Ltd., Hendon, are exhibiting an interesting range of measuring and testing instruments, including the "Luxometer" portable photometer. Measuring and testing instruments are also shown by Messrs. Evershed & Vignoles, Ltd., Chiswick, including instruments of the moving-coil and moving-iron types. The well-known "Megger," "Bridgemegger," and "Ducter" testing sets are also exhibited.

The exhibit of the National Physical Laboratory is exceedingly interesting. Mention should be made of the Duddell Oscillograph, which was the actual instrument belonging to the late Mr. W. Duddell. The electrical exhibits of the National Physical Laboratory are not quite up to the same standard as those dealing with other sections of the Laboratory's activities, but on the whole they are worth inspecting as showing what the institution at Teddington is capable of.

The difficulty of obtaining electrodes for use in electric furnaces serves to give prominence to the exhibit of the Alby United Carbide Factories, Ltd., of Hebburn-on-Tyne, who are showing amorphous carbon electrodes from 12 in. to 20 in. in diameter by 6 ft. 6 in. long, with screwed recesses for jointing and avoiding the loss of stub ends. These are used in electric furnaces for the manufacture of electric steel and ferro-alloys.

The exhibit of Messrs. Duram, Ltd., is especially noteworthy. It occupies very little space, but presents a range of tungsten products which indicate sufficiently the scope for the industry in this country. Specimens of finely drawn tungsten wire and tungsten contacts are shown together with other finished and partly finished products of tungsten and molybdenum. The Edison Swan Electric Co., Ltd., of Ponders End, are also showing exhibits of tungsten and molybdenum, from the ore to the finished article, which include targets for "Pointolite" lamps and wire for electrodes.

A preparation manufactured by Mr. H. E. Davis, London, is shown for obscuring electric lamps and other glass. It does away with sand-blasting or treatment with acids. It is claimed that by placing lamps in a solution for twenty or thirty seconds and afterwards wiping them with a damp sponge, a frosting equal to sand-blasting can be obtained.

(To be continued.)

WAR ITEMS.

German Hopes of "Restoration" Orders.—The "Times" states that great efforts are now being made in Germany to revive interest in the economic plans of "Central Europe," and a great deal of advertisement is coming from a new "German Economic Council for Central Europe." The list of founders contains all the usual names—Ballin, Merton, Lanz, Bosch, &c. The programme, however, is interesting, because it is rather more definite than usual about the commercial penetration of subjugated countries. For example, it says:—

> The establishment of the new-formed States in the west and south of Russia, and the restoration of the territories devastated by war, will provide a mass of public orders in which German industry must be interested. German participation ought to be secured by treaty, so that America and the other Entente States shall not be able to compete, with the advantage of their cheaper raw materials or cheaper tonnage.

In other words, Germany proposes that the Eastern States and municipalities shall be forced to buy her goods at artificial prices, instead of buying in the cheapest market. It is argued that in this way Germany will be able to supply the Polish towns with drainage and with gas or electric lighting; and it is pointed out that conditions in the Ukraine, the Baltic Provinces, and Lithuania are still more primitive. Having laid these countries waste, the German building industry is to enjoy the monopoly in restoring them.

Trade Disputes in War Time.—The following are the terms of a new regulation which has been made under the Defence of the Realm Act:—

> "Where a difference has been referred under sub-section (2) of Section 1 of the Munitions of War Act, 1915, for settlement in accordance with the provisions of the First Schedule to that Act, and it appears to the Minister of Labour that an award cannot be obtained, and that, in consequence thereof, the production of any article essential to the successful prosecution of the war is hampered, the Minister may annul the reference and substitute therefor a reference to a single arbitrator appointed by himself. An award given by any such arbitrator shall be binding both on employers and employed, and may be made retrospective. If any employer or person employed thereafter acts in contravention of or fails to comply with the award, or if an employer declares, causes, or takes part in a lock-out within the meaning of the said Act, or a person employed takes part in a strike within the meaning of the said Act, in connection with the difference so referred to a single arbitrator, he shall be guilty of a summary offence against these regulations, but a person guilty of any such offence shall not be sentenced to imprisonment."

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An Appreciation from France.—A correspondent writes:—"I write to express my sincere gratitude for the continued receipt of the Electrical Review. My service in France will soon have totalled four years, and although I have been constantly employed on one branch of electrical engineering—telegraphy and telephony—other branches are of greater interest to me, and therefore the receipt of your journal, week by week, has prevented absolute staleness, and kept me in touch with the general progress of the industry. My case, I feel sure, is by no means an isolated one, and many others must have realised with me how adequately your journal has proved a substitute for further study and recapitulation, which have been impossible in the circumstances, and yet so essential to the young engineer just at the end of his training. Personally, I read it twice, finding in a superficial glance, when time presses, the pleasure of fiction; and in a close study, which leisure affords, the instruction of a text book."

Exports to China.—The "London Gazette" for August 20th contains additions to, and amendments in, the list of persons and bodies in China to whom exports may be consigned.

Exemption of men of the new Military Age.—The Ministry of National Service announces that instructions have been given that men of the new military age who come within the terms of the List of Certified Occupations, R. 136, are not for the present to be called up for medical examination, the necessary consequence of which is that they are not called for military service, and need not make any application to tribunals. The list of certified occupations is now being revised, but it is proposed that, in general, the same provision should also extend to men of the new military age who are within the terms of the revised list. The object of this provision is to enable the older men who are engaged in a certified occupation to continue in that occupation, and in these cases it is therefore unnecessary and undesirable for men to change their occupation. Every care is taken that such men shall not be sent medical examination notices, but owing to the doubt as to the precise occupations of many men as shown in the National Register, some notices may be issued to men who should not receive them. In these cases it is arranged that the notice will be cancelled provided the man returns it at once to the office of issue, and establishes his claim to be of the new military age and to be engaged in a certified occupation.

Exemption Applications.—At Exmouth, E. H. Gudgeon (grade 2), electrical engineer, stated in his appeal that he was engaged at times on work of national importance in electrical work at the Red Cross Hospital. He was exempted until the end of the year.

An electrical engineer (39, grade 2), who appealed at Swinton and Pendlebury, was granted three months' temporary exemption.

At Reading, on August 12th, an appeal was made by A. Herbert, (45, grade 2), electrical engineer. He was granted three months, with leave to appeal again.

On a review, conditional exemption held by T. D. Webb, electrician at Herts County Asylum, has been cancelled, and three months substituted.

Bucks Appeal Court has dismissed an appeal for F. J. Simmons (46, grade 2), electrician to Mr. H. Lewis, and he was recommended enlistment on army transport work.

Before the Northants Appeal Court, an appeal was made against final exemption granted by the Brixworth Tribunal to A. E. Seaton (39), electrician at Cottesbrook Hall, where there is a Voluntary Aid Detachment Hospital. He was given open exemption until September 1st.

At Bath, the Electric Tramways Co. defended a military appeal against F. Gillham (30, grade 2). It transpired that the Board of Trade had sent instructions to suspend the calling up of tramway employés, and application for review of current exemptions, until further instructions were received, and the application was withdrawn.

At Oldham, a platelayer (48, grade 1), appealed for by the Corporation Tramway Department, was given exemption until December 31st.

Warwick Rural Tribunal has granted exemption on his enrolling as a National Service Volunteer, to E. C. Cotton (47, grade 1), electrician at the Siddeley-Deasey Works.

At Ashford, Kent, L. Burch (50, grade 2), electrician, of High Street, was granted six months' exemption, and excused volunteer service.

At Rochdale, on the recommendation of the Advisory Committee, exemption until November 30th has been granted to A. Clegg (42, grade 3), driller, appealed for by the Corporation Tramways Committee, and to C. Collinge (39, grade 1), stated to be indispensable in connection with repairs to the tramway track.

At Reigate, with the assent of the National Service representative, six months' exemption has been granted to C. Parsons (46, grade 2), foreman electrician with Messrs. Tamplin & Makovski, electrical engineers.

High Wycombe Rural Tribunal has given six months' exemption to F. Wooton (45, grade 2), electrical engineer, of Little Marlow.

LEGAL.

Poyzer *v.* Priestman Collieries, Ltd.

At Newcastle County Court, H. Poyzer, Blaydon, stoneman, applied for compensation for the loss of his son, who was killed at the colliery by an electric shock. Plaintiff said that deceased and another lad were waiting, according to order, at a place where there was stretched across a pipe which everybody in the pit thought carried water to the stables. There was no notice to indicate that it was an electric appliance. The lads had their hands on the pipe when it came away. Poyzer was killed outright by electric shock, and the other lad was seriously injured. Mr. Meynell (for the respondents) said the lads had nothing whatever to do in the place. Their duty when they came from the bottom of the shaft was to go on the inclines to relieve the boys there.

His Honour came to the conclusion that there was no order for the boys to wait in this place; that they were not in the place in the course of their employment; and that the accident did not arise out of or in the course of their employment. There would be an award for the respondents.

Damages Award Against the L.C.C.

At Lambeth County Court, on August 15th, C. H. Martin, employed at the G.P.O. on the outside telegraph staff, was awarded £48 damages, with costs, against the L.C.C. Plaintiff was travelling on a top seat of a tramcar when the car collided with another one, throwing him forward against the seat in front and fracturing two of his ribs.—*Evening Standard.*

BUSINESS NOTES.

Catalogues and Lists.—Messrs. Wagner & Co., Saint Etienne (Loire). (H. Sloog, London).—Descriptive catalogue of portable electric drills of various sizes for D.C. and A.C., with illustrations, tables of dimensions, spare parts, &c. Universal motors for D.C. or single-phase A.C. are included, as well as tapping devices and various accessory apparatus.

Higgs Bros., Dynamo Works, Summer Hill Street, Birmingham.—Stock list of shunt-wound motors, 0·17 to 28 H.P.

The British Thomson-Houston Co., Ltd., Rugby.—Descriptive list No. 4,110, dealing with lever switches for main circuit, field, starting, and isolating switches, with descriptions of special features of each switch for ratings ranging from 250 volts, 100 amperes, to 650 volts, 10,000 amperes, and 11,000 volts, 1,200 amperes.

National X-Ray Reflector Co., 235, W. Jackson Blvd., Chicago, Ill.—Leaflets relating to industrial, show-case, and flood lighting.

Book Notices.—"Free Trade or Free Production?" By J. S. Hecht. Pp. 20. London: P. S. King & Son, Ltd. Price 6d. net.

"Science Abstracts." Vol. XXI. Part VII. July 31st, 1918. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"A Scheme for the Syndication of the Brass Industry." By H. F. Smith. Second Edition. Birmingham: Smith & Davis, Ltd. Gratis.

"Coal Saving by the Scientific Control of Steam Boiler Plants." By D. Brownlie, B.Sc. London: *Engineering.*

Holidays.—The works and offices of Messrs. E. Brook, Ltd., Empress Works, Huddersfield, will be closed on Thursday night, August 29th, until Monday morning, September 9th.

Messrs. Pooley & Austin state that, owing to staff holidays, only most urgent correspondence is being dealt with between August 17th and 31st.

The works and offices of Messrs. Fleming, Birkby & Goodall, Ltd., Woodfield Mills, Liversedge, Yorks., will be closed from Saturday, August 31st, to Saturday, September 7th, inclusive, for the annual holiday.

Non-Ferrous Metal Industry Act.—Further lists of companies, firms, and individuals licensed under this Act are given in the *London Gazette* for August 20th.

Meeting of Creditors.—At Manchester, on August 14th, the adjourned meeting was held of the creditors of W. T. Smith, electrical engineer and inventor, of Bolton, whose liabilities were put down at £3,005 and assets at £128. The proposal was to pay unsecured creditors a composition of 5s. in the £ in full discharge of debt, this sum to be placed in shares of a limited company to be formed. The Official Receiver said there had been little response from the creditors to the proposal. The debtor was asked if other patents were producing money now, and he replied, "Yes, so far as we can get supplies from the machinists. We are short of materials, and many orders are waiting completion." The debtor added that he was two years ahead of the War Office. He had been unable to get them to look at his patent, but was now getting at them through a large firm. The Official Receiver suggested that the debtor canvass the creditors to accept his proposal, though it would have been better had he offered 5s. in the £ in kind rather than in shares. The meeting was adjourned to November 13th.

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Malay Rubber.—According to the *Times* correspondent at Singapore, the rubber position is creating extreme anxiety throughout Malaya in consequence of the virtual stoppage of shipments to America. Several estates have already stopped tapping and are discharging labour, but Indian and Chinese labourers cannot be repatriated owing to shortage of shipping.

Italy.—The firm of Franco Tosi, of Legnano, which hitherto was one of the largest, if not the largest, private electrical concerns in Italy, has now been converted into a *società anonima*, with a capital of 64,000,000 lire. The board now comprises, besides the Tosi family, representatives of the Banca Commerciale, the Banca Italiana di Sconto, the Borletti group, the Credito Italiano, and the Ferriere Lombarde, which betokens the important *rôle* which the firm is destined to play in the future industrial life of the country. It is intended shortly to increase the capital to 80,000,000 lire, in order to absorb the Officine Insubri and the Società Elettrotecnica Galileo Ferraris. The two last-named firms were formerly the German concerns of Langen & Wolf and a branch of the A.E.G. respectively, and our contemporary *l'Elettrotecnica* opines that the old patrons of the German undertakings may eventually seek to disturb the pure Italian character of the new amalgamation.

The Società Ansaldo e Ca. has increased its capital from 100,000,000 to 500,000,000 lire. This company has become the largest engineering concern in Italy, with many and varied establishments, including electric machinery works started some 18 years ago. It has launched out into electric installations, and has already in the valley of the Aosta installations, concessions, and constructions to a total capacity of 200,000 H.P., for the working of electric steel works and the exploitation of mineral deposits.

The Società Anonima Forni Elettrici Stassano, in liquidation, Turin, closes its liquidation balance with a loss of 350,000 lire, which, after re-imbursing 15 lire per share, leaves available 35,987 lire, permitting the allotment of 7·92 lire to each of the 4,540 privileged shares.

Liquidations. — Asuncion Tramway, Light and Power Co., Ltd.—Winding-up voluntarily, with Mr. B. H. Bender, 80, Bishopsgate Street, E.C., as liquidator. A meeting of creditors was held on August 21st last. Particulars of claims to be sent to liquidator by September 17th.

Devonport and District Tramways Co.—Creditors must send the usual particulars to the liquidator, Mr. P. N. Gray, Manchester Hotel, Aldersgate Street, E.C., by August 27th.

Trade Announcement.—The business formerly known as F. A. Butler & Co., of Edinburgh Road, Walthamstow, will in future be known as the East London Mica Co., Ltd., Omega Works, Ringwood Road, Walthamstow, E. 17, where larger premises have been taken.

LIGHTING AND POWER NOTES.

Aldershot.—Electric Light Failure.—With reference to our note last week under the above heading, we understand that there was no such failure on the date mentioned.

Argentina.—Coal Substitute.—The *Review of the River Plate* states that during the recent strikes in Buenos Aires, when the German electricity supply company had great difficulty in maintaining a supply for want of fuel, the Compania Italo-Argentina de Electricidad placed no restrictions whatever upon consumers. This was possible owing to the use of fuel made up of 50 per cent. of petroleum and 50 per cent. of sawdust, bran, and pollards.

Ashton-under-Lyme.—Price Increase.—The Electricity Committee has increased the charges for electricity, from the June quarter, as follows:—D.C. power, to 50 per cent. over pre-war prices; private lighting, to 1d., plus 25 per cent. over pre-war rates; the cash discount is to be reduced to 2½ per cent., and energy supplied to the tramway department to be advanced to 1·7d. per unit net.

Australia.—Hydro-electric Scheme.—At a meeting of delegates of the North-Eastern Municipalities of Victoria, it was stated that the promoters were prepared to spend £1,000,000 on the development of the Kiewa hydro-electric scheme, which is to supply energy to the towns between Albury and Melbourne. The Minister of Water Supply said the Government was not opposed to the scheme, but was considering whether the scheme was to be a Government one or a private enterprise. A motion was carried recommending that a deputation should urge the Government to declare its attitude in regard to the application of the Victorian Hydro-Electric Co. for concessions to harness Kiewa river, or to go on with the scheme as a Government concession.

Victoria.—The Premier of Victoria has announced that the preliminary work in connection with the Morwell power-house scheme is to be undertaken at once. This is estimated to take two years, and it is not thought necessary to order the plant required until it is completed. The cost of the scheme is approximately £1,750,000.

Aylesbury.—Price Increase.—The T.C. has decided to further increase the price for energy by 20 per cent., and that the charges for the supply to the works of Mr. Jas. Putman be advanced from 30s. to £2 per KW., and from 1d. to 1½d. per unit.

Canada.—Water Power.—The International Waterways Commission is considering applications by private American interests for the development of the Long Sault Rapids power project, and by the New York and Ontario Power Co. for approval of its plans to reconstruct, repair, and improve its dam and water-power properties at Waddington, on the St. Lawrence River. Opposition to the applications is being filed by the Canadian Government, which contends that the companies' schemes would interfere with the economic development of the St. Lawrence as regards navigation and power potentialities, and by the Dominion Marine Association in the interests of safe navigation.—*The Times.*

Cardiganshire. — Hydro-Electric Scheme. — The Council has approved a proposal submitted by the Finance Committee with reference to a scheme for generating electricity from the resources of the rivers Rheidol, Ystwyth, Aeron, and Teify.

Colchester.—Loan Sanction.—The T.C. has received sanction to a loan of £5,188 for additional plant at the electricity works.

Continental.—Germany.—Before the war the A.E.G. put down at Bitterfeld, close to important lignite deposits, a large electric generating station, the capacity of which was to reach 140,000 H.P. The energy was to be transmitted to Berlin. When the war broke out the State purchased the energy and utilised it in large electrochemical works which were rapidly put down. It was stated that the A.E.G. sold electricity at the rate of 0·9 pf. (0·108d.) per KW.-hour; the statement was also made that power stations which utilised lignite could generate electricity as cheaply as the Swiss hydro-electric plants. It was found later, however, that for the concern to pay, energy should be sold at 1·5 pf. (0·18d.) per KW.-hour at the switchboard; and although the State works later increased the price they paid, the A.E.G. was the loser. Owing to the heavy outlay incurred by the construction of this generating station, the A.E.G. company was obliged last spring to increase its capital, and the directors stated at the general meeting that the hopes which had been placed upon a power station utilising lignite as fuel did not all come true, adding that the experience gained at Bitterfeld showed that for the electrochemical industry the required energy should be obtained from hydro-electric power stations. It appears that, notwithstanding the improved mechanical appliances used for extracting the lignite, a large amount of labour was necessary. The removal, first, of a layer of earth about 12 ft. in thickness appeared to be a particularly costly undertaking. The maintenance of the large boilers also leads to a heavy outlay. It is doubtful whether electricity can be obtained at a price below 1 pf. (0·12d.) per KW.-hour. Since the Bitterfeld plant sold to the State the greater part of the energy generated (a total of 300,000,000 KW.-hours last year) it was to be expected that the State would finally purchase the plant, and this has recently been done. The price of the station was about 28,000,000 marks, that of the land and lignite deposits 6,000,000 M., and that of the mining installations was also about 6,000,000 M. The State now works the station in the form of a company with share capital.

Bavaria.—Important establishments for the production of nitric acid from the air are to undergo considerable extension, in which some 200,000 H.P. of water-power will be used. A syndicate of bankers has been formed to carry out the scheme, involving a capital of 150 million marks.

Dewsbury.—Price Increase.—The Electricity Committee has decided that, from the end of September, the charges for electricity shall be increased by a further 10 per cent. for power and heating; 5 per cent. for lighting, and 5 per cent. for energy supplied on the rateable value system.

Dublin. — Hydro-Electric Scheme. — The Dublin and Lucan Electric Railway Co. is promoting a scheme for the generation of electricity by the utilisation of the Salmon Leap Fall, at Leixlip, on the River Liffey. It is proposed to increase the present fall of 17 ft. 2 in. to one of 40 ft., and it is estimated that 2,000 H.P. will be obtained for six months of the year, while the promoters are satisfied that the minimum horse-power that can be generated is 1,800 for 183 days, 900 for 90 days, and 450 for 92 days each year. It is estimated that the annual saving in coal consumption will amount to 16,464 tons. The scheme will cost £50,000, and includes the acquisition of the Salmon Leap Mill and the installation of one 1,000-B.H.P. turbo-generator and two of 500 B.H.P. each. Already inquiries for power aggregating 3,000 H.P. have been received, including demands for an immediate supply to aerodromes, woollen, flour, and paper mills, hospitals, &c., in the district. An arrangement has been agreed upon for the supply of power to the Dublin Corporation during the winter months, and by the Corporation to the Railway Co. during the summer months, when the water-power supply will be at its lowest; the charge proposed is 1d. per unit in each case. The scheme has the approval of the Dublin Corporation and Chamber of Commerce, the English and Irish Coal Controllers, and of Lord Decies, who is the owner of the water rights. It is suggested that the entire capital expenditure should be granted by the Government, which is already committed to the extent of £3,000 per annum towards the working of the railway during war time.

Exeter.—Year's Working.—There was a gross surplus of £9,182 on the working of the Corporation electricity department for the past year, the net surplus being £1,348, against £2,043 in the previous year.

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Glasgow.—Year's Working.—The annual report of the Corporation electricity undertaking for the year ending May 31st shows a gross revenue of £789,002, compared with £580,412 last year, and working expenses of £542,717, against £404,404, out of which was met interest on loans £92,454 and sinking fund £86,551, leaving a balance on the year's working of £67,280, against £16,940 last year. After various deductions there was a surplus on the year's operations of £7,146, against a deficit last year of £38,667, which has been transferred to the reserve fund. Allowances granted to employés on Active Service reached £10,843. The capital expenditure amounted to £297,834. The average price received from consumers was 1·207d. per unit, against 0·975d. for the previous year; working cost per unit was 0·748d., against 0·602d. The number of consumers was 35,724, an increase of 775; units sold were 154,472,277, an increase of 13,958,597 (lighting, 22,085,527 units; power and heating, 132,386,750 units). The total number of motors in use was 12,904 against 12,401, of a total H.P. of 105,739 against 97,733, and consuming 129,456,525 units against 117,547,855 units last year. The total maximum demand connected to the mains was 132,316 KW., an increase of 9,136 KW., and the maximum demand made upon the stations was 55,610 KW., an increase of 6,425 KW. on last year. During the year the following alterations and additions have been made:—At Port Dundas a third 8,000-H.P. turbo-alternator was put into commission, and a fourth 8,000-H.P. set by Dick, Kerr & Co. has been purchased, and is expected to be on load this year. Two old sets are being removed to make room, and the capacity of the station will then be 48,160 H.P. Underfeed stokers, with forced draught and a new steel chimney, with induced draught, have been fitted to four boilers. Two 1,000-KW. B.T.H. rotary-converters have been installed in the sub-station, the capacity of which is now 4,000 KW., and the erection of a 20,000-volt sub-station to form a connecting link between Port Dundas and Dalmarnock stations is being proceeded with. At Pollokshaws Road the 8,000-H.P. Willans turbo-alternator is now in regular service, the capacity of this station being 33,120 H.P. Two small generating sets have been removed to make room for two 1,500-KW. Bruce Peebles rotary-converters, and a 20,000-volt sub-station is being erected in this station, the switchgear of which is complete. The grate areas of the large boilers have been increased, and a new induced draught fan installed, and a new bucket conveyor has been installed to relieve the overloaded coal conveyor. A 1,000-KW. B.T.H. rotary-converter has been installed in, and a similar set has been ordered for, both the Govan and Partick stations; their capacities will then be 3,750 and 2,750 KW. respectively of converting plant. There is no change in the generating plant, and the steam plant at Partick was only run during the winter months. At Yorkhill a 500-KW. Bruce Peebles rotary-converter has been installed in place of a 250-KW. set removed to another sub-station. The transformer sub-stations on consumers' premises now number 42, being an increase of four, and a further 18 are in progress. Steady progress has been made with the building of the new Dalmarnock works, and orders have been placed for two additional 15,000-KW. turbo-alternators, making four in all. During the year ½ mile of L.T. feeders and 6¼ miles of H.T. feeders, in addition to 1½ miles of distributors, were laid on the north side of the river, and 2 miles of L.T. feeders and 6¼ miles of H.T. feeders, in addition to 1 mile of distributors, were laid on the south side of the river.

Harrogate.—National Electricity Supply.—The T.C. has protested against the Government proposals to take over electricity generating stations, and has decided to oppose any Bill introduced for this purpose.

King's Lynn.—Year's Working.—The Electricity Committee has reported that the total revenue of the undertaking for the year ended March 31st last was £12,227, against £8,759 in the previous year. The gross profit was £4,820, against £3,032, and, after payment of interest and instalments on loans, the net profit was £2,146, against £290. This is the best year the undertaking has had. The expenditure on capital account was £1,127, bringing the total to £59,483. The balance standing to the credit of the net revenue account was £2,639, of which £1,035 was used to pay off outstanding liabilities on capital account, and £1,604 carried forward to next year's accounts.

Price Increase.—The Committee recommended that the price of energy for lighting and power purposes be increased by ½d. per unit, and this was referred back for consideration as to whether there should be any differentiation between lighting and power.

Linthwaite.—Proposed E.L.—At a meeting, last week, the Council declined to pass the account of the local gas company, which was held to be excessive, and it was suggested that Colne Valley was behind the times in not having an electric lighting system. The question of installing electric light is to be considered at the next meeting of the Council.

Nenagh (Co. Tipperary).—Proposed E.L.—The Gas Consumers' Co. has decided to install an electric lighting plant.

New Zealand.—Hydro-Electric Scheme.—A deputation of the local Industrial Association has approached the Auckland City Council on the question of the advantages of a hydro-electric scheme. The deputation pointed out that it would be in the interests of the Council and the industrial development of the city to take its supply of electricity from the Government, and use the existing plant as a reserve.

Sheffield.—Mains Extensions.—The Corporation has decided to lay an E.H.T. cable between Neepsend power station and Renton Street sub-station, a distance of 5,340 yards, at an estimated cost of £10,584. Land and buildings opposite Lambert Street are to be taken over as a site for a sub-station.

Subject to the approval of the Finance Consultative Committee, the Corporation has sanctioned the expenditure of £700,000 for the purchase of turbo-alternators, boilers, &c., for the electricity department.

Stoke-on-Trent.—Loan Sanction.—The necessary consent has been received to the borrowing of £7,340 for laying an L.T., D.C. feeder from Bagnall Street sub-station to Holtshill.

Tonbridge.—Price Increase.—The U.D.C. has decided to increase the charges for electricity by which the revenue from the general supply will be increased by £390, and for large consumers by £610.

Warrington.—Price Increase.—The E.L. Committee has increased the charges for electricity by 5 per cent. for lighting and by 10 per cent. for power (other than for tramway purposes) from September 30th next.

TRAMWAY AND RAILWAY NOTES.

Aberdeen.—Year's Working.—The annual report of the Corporation tramway undertaking states that the revenue for the year ending May 31st, 1918, was £116,397, or £16,324 more than in the previous year, while the expenditure amounted to £76,997, an increase of £12,971. Capital charges accounted for £27,188, and £8,141 was added to the reserve fund, leaving a net profit of £4,070. The car-miles run numbered 2,172,792, an increase of 307,220. The average price paid for energy, which increased by 32 per cent. from February 12th, was ·917d. per unit, against ·839d., and the energy consumption per car-mile was 1·312 units, against 1·251.

Ashton-under-Lyme.—Extensions.—In view of the purchase of the undertaking of the Oldham, Ashton, and Hyde Electric Tramways Co., the Corporation has completed arrangements for large extensions to its existing car shed, and has purchased land for further extensions.

Burnley.—Threatened Strike.—Owing to the dismissal of several employés of the tramways department, the remainder handed in their notices last week. The notices have now been withdrawn, and a meeting of the Tramways Committee and the men's Unions has been arranged to discuss the matter.

Canada.—Strike.—The employés of the Ottawa tramways struck work last week for an increase of wages; an offer by the company to put the matter before the Federal Labour Board was refused.

Chile.—Proposed Electric Railway.—The Ministry of the Interior has postponed the construction of an electric railway between Vina del Mar and Concon until one year after the end of the war, and between Vina del Mar and the River Aconcagua until two years after the end of the war.—*B. of T. Journal.*

Continental.—Swiss Electrification Scheme.—The general management of the Swiss Federal Railways has submitted to the Council of Administration a scheme providing for the introduction of electric traction. It is proposed that the programme shall be completed in 30 years, in three sections, at a total cost of from 3,000,000,000 to 4,000,0000,000 fr. Three-quarters of the electric power is already assured, whilst the remainder will be provided by future concessions.—*Financier.*

Germany.—An extensive network of electric railways is planned for the industrial district of Merseburg, where recently very important industries have been established, including a large factory for ammonia for use in making artificial nitrates. The length of the railway lines is to be 68 kilometres, and the cost of construction is estimated at 10,000,000 marks. A new company will be established with a capital of 2,500,000 marks, of which the A.E.G. subscribes 1,000,000 marks, leaving it principally to the municipalities interested to raise the remainder.

France.—It is reported that an aeroplane alighting in Marseilles owing to engine trouble, struck the tramway trolley wires, resulting in two cars which were approaching being set on fire. Four passengers were killed and several injured, while the two aviators were seriously burned.—*Pall Mall Gazette.*

Electric Vehicle Progress.—Burnley Electricity Committee is considering the purchase of an electric vehicle.

Glasgow Corporation Cleansing Committee recommends that for the collection of refuse four additional electric vehicles be purchased, at a cost of £5,200.

Maidstone T.C. has received sanction to purchase a 3½-ton electric tipping wagon, at a cost of £1,200.

Huddersfield.—Service Reduction.—A recommendation of the Tramways Committee for the reduction of the tramway services every day was defeated by one of the General Purposes Committee for the total stoppage of the cars on Sundays. This is subject to confirmation by the Council.

London.—Collision.—An L.C.C. tramcar and a steam lorrey collided at Stockwell, on Friday morning last week, considerably damaging the front of the car. The driver, a discharged soldier, was rendered unconscious, and four passengers had to be conveyed to hospital.

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Strike.—A strike of tramway and 'bus conductresses on Saturday brought nearly all the omnibus services and a large part of the tramway services to a stop. Conferences were held to deal with the points at issue—the claim of the women workers to equal pay and bonuses with the men for equal work. Most of the L.C.C. conductresses are members of a Union, which asked its members to remain at work pending the result of the conferences. The strike began on the L.U.T. system in support of a demand for the 5s. bonus recently awarded to the men workers by the Committee on Production, and the Provincial Union of Licensed Vehicle Workers approved the action, and called on all its members to cease work. In consequence, the strike extended to all the omnibus and tramway systems, excepting the L.C.C. and the M.E.T., which were kept running; a number of their conductresses who are members of the Union ceased work, however. The London United, Croydon Corporation, and the South Metropolitan services were entirely suspended. At a mass meeting of the strikers the action of the Vehicle Workers' Union was approved, and it was resolved to call out the members of the Union throughout the provinces on Monday morning. The meeting pledged the members not to return to work until the women's demands were satisfied and the strikers reinstated. It was stated that the majority of the L.C.C. employés were not prepared to strike. The Amalgamated Association of Tramway and Vehicle Workers' Union posted notices in the depôts on Sunday telling its members, in their own interests, not to cease work pending the conference which the representatives of the employers and workers were to have with Sir George Askwith on Monday. A conference of the Unions took place on Wednesday under the auspices of the Transport Workers' Federation. As a result of the strike, there was much overcrowding on the Underground Railways.

The 5s. is equivalent to the 12½ per cent. grant made to the men. It was not extended to the women, and in no trade in the country have the women received this 12½ per cent. grant. If the 'bus and tramway girls succeed in getting this 12½ per cent. equivalent, it will be the thin edge of the wedge for women in all trades all over the country, and will cost the Government millions of pounds. The assistant secretary of the Transport Workers' Federation stated that the average wage for a 'bus driver was £4 per week, and therefore 12½ per cent. would be 10s. The Committee on Production awarded the men 5s., and if it gave the women the 5s. for which they asked, that would then make the total award equivalent to 12½ per cent.; the men would be satisfied if the women got the 5s. balance on the 10s., and a settlement would be reached.

The trouble spread to the provinces, and on Monday the services at Hastings, Hove, Worthing, Brighton, Bath, Bristol, Folkestone, and Weston-super-Mare were disorganised. During the day meetings took place between Sir Geo. Askwith, the employers, and the Union officials, but no settlement was arrived at.

A number of women platform attendants on the Bakerloo Railway struck work on Monday in sympathy with the tramway workers. Apparently the girls have a grievance of their own; after a short meeting it was declared that they were getting 12s. 6d. per week less than the men, although working the same hours.

Manchester.—Railway Accident.—A heavily laden electric passenger train, instead of slowing down, so it is alleged, accelerated its speed as it entered Victoria Station, and crashed into the hydraulic buffers. Twenty-nine persons were injured.

Monte Video.—Strike.—The strike of the tramway employés continues, although men in other industries have resumed work. Last week the police discovered a plot to assassinate the manager of the tramway company; police and troops were bivouacked in the streets to preserve order.

New Zealand.—Electric Vehicles.—It is stated that electric vehicles garaged by the Christchurch City Council have their electrical equipment kept in repair and batteries charged for £35 per annum. In one factory, where 49 H.P. is used, the average monthly cost is from £8 10s. to £8 15s., against £32 per month for steam for 58 H.P.

Rochdale.—Fare Revision.—In place of a general advance of fares, the Tramways Committee proposes to institute a war tax on fares, and has applied to the B. of T. for permission. The proposed tax is as follows:—½d. on 1d., 1½d., and 2d. tickets, 1d. on 2½d., 3d., and 3½d. tickets, and 2d. on 5d. and 6d. tickets.

Sheffield.—Electric Tower Wagon.—The Tramways Department is to purchase an electric vehicle chassis for use as a tower wagon.

Linking-up.—The linking-up of Sheffield and Chesterfield—12 miles—by tramway is being arranged, the Sheffield Corporation having entered into an agreement with the Chesterfield R.D.C. to construct a tramway to Dronfield.

Southport.—Extension of Time.—The B. of T. has extended the time for the completion of the electrical equipment and apparatus for the working of trolley vehicles, on the route authorised, for one year from August, 1918.

Saving Tramway Power.—According to the *Electric Railway Journal* the Connecticut Co. has tackled the problem of the education of its employés, to the number of 2,500 drivers and conductors, running 1,100 passenger cars, resulting in an 11 per cent. reduction of power in five months; in a demonstration it was shown that an ideally-operated car absorbed from 25 to 32·5 per cent. less energy than one operated on the same route by the average motorman's method. Economy in fuel may be made in many ways by the application of a little intelligence and very little sacrifice in convenience. For example, notices in the cars call for the warning to the driver to stop to be given in good time, to enable him to coast along to a stop with the final minimum application of brakes, rather than by a sudden stop, with consequent wear on brake-shoes and wheels and loss of the stored momentum in the moving car. The saving of a few seconds at each stop would, within the time allowed for the journey, permit of more coasting in stopping, with the resultant saving of energy. Again, a maximum of energy is required to start up a car, the energy thus used being estimated to be equal to that required to run a quarter of a mile on the level. Economy in many directions can be effected. To realise this, both driver and conductor need to be impressed with the importance of the saving which can thus be made.

Tramway Undertakings and Coal Rationing.—A conference of tramway undertakings and electrical engineers was held at Manchester last week, when discussion took place on the question of tramway economy, as relating to the order requiring tramway authorities to reduce their consumption of electricity by 25 per cent. The opinion was expressed by those present that whilst they were anxious to help the B. of T. in every way and to conserve fuel, they thought it was unfair that the tramway authorities should be singled out for the rationing of coal. It was suggested that whatever action might be taken, nothing should be done until there was a general rationing in all industries.

Yarmouth.—Strike.—After lasting three days the strike of the tramway employés came to an end on Monday, work being resumed on the Corporation conceding an advance in wages of 7s. per week, making 20s. increase on pre-war rates.

TELEGRAPH AND TELEPHONE NOTES.

American Marconi Decision.—Under a legal decision in the New Jersey Courts, the Marconi Wireless Telegraph Co. of America is held liable for royalties to the International Signal Co. in respect of certain transactions. The amount was not in dispute, but merely the obligation to pay it. The sum, however, is considerable, approximating £600,000.—*Financial Times.*

Australia.—At Melbourne City Court, on June 14th, Sydney Paul Morris, formerly employed as wireless operator by the Defence Department, was charged with having been found in possession of an official wireless telegraph manual and other confidential documents. After evidence had been given, the accused was committed for trial before the Supreme Court in July.

At the Malvern Police Court J. W. T. Rowe was fined 40s., and £4 6s. 6d. costs, for having in his possession instruments connected with the sending or receiving of messages by wireless telegraphy.—*Melbourne Age.*

Hungary.—Telegraph and telephone communication between Budapest and Northern Hungary has been interrupted as the result of the explosion of a petroleum train at the station of Erlau, in Hungary.

New Zealand.—Sir Joseph Ward, the Postmaster-General, referring to the future development of the telephone system in New Zealand, has indicated that as soon as possible after the war there will be a development of the automatic system which will practically mean the elimination of the exchanges in some of the more important districts, and enable continuous service to be carried on independently of operators. When the price of copper wire permits they will have a telephone service which will connect every town in the North Island with every town in the South Island.—*Sydney Sun.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—September 4th. Victorian Railway Commissioners. 800 lighting transformers for signal system. A copy of the specification may be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence) in London.

Manchester.—September 13th. Corporation Electricity Committee. 3½-ton electric tipping wagon. See "Official Notices" to-day.

Spain.—The municipal authorities of Villarramiel (Province of Valencia) recently invited tenders for the concession for the electric lighting of the town during a period of four years.

CLOSED.

Australia.—Melbourne.—Electricity Committee recommended:—

1,600 500-watt, gas filled metal filament lamps	£1,200
400 800-watt, ditto	275
2,500 50-c.p., 230 volts, ditto	219
7,500 ditto, 200 volts, ditto	612
500 100-c.p., gas filled, ditto	137

Australian General Electric Co.

P.M.G.'s Department, N.S.W.:—

3 10-H.P. motors, 480 volts D.C., £264.—T. M. Goodall & Co., Ltd.

—*Tenders.*

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Cape Town.—City Council. Messrs. E. A. Shaw & Co. Extension of the electric lighting at the City Council, £276.

Colchester.—T.C. Engines and dynamos. Davey, Paxman and Co., Ltd., and Crompton & Co., Ltd.

Government Contracts.—Placed July, 1918 :—

War Office.

X-ray apparatus.—Johnson & Sons.
Electric cables.—General Electric Co., Ltd.; Western Electric Co., Ltd.
Dynamos, &c.—Tilling, Stevens, Ltd.
Fans, &c.—Davidson & Co., Ltd.; J. Keith, Blackman & Co., Ltd.; Sturtevant Engineering Co., Ltd.
Generating sets.—Belliss & Morcom, Ltd.; H. T. Boothroyd, Ltd.; Browett, Lindley & Co., Ltd.; Buffalo Forge Co., Ltd.; Equipment and Engineering Co., Ltd.; General Electric Co., Ltd.; H. Green & Co.; R. A. Lister & Co., Ltd.; Siemens Bros. Dynamo Works, Ltd.
Motors, &c.—Maudsley's, Ltd.
Transformers.—Foster Engineering Co., Ltd.
Works services: Electrical.—Dargue, Griffiths & Co., Ltd.; Northern Electrical Ventilating Co., Ltd.
Iron wire, &c.—R. Johnson & Nephew, Ltd.; J. Pring & Sons; Rylands Bros., Ltd.; Whitecross Co., Ltd.

H.M. Office of Works.

Engineering works.—National Physical Laboratory, Teddington.—High-tension switch panels, Ferguson, Pailin & Co., Ltd.; ditto, electric supply cables, Siemens Bros. & Co., Ltd.

Post Office.

Protective apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.
Arm bolts.—Bayliss, Jones & Bayliss, Ltd.; Bullers, Ltd.; C. Richards and Sons, Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Telegraphic and telephonic cable.—W. T. Henley's Telegraph Works Co., Ltd.; New Gutta-Percha Co., Ltd.; Siemens Bros. & Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Telephone cords.—British Insulated & Helsby Cables, Ltd.; London Electric Wire Co. and Smiths, Ltd.; Peel-Conner Telephone Works, Ltd.; Phœnix Telephone and Electric Works, Ltd.
Ducts.—Albion Clay Co., Ltd.
Telephone earpieces.—Siemens Bros. & Co., Ltd.
Cable distribution plugs.—British Insulated & Helsby Cables, Ltd.
Telephone plugs.—British L. M. Ericsson Manufacturing Co., Ltd.
Insulator spindles.—Bayliss, Jones & Bayliss, Ltd.; Bullers, Ltd.
Stay swivels.—Bullers, Ltd.
Telephones.—Peel-Conner Telephone Works, Ltd.
Voltoids.—Brunner, Mond & Co., Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., incorporated in the London Electric Wire Co. and Smiths, Ltd.
Bronze insulated wire.—Siemens Bros. & Co., Ltd.
Copper wire.—T. Bolton & Sons, Ltd.; British Insulated & Helsby Cables, Ltd.
V.I.R. wire.—Johnson & Phillips, Ltd.

India Office (Stores Department).

Crucibles.—Morgan Crucible Co.
Telephone sets.—Peel-Conner Telephone Works.
Wire.—Callender's Cable Co., Ltd.; Shropshire Iron Co.; R. Johnson and Nephew, Ltd.

NOTES.

Mineral Output of the United Kingdom in 1917.—Part I of the annual general Report on Mines and Quarries has now been issued for the year 1917. In a preliminary report previously issued details were given as to the mineral output from mines under the Coal Mines and Metalliferous Mines Acts. The present issue includes also that from quarries. The following table shows some of the outputs :—

Mineral.	Total, 1917, in tons.	Inc. or dec. in tons.
Coal	248,499,240	+ 7,876,126
Copper ore and precipitate	1,159·5	+ 131·5
Iron ore	14,845,734	+ 1,351,076
Iron pyrites	8,515	— 1,966
Lead ore	15,322	— 1,785
Lignite	900	+ 400
Manganese ore	9,942	+ 4,802
Oil shale	3,111,658	+ 102,426
Tin ore (dressed)... ...	6,576	— 1,316
Tungsten ores	241	— 153
Uranium ores	13	— 38
Zinc ores	7,484	— 992

Coal Conservation Committee's Report.—The Ministry of Reconstruction has just issued the final Report (Cd. 9,081) of the Coal Conservation Committee, which was appointed to consider and advise as to the improvements which could be effected (1) in the mining of coal, (2) in the using of coal, and (3) in the extension of coal supplies. Five Sub-Section Committees were appointed to deal with different phases of these questions—namely, with mining methods, power generation and transmission, metallurgy, carbonisation, and geology. At a later date the Sub-Committees on Carbonisation and Metallurgy were amalgamated. The Reports of these various Sub-Committees have been approved and adopted by the main Committee, and they are now published along with the final Report in the form of appendices. The Report of the Power Generation and Transmission Committee was published separately early this year, and its recommendation of a national scheme of electrical generation and transmission has attracted wide attention. This Report is reproduced in the final Report, which forms a comprehensive survey of the place of coal in the industries of the future. Considerable attention has been given to the part which the carbonisation of coal is calculated to play in reconstruction, and all known methods of preparation and treatment have received full examination. Steps are suggested not only for making more efficient use of those grades of coal at present burned in a raw state, but also for putting to valuable use inferior coal, shale, and coal dust, now regarded as waste. Another matter of which the Committee emphasises the importance is the necessity of obtaining fuel oils, motor spirit, and the raw materials for explosives, drugs, and dyes. It is considered practically certain that larger supplies can be obtained from coal by the new methods of working which are proposed. The Committee recommends the combined working in groups or units of coke ovens, blast furnaces, steel furnaces, and rolling mills, each unit to have a capacity of from 300,000 to 500,000 tons of finished steel per annum. One of the conditions of success will be the grouping of these united plants in suitable districts. A definite conclusion has been reached regarding the production of electric power on a large scale, and it is felt that there is also a definite field for the use of gas engines of the ordinary type. Research work is in progress with a view to forwarding the design and production of internal-combustion engines. The necessity of replacing old with modern plant, especially in the smaller colliery undertakings, is pointed out as a further means of economising in fuel. The establishment of a Ministry of Mines and Minerals is recommended. It is proposed that, with certain exceptions, those functions connected with the coal-mining industry now vested in various Government Departments shall either at once or after the war be transferred to a Ministry presided over by a Minister with a seat in Parliament. It appears that no fewer than seven Government Departments are now intimately concerned with mines and minerals. It is pointed out that considerable possibilities in connection with the location of new coalfields and the extension of those already being worked lie within the scope of the geological survey now being made. It is possible, the Report shows, that a large increase in our mineral wealth might be found were systematic exploration carried out by this body.

Prohibited French Exports.—Since the commencement of the war, various Orders have been issued by the French Government imposing prohibition on the exportation from the country of certain materials. The *Board of Trade Journal* has just rendered a useful service by publishing a complete list of the Prohibition Orders at present in force in France, from which we have compiled the following list of goods and materials appertaining to the electrical industry : -Electrical apparatus, materials and parts adapted for use in war; dynamo-electric machines; magnetos; accumulators and accumulator plates; electric batteries and their elements; telegraphic apparatus—land, submarine, and wireless; carbons and other electrodes for electrical purposes; carbon brushes for dynamos; cables and insulated wire for electrical purposes; insulating materials other than rubber; electrical insulating compositions and products; ebonite; and vulcanised fibre.

Industrial Reconstruction Council.—In its report for the six months ended June, the Council says that since the date of the last report great progress has been made with the movement towards self-government for industry. There is general recognition on all hands of the need for organisation. Trade Associations are experiencing a great accession of membership, and workers are flocking into their Trade Unions. This strengthening of Associations and Unions is almost entirely due to the belief that joint bodies will be formed. There is no trade that is not discussing, if only in a preliminary or unofficial way, its relation to the Whitley Report, and hardly any trade that has not accepted its underlying principles. The work of the Ministry of Labour in promoting Joint Standing Industrial Councils, and of the Ministry of Reconstruction in connection with Industrial Reconstruction Committees, appears to be reaching out over the whole range of industries, and the prospects of the early establishment of a general joint advisory system for Government purposes seem to be extremely bright. The Council regrets a tendency among employers in certain quarters to restrict the function of joint bodies to what are known as "Labour questions." It holds that if discussions are confined to "Labour questions" the main object of the Joint Industrial Councils will be sacrificed. We agree with the Council that there is still a great deal of work to be done in the education of the public as to the true needs of industry and the real functions of Industrial Councils.

The Council has arranged for a series of conferences and discussions to be held at 6 p.m. on alternate Tuesdays in September, October, November, and December, in the Hall of the Institute of Journalists, 2-4, Tudor Street, E.C., 4 :—

September 10th.—"Works Committees," Mr. Robert Wilson (Ministry of Labour).
September 24th.—"Trade Boards," Mr. J. J. Mallon.
October 8th.—"Interim Industrial Reconstruction Committees," Mr. W. Henderson Pringle (Ministry of Reconstruction).
October 22nd.—"The Place of Conciliation and Arbitration in the Whitley Scheme," Mr. E. H. C. Wethered.
November 5th.—"Women in Industry," Miss Lilian Dawson (Fabian Society, Women's Group).
November 19th.—"The Trade Union of the Future," Mr. George A. Isaacs (National Society Operative Printers and Assistants).
December 3rd.—"Functions of Industrial Councils," Mr. E. McGegan (Ministry of Labour).
December 17th.—"Restriction of Output," Mr. Wilfrid Hill.

Sydney Electrical Trade Unionists and the Labour Union.—An Australian newspaper states that in June the Executive of the Electrical Trades Union recommended the withdrawal of that Union's affiliation from the Sydney Labour Council, as the latter was no longer a true reflex of the opinions of the Trade Union movement. The extreme elements which had obtained control were considered to be pursuing a policy inimical to the best interests of Labour. Certain delegates had adopted revolutionary policies which, if submitted to a referendum of their Unions, would not secure a 20 per cent. vote of the most militant bodies.

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Fatalities.—At the resumed inquest in Dublin in regard to the death of Dennis White, an electrician, while working in a city munition factory, the jury found that death was caused by fracture of the skull resulting from an accidental fall, and expressed the opinion that there had been negligence on the part of the factory authorities.

Mr. M. H. Harris, permanent electrician, said instructions had been given that unauthorised persons were not to interfere with the switchboard, and temporary electricians (under which heading deceased came) were unauthorised persons. It was much safer, he added, to walk on the girders than to use a ladder. No instructions had been issued against entering the switchroom. Mr. W. Hesketh, engineer and manager of the factory, said there were plenty of facilities for erecting ladders, and he never encouraged men to walk along the girders. Mr. A. E. Porte, consulting electrical engineer, said that from his examination of the wire he was of opinion that had deceased taken the natural precaution of seeing that the main switch was open, the wiring on which he was working would have been dead and quite safe to handle. He admitted that the switches in the time office were on the wrong pole, and that Regulation 9 of the Home Office List was not complied with at the time of his visit. Under Regulation 28 a second person should be in attendance within reach.

Through touching an iron fence, on which was carried an electric cable which had become defective, Bombardier W. J. Ricketts, R.G.A., has been killed. At the inquest a verdict of "Accidental death" was returned. A doctor found only a small burn on Ricketts's hand.

An inquest was held, on Friday, on the body of Thomas Priest (36), fitter, Wednesbury, an employé of the South Staffordshire Tramways (Lessee) Co. A wire broke over the top of the live trolley; and as the company's regular wireman was on holiday, Priest, an experienced workman, was called out to attend to it. Priest mounted the covering of the top deck of the car, and endeavoured to cut the broken wire away; failing, he tried to snap it. The handle of the cutters apparently came in contact with the live wire, and Priest received a shock. Mr. G. A. Woolley, the company's resident engineer, stated that the tower wagon should be used for all repairs. Priest would have been quite safe had he gone to the nearest section box and cut off the current. A verdict of "Accidental death" was returned.

Foreign Trade.—The July Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

	July, 1918.	*Inc. or dec.*	*7 months*, 1918. *Inc. or dec.*
Imports.			
Electrical goods ...	£116,873	+ 16,905	— 177,337
Machinery	850,391	+195,449	+ 1,776,856
Exports.			
Electrical goods ...	161,003	— 85,929	— 658,349
Machinery	1,436,688	—476,398	— 2,437,424

Institution and Lecture Notes.—Electrical Power Engineers' Association.—On Thursday, the 15th inst., the London Western Section was inaugurated at Hammersmith. The chair was taken by Mr. G. C. Law, publicity secretary, and 19 undertakings were represented, the attendance including over 50 staff engineers. The chairman briefly outlined the history of the E.P.E.A., the advantages of its constitution, and the recognition by the Institution of Electrical Engineers and similar authorities of the E.P.E.A. as *the* protective Association for Staff Engineers of the electrical supply industry. The phenomenal growth of the E.P.E.A. had necessitated a measure of decentralisation, so as to secure the democratic control of the affairs of the Association. All non-members present agreed to become members of the Section. A strong Section Committee was elected, and meetings will be held on the first Thursday in each month. All staff engineers (lighting, power, and traction undertakings) engaged or residing in the area 5 miles west, north, and south, and 1 mile east of Hammersmith, who wish to become members should communicate with the Section Hon. Secretary, Mr. W. J. Wilcocks, 8, Willow Avenue, Barnes, S.W. 18.

Iron and Steel Institute.—The autumn meeting will be held at the Institution of Civil Engineers, Great George Street, Westminster, on Thursday and Friday, September 12th and 13th, commencing at 10.30 a.m. on the 12th and at 10 a.m. on the 13th.

Amongst the papers to be read are the following:—

E. D. Campbell: "The Rate of Change at 100° C. and at Ordinary Temperatures in the Electrical Resistance of Hardened Steel."
D. Hanson and J. E. Hurst: "Case-Hardening Practice."
K. Honda: "On Magnetic Analysis as a Means of Studying the Structure of Iron Alloys."
Cosmo Johns: "Standardisation of Tests for Refractory Materials."
T. B. Mackenzie: "The Utilisation of Waste Heat from Open-Hearth Furnaces for the Generation of Steam."

A Limerick Wages Dispute.—In an award by Sir Plunket Barton, Dublin, in a wages dispute between Limerick coal merchants and dock labourers, the tonnage rate for the working of an electric crane at the docks was fixed at 1s. 3d. The demand was for 1s. 6d. and 9d. had been offered.

To Increase Coal Output.—We understand that the Government has decided on the immediate appointment of a practical coal expert, whose task it will be to devote all his energies to increasing the coal output of the country. This action is an indication of the gravity with which the Prime Minister regards the coal situation in relation to this country and its Allies. —*The Times.*

The A.S.E. and Working Hours.—The *Times* state that the A.S.E. has asked the Engineering Employers' Federation for a special conference to discuss the question of shorter working hours without a reduction of wages.

Electrical Engineer Fined.—At the Mansion House, Alderman Sir J. Knill imposed a fine of £100, with £21 costs, on each of three summonses against David Assersohn, electrical engineer, St. Bride Street, E.C., for having, between November 30th, 1917, and May 16th, 1918, committed certain acts in connection with a gravity petrol tank likely to render it ineffective, and calculated to deceive persons in the employ of the Ministry of Munitions as to its quality as war material.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Corps Orders No. 35, by Lieut.-Colonel C. B. Clay, V.D., Commanding:—
Captain of the Week.—Capt. W. Hynam.
Next for Duty.—Capt. W. Darley Bentley.
Monday, August 26th, to Friday, August 30th.—Drills as usual.
Sunday, September 1st.—Commandant's Parade at Waterloo Station, 8.45 a.m., opposite No. 9 Platform, for work at Esher. Dress: Drill Order, without rifles. Mid-day and tea rations to be carried.

C. Higgins, *Capt.* R.E., *Adjutant.*

Home Production of Fuel Oil.—The question of the production of fuel oil from home sources has been investigated by a Committee appointed by the Minister of Munitions. The report states that the best method is the carbonisation of cannel coal in existing vertical retorts at gas works, although no very largely increased quantity of oil can be obtained from this source during the war owing to difficulties of labour, coal transport, &c. Other sources of supply available in the future include boring for oil in Great Britain, the further development of the Scottish shale oil industry, and the increased carbonisation of raw coal. In the latter connection the report states that some 1½ million tons of fuel oil might be obtained from every 20,000,000 tons of coal carbonised.—*The Times.*

Dublin Strike.—Over 10,000 artisans and labourers in the building trade struck work on Monday morning. They demand an increase of 3½d. per hour in wages, and reject the employers' offer of an increase of ¾d. It is feared the trouble may spread, the Electrical Trades Union having decided to throw in its lot with other Trade Unions that may decide to take part in the strike.

Electric Lighting Sets on War-Service Motor-Cars.—In the early days of the war the specification of a W.D. motor-car included a dynamo lighting set, but, according to a letter from Major A. Warren-Lambert, A.S.C., in the *Light Car and Cycle-car*, it soon became apparent that these lighting systems, in the hands of the average driver, were not sufficiently reliable to meet the demands of the Services in France. The Major adds that, "in my capacity as officer-in-charge of a workshop at that time, I was continually having to withdraw from service for repair cars allotted to senior officers on the Army Staff solely on account of troubles with the lighting system, and eventually these became so serious that I removed the dynamo sets from the cars as they came in, substituting for them acetylene lamps and generators. The electric sets originally fitted included those made by practically every known concern, and, although the dynamos were fairly reliable, generally speaking, every other part of the equipment gave trouble. In fairness, it should be stated that the sets gave every satisfaction when fitted to cars which were not overtaxed, and were used on comparatively good roads at home; but they were not sufficiently reliable for cars used continuously, sometimes day and night, over exceedingly bad roads, such as are met with in the battle zone."

Electroculture.—According to the *P.M. Gazette*, crops of barley, oats, and potatoes have been treated with electricity in Glamorganshire with good results. Experiments are also in progress at Llantwit Fardre, under the direction of the South Wales E.P.D. Co.

Engineering Trade Unions and Amalgamation.—It is stated that on September 11th and 12th a conference of Trade Unions connected with the engineering industries is to take place, probably at York, to consider proposals for their amalgamation. The Electrical Trades Union and the Scientific Instrument Makers are included among the numerous bodies to take part in the proceedings.

Engineers and Whitley Committees.—The *Daily Chronicle* states that the A.S.E. London Committee has requested shop stewards and branches not to take part in forming Committees on the basis of the Whitley Report.

Production of Platinum in the United States in 1917.—The Geological Survey reports that, according to figures compiled by J. M. Hill, of the U.S. Geological Survey, only 605 oz. of crude platinum were sold by placer mines in 1917. This is less than the sales in 1916 by about 100 oz. The imports of crude platinum amounted to 31,921 oz., not counting the 21,000 oz. of Russian crude platinum which were received by the Government late in December. During 1917, refiners made about 33,000 oz. of platinum, 4,800 oz. of palladium, 833 oz. of osmiridium, and 210 oz. of iridium, which can be called "new metals." Of this amount about 7,400 oz. probably originated from domestic materials. The saving of scrap platinum of all classes resulted in much larger recoveries of secondary platinum metals than in previous years, a total of 72,000 oz. being recovered, as compared with 48,000 oz. in 1916.—*Bulletin* of the N.E.L.A.

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Reactances at the G.E. Co., Buffalo.—The somewhat peculiar arrangement of the reactances and switchgear installed by this company is shown in the accompanying diagram (fig. 1). The

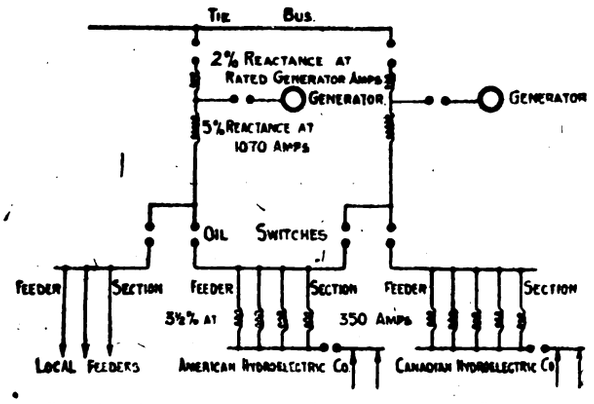

Fig. 1.—Reactances and Switchgear at Buffalo.

voltage generated at the company's station at Buffalo is 12,000 and the periodicity 25. A peculiarity of the system is that thousands of premises are supplied with alternating current for lighting purposes, which has a periodicity of 25. At the leading hotel in the city the rapid variation in the light of the incandescent lamps, due to this low periodicity, is quite apparent. The normal maximum daily load carried by the steam station is from 34,000 to 38,000 kw. About 38,000 kw. is drawn from one of the Niagara hydro-electric companies. The kw.-hours generated for the month of September last year were 11,487,000, and there were used on the works 281,000. The load factor for the month was 38·4 per cent.—*Commonwealth Engineer.*

Power Transmission in Scandinavia.—At a recent joint meeting of the Institutions of Electrical Engineers of Norway and Sweden, an instructive paper on "Inter-Scandinavian Power Transmission" was read by Major Hj. Johansen. The paper dealt with the progress that had been made in linking up the electric power stations in Norway and Sweden with Denmark; a summary of it, together with illustrations, appears in the Stockholm *Teknisk Tidskrift Veckoupplagen* for July 20th last (No. 64).

Educational.—Royal Technical College, Glasgow.—Particulars of the diploma and degree courses in Engineering, &c., for the new session (which begins on September 24th), are advertised in this issue.

For Sale.—Buxton Corporation Electricity Department has for disposal a Belliss triple-compound engine, coupled to a Siemens dynamo, and two Laidlaw & Laidler dynamos, with spare armature; Salford B.C. Electricity Department invites offers for two 1,000-kw. Willans disk and drum type turbo-generator sets. For particulars see advertisement pages to-day.

Callender's Bowling Club Helps St. Dunstan's Hostel.—For the third year in succession the Bowling Club connected with Callender's Cable and Construction Co.'s "Anchor" Works, Leigh (Lancs.), have played a match with a selected teem representing the other bowling clubs in the Leigh district, the whole of the proceeds being remitted to St. Dunstan's Hostel for Blinded Soldiers and Sailors. This annual event took place on the "Anchor" Works Green last Saturday, and attracted a large number of visitors. Mr. J. Bowyer (manager of the Leigh Works), and Mr. T. D. Harrison (managing director, Messrs. Harrison McGregor, Leigh), led off for the respective sides, and the 30 games played were so keenly fought out, that the narrow margin of 12 points only decided the issue in favour of the "Anchor" team. Light refreshments were served in the canteen. The success of the event may be gauged by the fact that St. Dunstan's Hostel has benefited to the extent of over £60.

Chief Technical Assistants' Association.—At a special meeting of the above association held at Anderton's Hotel, Fleet Street, E.C., on Aug. 13th, the report of the delegates to the National Conference of the Electrical Power Engineers' Association, held at Manchester on July 27th, was considered, and it was decided unanimously to recommend all members of the C.T.A.A. to join the E.P.E.A. for protection purposes. The C.T.A.A., however, remains as a technical association, for the exchange of information among the senior men in electricity supply undertakings. Mr. W. E. Bradshaw, mains superintendent, Islington (Electricity Works, Eden Grove, N.) is acting as secretary to the Committee of Mains Engineers, which is investigating in detail the various methods of fault localisation in use, and particulars of the information and data required can be obtained from him. The Hon. Sec. (Electricity Works, Eden Grove, N.) is always pleased to put members who desire information on any special subject in touch with those members who can supply it, and where the subject is of sufficient general interest, the data will be collected and circulated amongst the members.

The American Turbine Industry.—According to the *Electrical Review* of New York, the turbine industry has been taken over by the Government as a necessary step in speeding up the production of prime movers for marine work, federal plants throughout the country, and necessary extensions to other needed plants. Taking over this industry probably means that the condenser industry will follow suit, part and parcel as it is of the turbine. Already the country has been sorely taxed in meeting the needs of marine work for surface condensers.

Electric Welding in Shipbuilding.—The General Committee of Lloyd's Register has confirmed recommendations of the Technical Committee with regard to the use of electric welding in shipbuilding. Elaborate experiments have been carried out, as the result of which a series of regulations has been compiled to control the use of the process.

An Electricity Works in the Roll of Honour.—*La Revue Générale de l'Electricité* states that the French Ministry of Munitions of War in an Order of the Day has commended to the notice of munition factories the fine conduct of the staff of the Compagnie d'Electricité d'Amiens. Under the energetic direction of M. Pasquier, the manager, and M. Husson, the engineer, the works with the greatest coolness, while exposed to a violent bombardment by shells and aerial bombs, continued to carry on the supply of electricity for the military, public, and private requirements in the neighbourhood of Amiens. One of the staff was killed and one wounded.

Aerial Cable Construction.—Mr. E. B. Meyer's paper read before the A.I.E.E. (*Proceedings*, Vol. XXXVII, No. 6) deals with the problem of supplying a high-tension electric service where conditions do not permit of the use of open wire or underground circuits. The methods of overcoming difficulties incidental to providing for high-tension service are discussed in detail, together with a description of the types of cable used and methods of installation.

One of the special methods adopted by the Public Service Electric Co., New Jersey, in meeting war-time demands, was that of furnishing the customer with primary service by the use of aerial cable run on poles and supported by messenger wire, a type of construction similar to that used in telephone work. This system was first used by the company about seven years ago, when it was found necessary to connect two large generating stations through tie feeders.

The matter of running overhead wire was considered, but found impracticable, because the line in several places would have to cross freight yards, trestles, and bridges, and the owners of these structures objected to open-wire high-tension lines. Most of the section

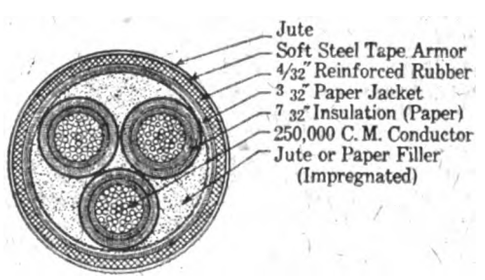

Fig. 2.—Reinforced Rubber-Covered Aerial Cable.

between these two stations was soil of a marshy character, through which it would have been impossible to run a duct line without the use of foundation piling.

It was, therefore, concluded that the use of aerial cable furnished the most satisfactory solution of the problem. In this installation ordinary lead-covered cable of the same type as that used for underground work was run on a pole line with 50-ft. pole spacing. To protect the sheath from mechanical injury there was applied a covering consisting of several layers of jute and marlin with an outer armour of soft steel tape. The use of lead-covered cable for aerial work was found undesirable, however, because of the excessive weight of the cable and the fact that it could not be installed on standard pole line construction, and a special form of 13,200-volt cable was developed to overcome these objections. This cable (fig. 2) is illustrated herewith.

Appointments Vacant.—Electrical engineer, for the Royal Victoria Infirmary, Newcastle-on-Tyne; teacher of electrical engineering for evening classes and teacher for instructing disabled soldiers in electrical wiring, for the Regent Street Polytechnic; shift engineer, £156 + 12½ per cent., for the Barnsley Corporation Electricity Department; two switchboard attendants, for the Northampton Corporation tramways; engineer-in-charge, £163, for the Tunbridge Wells Corporation Electricity Works; junior shift engineer, 55s., for the Heywood Corporation Electricity and Tramways Department; teacher of Engineering (£250 + £25 for evening work), for the Walthamstow Engineering and Trade School; shift engineer, for the Stretford U.D.C. electricity department; shift engineer (£208) and switchboard attendant (56s. 3d.), for the Birkenhead Corporation electricity department. See our advertisement pages to-day.

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The Electrical Trades Union and the E.P.E.A.—We have received from Mr. W. J. Webb, the London District Secretary of the Electrical Trades Union, copies of correspondence which has passed between him and Mr. W. A. Jones, Hon. Sec. of the Electrical Power Engineers' Association. The latter forwarded to Mr. Webb a copy of a letter which his association had addressed to the Chief Industrial Commissioner, referring to the action taken by the Electrical Trades Union, in conjunction with other unions, in connection with the wages and conditions of employment of certain members of the technical staffs of electricity supply undertakings in the Metropolitan area, and reminding Sir George Askwith that on Oct. 20th, 1917, when this matter was previously before him, a memorial signed by the technical staffs of 34 power stations in the London area, protesting against the claims of the E.T.U. to act on their behalf, was sent to him by the association (then known as the A.E.S.E.). Mr. Jones stated that the authority of the E.P.E.A. to act on behalf of the engineers referred to was recognised by the I.E.E., the I.M.E.A., company chief engineers, and the Conference of Local Authorities on Wages, and the association was in negotiation with the Lancs. and Cheshire Chief Engineers' Association and the Conference of Local Authorities on Wages with reference to a schedule of salaries submitted by the association. He therefore requested that on any conference that might arise out of the demands that had been made, the association might be represented on behalf of the members of the technical staffs. Mr. Webb replied stating that the E.T.U. only dealt with *bona-fide* trade unions, and his committee would certainly object to the E.P.E.A. being represented at any hearing before Sir George Askwith or the Committee on Production referring to rates of wages and working conditions for all grades in electricity undertakings. He further said that members of the E.P.E.A. who considered it *infra dig.* to belong to the E.T.U. were not above receiving any awards that were got generally for the industry, through the agency of the E.T.U., and their interests would not suffer, but would be enhanced by the application made by the E.T.U. and other trade unions.

Other correspondence forwarded to us by Mr. Webb relates to the loan of a room at the Hammersmith Electricity Works to the E.P.E.A. by the Borough Council. He asked that the same privilege should be extended to the E.T.U. In reply, the Town Clerk stated that the use of the room by the Western Section of the E.P.E.A. had been discontinued, but he would bring the application of the E.T.U. before the appropriate committee of the Council. Mr. Webb then wrote expressing regret if his letter had been the cause of the discontinuance, but asking that the Council would allow the E.T.U. to use the room for the same length of time as it had been used by the E.P.E.A., on the ground that a large number of the members were ratepayers in the borough.

The Manufacture of Copper Wire in Australia.—According to the *Melbourne Age* for May 16th, which is just to hand, the announcement that the Victorian Government had decided to obtain supplies of copper wire for the railway department from America, at an increased cost of £7,000 over the British contractors' price, was received with great surprise in certain quarters, in view of the probabilities of the manufacture of copper wire being undertaken on a large scale in Australia in the near future. Commenting on the matter, the *Age* says: "The value of the contract to America is £31,000, and to retain that amount of money in Australia at the present time instead of sending it abroad is highly desirable, particularly as it would assist in the establishment of a new and important industry. When the British contractors announced that owing to the war they would not be able to execute the order placed by the Railway department for copper wire, officers of the department investigated the question, and decided that America was the best source of supply. Although, however, American firms can supply the article, the shipping difficulty has still to be overcome. When the wire will reach Australia, therefore, is problematical, and it is quite within the bounds of probability that Australian-made wire will be available before the American wire has been shipped. In any case, there has been so much delay already in connection with the electrification equipment that a little more in favour of one's own country would be readily excusable. At Port Kembla, N.S.W., over £100,000 has been spent in construction works by Metal Manufactures, Ltd., and for some time past everything has been ready for the installing of the machinery, the manufacture and dispatch of which from Great Britain has been delayed by the war. Some of the plant, however, has already arrived in Australia, while more is on its way, and unless further unforeseen delays occur it is expected that operations will be commenced in about a month. The manufacture of copper wire is only one of the many proposed activities of the firm, and in this connection it is stated that preparations are being made to supply the whole of the requirements of this country. At first, however, the output will be restricted to the capacity of the plant available, but it will be increased from time to time as quickly as the additional plant can be brought into use. In view of such facts as these, it is difficult to understand why the Railway department should find it necessary to spend an additional £7,000 to obtain copper wire from America. It is explained that the agreement of the Cabinet to an additional expenditure of £7,000 on electrification equipment in order to enable copper wire necessary to the present work of construction to be obtained from America, will enable half of the electrification scheme to be put into operation for certain as soon as it is constructed. The new arrangement will furnish sufficient overhead wire to enable the St. Kilda, Williamstown, and Port Melbourne lines to be completed, and they, in conjunction with the Sandringham-Essendon line, form about one-half of the suburban railways of Victoria. In speaking on the matter, Railway Commissioner E. B. Jones said that all these lines were now assured of coming into operation as soon as the work upon them was completed. The rest of the system he thought would probably have to wait until after the war, and with reasonable luck might be completed soon afterwards."

British Capital for Australian Industries.—The Victorian commissioner of public works recently stated that he knew of a number of projects for the establishment of industries—British manufactures—in Australia. The Commonwealth Government had sifted applications, but the Imperial Treasury had forbidden British manufacturers to remit the necessary capital to Australia. This attitude, if persisted in, said the commissioner, would have a serious effect on the Empire trade, for after the war was over the position would be that the Australian market would be in the hands of outside countries.—*Tenders.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Central Station and Tramway Officials.—Mr. B. Hall, of the Chatham & District Light Railways Co., having been appointed assistant engineer and manager of the Keighley Corporation Tramways, was presented with a case of instruments and a pipe, subscribed for by the company's staff and employés, Mr. Jensen, the general manager, making the presentation.

Mr. R. L. Acland, electrical engineer and tramway manager, Chesterfield, has been appointed by the Controller of Coal Mines to be the district engineer for the purpose of assisting in the Coal Economy Campaign.

Mr. J. A. Davison, mechanical engineer at Belfast electricity works, has resigned in consequence of a breakdown in health. The Electricity Committee is empowered to make a new appointment.

At Southport Town Council opposition was offered to the Tramway Committee's recommendation to increase the salary of Mr. T. J. Kendrew, the tramway manager, from £300 to £400 per year. Coun. Aveling said their tramways was regarded by the Government as non-essential—grade 3. They would have to reduce their mileage in the near future. Coun. Kennedy said Mr. Kendrew's salary in 1914 was £250, and in April of last year it was raised to £300. He had now the management of a much bigger undertaking than then, and no firm in the country would pay such a small salary. The proposal was taken back for further consideration.

The Ipswich Council has resolved to increase the salary of Mr. Ayton, the electrical engineer and manager, from £700, at which it has stood since March, 1913, to £850, as from March, 1918.

At a recent meeting of the Cape Town City Council a letter was received from Mr. W. F. Long withdrawing his offer to act as consulting engineer to the Council, and requesting a testimonial having regard to his services on behalf of the Council since 1902.

Mr. C. W. Gooden, of the Grays U.D.C. electricity works, has been appointed chief electrical assistant at the Horsham U.D.C. electricity works at £190 per annum. There were 31 applications.

On the occasion of his wedding, Mr. Arthur Wilkinson, of the Lytham and St. Annes Tramway Co., was presented with four silver pieces from different departments of the company.

General.—The staff of the electrical department of Messrs. Clayton & Shuttleworth, Ltd., of Lincoln, have presented a barometer and thermometer in oak case, and a butter dish to Mr. W. Watkinson on his marriage.

Owing to increased business of the East Anglian Engineering Co., Ltd., the "Bull" Motor Works, Stowmarket, have appointed Mr. H. C. Waters as chief draughtsman and electrical engineer. Mr. Waters served for a good many years on the motor draughting and design staff of Messrs Crompton & Co., Ltd., of Chelmsford.

Roll of Honour.—Private J. A. Westley, Inniskilling Fusiliers, killed in action, aged 20 years, was employed by Messrs. Ferranti, Ltd., Hollinwood.

Private H. Saville, K.O.Y.L.I., who has been awarded the Military Medal, was on the staff of the Wakefield Corporation's Electricity Works.

Private F. Barnwell, Royal Marines, who enlisted from the works of Messrs. Willans & Robinson, Ltd., of Rugby, has died in hospital.

The Croix de Guerre has been awarded to Norman E. Gripper, Blackburn, who was killed in action in France in May last. He was on the staff of the Blackburn Corporation electricity works.

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Private C. Owens, Royal Berkshire Regiment, who is a wounded prisoner of war in Germany, was at the depôt of the Bath Electric Tramways, Ltd.

Naval Electrical Artificer H. F. Rendall, who has been accidentally killed by an explosion, was an electrician with the English Sewing Cotton Co., of Belper.

Mr. H. S. Woodford, who was on the Rugby staff of the B.T.H. Co., Ltd., has been gazetted second-lieutenant in the Royal Engineers.

Private A. E. Harrison, Royal Sussex Regiment, killed, aged 19, was employed by Messrs. Greenwood & Batley, and previously at the Woolwich Borough Electricity Works.

Sapper A. Snow, who is a prisoner of war in hospital in Germany, was employed at Hanley Electricity Works.

Private F. W. Fletcher, who was formerly employed as a draughtsman by the Birmingham Electricity Committee, at Witton, is a prisoner of war.

The Military Cross has been conferred upon Lieutenant (Acting-Captain) C. Higgs, R.E., under the following circumstances:—When in command of the divisional signal company during heavy fighting and withdrawal lasting 10 days, his indefatigable energy, courage, and unfailing resourcefulness in maintaining communication largely contributed to a successful withdrawal and rearguard actions, in which the division took part. Throughout the period he worked with little rest, and set a magnificent example to all ranks. Captain Higgs is a partner in the firm of Higgs Bros., Summerhill Street, Birmingham. He was granted a commission in the R.E. about three years ago, and has been with the B.E.F. about 18 months.

Obituary.—Mr. J. M. Martin.—The death occurred last week, at Holmhill, Newmains, N.B., at the early age of 39 years, of Mr. J. M. Martin, general manager of the Chapel Coal Co., Ltd. The deceased was for some years on the staff of Messrs. Mavor & Coulson, electrical engineers, Glasgow, but succeeded his father in the position at the colliery about two years ago.

CITY NOTES.

Lisbon Electric Tramways, Ltd.

Net profit for 1917, £16,678, plus £9,224 brought forward; £10,000 has been put to depreciation reserve, leaving £15,902, out of which the preference dividend for the half-year ended June, 1917, amounting to £12,767, has been paid, leaving £3,135 to be carried forward. The passengers carried numbered 79,434,362, earning Es.2,754,964, as compared with 76,620,194, earning Es.2,324,655 in 1916, a considerable increase. Working expenses continued to increase, and were Es.568,381 higher than in the previous year owing to rises in price of coal and other supplies and in wages. The average of the rate of exchange fell during the year from 33.73d. to 30.656d., and is a further adverse feature. Owing to strikes and political disturbances, the system was closed down on several occasions, and the receipts for seven operating days were lost. The very serious reduction of profits prevented the payment of the preference dividend for the second six months of the year. A new Portuguese law prohibits any increase in price of season tickets for the duration of the war and six months after unless authorised by the Government, the General Council of the district, or by the municipality. This law is a direct violation of the terms of the company's concession. After the revolution in December a new Government came into power, and an agreement was arrived at with the Lisbon municipality under which the company was enabled to raise the rates of the season tickets by 40 per cent. as from January 1st last. The whole of the increase is required to meet the demands for higher wages. Certain further tariff increases have been made which will help to compensate for the ever-rising working expenditure.

French Supply Companies.

The Société Centrale pour l'Industrie Electrique, reporting on the year 1917, reviews at length the position of the various supply undertakings in which the company is interested. The directors state that as a general rule the supply industry presented the same characteristics as in preceding years. The receipts almost everywhere had progressed, and the hydro-electric works were in a prosperous condition. On the other hand, the companies using steam power found their situation becoming worse in consequence of the high prices and inferior quality of the coal. The company's net receipts from the investments amounted to £35,009, and after writing down furniture and installation the balance has been carried forward to the next account.

The directors of the *Société Lyonnaise des Forces Motrices du Rhone*, in presenting a balance-sheet for 1917 showing a great improvement over that for the preceding year, drew attention to the considerable increase in the working expenses owing to the general costliness, and the excessive wear and tear due to the necessity for meeting the growing demands for energy in connection with the national defence. As a consequence, the company had been compelled to consider the question of raising prices, and ministerial authority to do so was received last December. The number of customers at the end of 1917 was 39,130, and the horse power supplied was 40,692. The net profits are returned at £168,000, and the dividend on the ordinary capital of £1,200,000 is at the rate of £1 5s. 3d. per share, or 6.39 per cent.

The Société l'Ouest-Lumière reports that the results in 1917 were influenced unfavourably by the same causes as in the previous year, namely, the constant advance in the prices of raw materials, coal and wages, combined with the inferior quality of the coal and the abnormal wear and tear of the machinery and plant. Moreover, and notwithstanding the increases in the tariffs obtained from some private customers and various local authorities, the receipts were less than the working expenses, and the working closed with a deficit of £98,000, which, however, was reduced to £55,000 by the absorption of the balance from 1916. It was only possible to bring into operation at the end of the year the three boilers ordered in 1916, and therefore the improved conditions of working would first apply to the new financial year. The company had participated in the purchase of colliers with the object of overcoming the difficulty of freight, but owing to the delays in the delivery the year's working had benefitted only slightly from the expected economy from this source.

The report of the *Compagnie Générale de Distribution d'Energie Electrique*, whose principal scope is the supply in bulk of energy to traction and distribution companies, states that the gross receipts in 1917 amounted to £221,000, and the gross profits were £25,000, but special war charges converted the year's working into a loss of £27,000. It was possible to pay a dividend of 5 per cent. in 1915, but no distribution has taken place since that year. The directors remark that the war had entirely disturbed the industry. The working expenses, particularly owing to the rise in the cost of coal and labour and materials, were 45 per cent. higher than in 1913, represented in kilowatt-hours sold. On the other hand, the contracts running with customers were at very low rates and for a duration of several years, and the former refused to agree to any modification. In January, 1918, however, a law was enacted which permits of the adoption of procedure for securing a revision by mutual understanding or by having recourse to the courts, and negotiations were proceeding with some customers, whilst in other cases legal action was proposed to be taken. The new generating station which was begun before the war was now to be completed with the financial assistance of the State by means of two loans of £140,000, and new plant had been ordered for the existing station, so that the company would be prepared for the situation after the war.

The Société l'Energie Electrique du Littoral Méditerranéen, which, a few months ago, invited subscriptions in the English money market, report gross receipts of £543,000 in 1917, or £101,000 in excess of the preceding year. On the other hand, the working expenses largely increased, the final result being net profits of £135,000. This sum has permitted the declaration of a dividend of 6 per cent. on the ordinary share capital. The directors' report states that the production of the hydro-electric works made further progress during the year owing to the better utilisation of the power available and of the Largue works on the Durance, which was started in August, 1916. The number of lighting and power consumers experienced an augmentation, and the supply in bulk to other companies also increased. The contracts concluded with the administration of the national defence and the manufacturers working for this purpose had now reached the full yield, and it was only possible partly to satisfy the new applications received for supply. Dealing with the developments in hand the report states that it had been impossible to complete the extensions of the Ventaron and the Fontan works owing to the difficulties of transport, the recruiting of labour, and the supply of materials. It was, however, hoped to finish the former shortly, and the latter by the beginning of the winter.

The directors of the *Compagnie Parisienne de Distribution d'Electricité*, which is the amalgamated undertaking of the former supply companies or secteurs, state that the prolongation of the war renders the production and distribution of electricity more difficult and more costly in 1917 than in any one of the three preceding years. Notwithstanding the considerable reduction in the consumption for lighting, the great expansion in the use for motive power purposes compelled the company to work all the plant to the limit of its capacity. The production, which reached 176,912 KW.-hours in 1916, rose to 211,634,000 KW.-hours last year, the consumption by customers having been 128,263,000 KW.-hours, and 161,205,009 KW.-hours in the two years respectively. In 1913 the lighting service represented a consumption of 64,000,000 KW.-hours, and that of motive power only 23 millions, whereas the latter requirements in 1917 formed 125,786,000 KW.-hours out of the total consumption by customers. That part of the business which formerly was the accessory had now become the principal, and it had permitted war contractors to obtain cheaply energy which could only have otherwise been procured at a high price. The co-operation of the public authorities had assured the company of supplies of coal for the works, but despite the relief resulting from large deliveries of French coal the prices of all raw and other materials had risen enormously. As compared with pre-war quotations the company had to bear a surcharge in this respect of over £640,000, which had only been recouped in a very insufficient way by price increases agreed to by cu[s]

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tomers. It had been necessary to make extensions of the generating works, sub-stations, mains, &c., in order to be able to supply new consumers. The convention with the City of Paris of 1907 laid upon the company the obligation to expend as from January 1st, 1914, a yearly average sum of £68,000 in extensions, but these had been carried out on such a scale as to exceed by £160,000 the actual amount to be defrayed by the company. This excess had to be borne by the City of Paris, and although a controversy remained open on the matter, provisional measures had been taken pending a solution. The gross receipts in 1917 amounted to £2,009,000, and after deducting working expenses, maintenance charges, taxes and general expenses, and the rental payable to the City of Paris on the gross receipts—£252,000, as against £170,000 in 1916—the balance remaining is £476,000. The interest charges on the debentures and the redemption account absorb £347,000, leaving net profits of £129,000, which with the balance brought forward makes a total of £227,000. The dividend is at the rate of 4 per cent. on the ordinary share capital of £4,000,000, the debentures still in circulation being for £3,635,000.

Brazilian Traction, Light & Power Co.—The revenue for the year to December 31st in Canadian currency was: Revenue from securities, $6,005,138; interest on advances to subsidiary companies, $198,560; general and legal expenses, &c., $937,180; net revenue, $5,266,518; transferred to general amortisation reserve, $250,000; dividends Nos. 16, 17, 18, and 19 at 1½ per cent. each on preference shares, $600,000; dividend No. 18 at 1 per cent. on ordinary shares, $1,064,136; surplus carried forward, $3,352,382. The total gross earnings of the subsidiary companies in Brazil for the year were 92,200,309 milreis, being an increase, as compared with the previous year, of 7,258,077 milreis, or 8.54 per cent. The operating expense were 45,127,341 milreis, leaving the net earnings 47,072,968 milreis, an increase in net earnings of 546,772 milreis over those of the previous year.

Brisbane Tramways Co.—The "Times" is informed that the Brisbane Tramways Co. has received advice by cable to the effect that the two Tramways Bills which have been re-introduced by the Ryan Government have passed the Legislative Assembly, and have been read a first time in the Legislative Council with the single modification that the Purchase Bill has been amended so as to give the company the option of payment either in cash or debentures. It is an unfortunate omen that in the debate in the Lower House the Minister for Railways asserted that there was no contract between the company and the Government, and that, in any case, the present Parliament was not bound by the action of any previous Parliament.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following to be quoted in the Official List:—

Edison Swan Electric Co., Ltd.—100,000 first preference shares of £1 each, fully-paid, Nos. 1 to 100,000.

Madras Electric Supply Corporation, Ltd.—6,000 additional ordinary shares of £1 each, fully-paid, Nos. 180,001 to 186,000.

Adelaide Electric Supply Co., Ltd.—Dividend at the rate of 6 per cent. per annum, less British tax, for the past half-year, on the 6 per cent. cumulative preference shares.

Melbourne Electric Supply Co., Ltd.—Dividend at the rate of 7 per cent. per annum, less British tax, for the past half-year, on the 7 per cent. first cumulative preference shares.

Para Electric Railways & Lighting Co., Ltd.—Interim dividend at the rate of 6 per cent. per annum, less income-tax, on the ordinary shares for the half-year.

South American Light & Power Co., Ltd.—Dividend 5 per cent., less tax, for year.

STOCKS AND SHARES.

TUESDAY EVENING.

WITH the continuance of good news from the Western front, the Stock Exchange markets remain in good fettle. There is plenty of business amongst industrials. Rising prices are the order of the day in some of the electrical railway issues, in the Marconi group, and in various other directions. The gilt-edged markets are so firm that the 5 per cent. War Loan has risen to within all but a few shillings of its issue price of 95, so serving to maintain all investment stocks. Provincial Stock Exchanges are busy, too. One firm of brokers in a West of England town made £750 last week in brokerage alone, and the office staff consists of a lady and two lads.

Underground Electric Railways shares have been very active, the ten-pounders jumping to 3, while Bus "A" moved up to 8s. 3d. The strike made little difference to the market in Underground shares, and the Income Bonds kept fairly firm. In Districts and "Mets" business has been quiet, with prices good, though the market in steam stocks is somewhat patchy.

Electric lighting shares are practically unchanged. There is nothing to indicate the likelihood of any change in conditions at present, and proprietors are perforce obliged to follow the Asquithian rule of Wait and See. How the companies will be affected by the coal shortage promised us in the forthcoming winter, combined with the rationing order, is a matter that is more inviting to abstract speculation than to concrete investment.

The Brazilian Traction, Light & Power Co.'s report breathes chastened cheerfulness. The directors apparently intend to pay no more than 1 per cent. per annum on the common shares during the "continuance of the abnormal conditions produced by the war." The average rate of exchange is substantially better for the first half of 1918 than it was during the whole of 1917. Developments of Brazilian telephone undertakings have turned out satisfactorily. The shares appear to be worth holding.

Mexican affairs have taken one of their periodical turns for the better. The Mexican Government has modified, under protest, certain decrees that bore harshly on the oil industry, and this is taken as a hopeful sign for other commercial concerns in Mexico. Wherefore prices have taken a sharp upward turn, and look more healthy again. Anglo-Argentine Trams are also attracting a little favourable attention.

The Marconi market is very animated. American Marconis have taken the lead, and the price rose to 30s., while the parent shares are better at 4½ ex dividend. Marconi Marines strengthened to 3 bid, and Canadians are a little higher at 14s. 3d.

British Aluminium provided a pronounced feature of strength with a sudden rise to 40s. The British Platinium and Gold Corporation underwriters are said to have been left with about 85 per cent. of the issue on their hands. General Electrics are steady at 18¾, while the preference remain about 10¼. Callenders are better at 11½, ex the bonus. Babcock & Wilcox hover around 3¼. Ediswan "A" shares are a good market at 48s. The armament group keeps hard, but rubber shares continue uncertain, with business slack in most sections.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Aug. 20. 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6¾xd	—	£7 17 0
Charing Cross Ordinary	5	4	3⅛	—	6 8 0
do. do. do. 4½ Pref.	4½	4½	3½	—	6 18 6
Chelsea	8	5	3½	—	7 13 10
City of London	8	8	11⅜	—	7 0 3
do. do. 6 per cent. Pref.	6	6	9⅜	—	6 0 4
County of London	7	7	10⅜	—	6 17 7
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	6	7	6½xd	—	6 17 7
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3½	—	7 13 10
Metropolitan	3	4	3⅝xd	—	6 8 0
do. 4½ per cent. Pref.	4½	4½	3½	—	6 18 6
St. James' and Pall Mall	8	9	6⅜	—	7 1 2
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	5½xd	—	7 13 3
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	97½	+1½	6 3 0
do. Def.	1½	1½	23½	+ ½	6 7 8
Chile Telephone	8	8	7½	+ ½	5 6 8
Cuba Sub. Ord.	7	7	10	—	*7 0 0
Eastern Extension	8	8	15⅛	—	*5 3 3
Eastern Tel. Ord.	8	8	158½	—	*5 1 0
Globe Tel. and T. Ord.	7	7	14⅜	—	*4 17 5
do. do. Pref.	6	6	10⅜	—	5 18 5
Great Northern Tel.	24	22	87½	—	5 17 4
Indo-European	13	—	57½	—1	5 12 6
Marconi	15	20	4½xd	+ ⅛	4 17 1
Oriental Telephone Ord.	10	10	3⅛	+ ⅛	3 4 0
United R. Plate Tel.	8	8	7½	—	*5 6 8
West India and Panama	6d.	9d.	2	+⅛	*1 17 6
Western Telegraph	8	8	16½	—	*4 19 3
Home Rails.					
Central London Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	1	1	26½xd	+3	4 4 8
do. District	Nil	Nil	23	+1½	Nil
Underground Electric Ordinary	Nil	Nil	3	+ ⅛	Nil
do. do. "A"	Nil	Nil	8/3	+1/9	Nil
do. do. Income	6	4	85½	+ ½	*4 13 7
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅜	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3⅛	+ ⅛	—
do. do. 2nd Pref.	5½	—	2⅜	—	—
do. do. 5 Deb.	5	5	66	+ ½	7 12 2
Brazil Tractions	—	—	45½	— 1	—
Bombay Electric Pref.	6	6	9½ xd	—	6 9 9
British Columbia Elec. Rly. Pfce.	5	5	61½	—	8 2 —
do. do. Preferred	Nil	Nil	45	—	Nil
do. do. Deferred	Nil	Nil	40½	—	Nil
do. do. Deb.	4½	4½	60½	—	7 0 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	51	+6½	Nil
do. 6 per cent. Bonds	Nil	Nil	42	+5½	Nil
Mexican Light Common	Nil	Nil	25	+4	Nil
do. Pref.	Nil	Nil	43½	+4½	Nil
do. 1st Bonds	Nil	Nil	56½	+7½	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	8⅜	— ⅛	3 17 2
British Aluminium Ord.	10	10	2	+ ⅛	5 0 0
British Insulated Ord.	20	20	2	—	5 0 0
British Westinghouse Pref.	7½	7½	2⅞	+ ⅛	5 4 4
Callenders	20	25	11½	—	6 4 6
do. 5 Pref.	5	5	4½	+ ½	5 17 8
Castner-Kellner	22	20	3⅜	+ ⅛	5 10 4
Edison-Swan, fully paid	—	—	3⅜	+ ⅛	Nil
do. do. 4 per cent. Deb.	4	4	75½	+1	5 6 0
Electric Construction	7½	10	1⅛	—	7 12 4
Gen. Elec. Pref.	6	6	10½	—	6 5 4
do. Ord.	10	10	18½	+ ½	*5 6 8
Henley	25	25	2½	+ ⅛	5 15 0
do. 4½ Pref.	4½	4½	4	+ ⅛	5 12 6
India-Rubber	10	10	16⅜	+ ⅛	*3 0 4
Telegraph Con.	20	20	45	+ ½	*5 7 8

*Dividends paid free of Income Tax.

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WATER-POWER IN THE BRITISH EMPIRE.

(*Concluded from page* 152.)

At the present time the only parts of the Empire in which any systematic attempt has been made to collect and tabulate the necessary data are Canada and New Zealand, and to a smaller extent Tasmania, New South Wales, and South Africa.

It is a matter of urgent importance that the preparation of the necessary hydrographic and meterological data should be undertaken at the earliest possible date in the remaining Dominions and Dependencies of the Empire.

Great Britain and Ireland.—Much information relative to the water-powers of the British Isles is given in a paper* read before the Society of Arts in January, 1918, by Mr. Alexander Newlands, M.Inst.C.E., a member of the committee, who, assuming that 28 in. of the total rainfall in the Scottish Highlands is available for power, calculates that a total of some 235,000 continuous H.P. is available. Mr. W. Vaux Graham, M.Inst.C.E., has investigated 60 possible schemes in the Highlands, and arrives at the conclusion that an aggregate of upwards of 400,000 continuous H.P. is available, divided as follows: 10 above 10,000 H.P., 20 between 5,000 and 10,000 H.P., 20 between 2,000 and 5,000 H.P., and 10 below 2,000 H.P.

While the possible water-powers of the United Kingdom are comparatively small, yet, occurring as they do at no great distance from industrial regions, they are relatively valuable, and every effort should be made, by close investigation, to ascertain their commercial value at an early date.

India.—The power problem in India is in general complicated by the urgent necessity for conserving as much water as possible for irrigation purposes. Over the greater part of the country there are few perennial streams, and storage reservoirs for conserving the high rainfall of the monsoon season would be necessary. Many of the elevated valleys of the Ghats lend themselves to the construction of storage reservoirs, and a very large proportion (up to 90 per cent.) of the rainfall may be collected and stored. The Tata Hydro-Electric Undertaking receives its water supply from three such valleys. The total catchment area is only 22 square miles, but this is sufficient to give 100,000 E.H.P. for 3,600 hours per annum. Other projects of a similar type are under investigation in the Western Ghats. It is estimated that a continuous 300,000 E.H.P. may be obtained from the Koyna River alone; that 100,000 E.H.P. may be obtained from each of the rivers Vaiturna and Kali Nadi, and from the Andrha Valley; that a continuous 20,000 E.H.P. is available at Kali Nadi, Gersappa and Lushington Falls, and that, by a combined system of storage reservoirs, suitable also for irrigation purposes, a continuous 50,000 E.H.P. might be developed from this system.

The North-west corner of the United Provinces would also appear to be a promising locality for early development. At present the erection of a generating station on the Jumna is under consideration. From 40,000 to 50,000 H.P. can be easily and economically developed on the rivers Jumna and Tons, and as this region is thickly populated, there would be immediate markets for energy for the operation of cotton, rice, sugar, flour, oil, and saw-mills, and for other industrial undertakings.

There are also known to be many promising sites in the Central Provinces.

In Mysore the very successful Government undertaking on the Cauvery River has a capacity of over 22,000 N.H.P. The power is transmitted some 90 miles to the Kolar gold-fields and to Bangalore and Mysore, respectively 57 and 37 miles distant.

In the Native State of Kashmir an installation on the Jhelum river at Mohora is designed to develop 20,000 H.P., and transmits its power to Baramula and Srinagar.

In general the hydraulic possibilities of India appear to be very great. The country possesses in abundance the minerals necessary for metallurgical development, the climate and land for the cultivation of cotton, flax, jute, and many other commodities, and an enormous population which, if trained, would provide aoundant skilled labour. It is certain, too, that the demand for nitrogenous fertilisers will be enormous.

Ceylon.—Mr. H. T. S. Ward, M.Inst.C.E., estimates that at least 68,000 continuous H.P. is available even in the dry season at the falls of the Mahaweliganga and about one-half as much from the river Walawe Ganga. The water rights belong to the Ceylon Government.

Burmah.—The catchment area drained by the upper reaches of the rivers is about 80,000 sq. miles, and assuming it possible to utilise one-fifth of the discharge over a head of 500 ft., this would give a potential 7,000,000 H.P.

British Guiana.—While the water-power resources of this colony are comparatively large, no definite information is yet available. The falls of Kaieteur are said to form perhaps the finest untouched water-power in the Empire.

British Honduras.—Here also, while the water-power possibilities are known to be large, no definite information is available.

Canada.—During recent years, the Canadian Government, through the Dominion Water-Power Branch of the Department of the Interior, has devoted much attention to the systematic examination and development of the hydraulic resources of the Dominion, and the data, as regards the largest, most readily available, and most promising water-powers are sufficiently complete to permit a reasonably close idea of their possibilities to be obtained.

The Canadian Conservation Committee estimates that of the 3,730,000 square miles of the Dominion, 2,000,000 miles may be expected to be fairly thickly settled within the next few decades. The remaining area is known to have thousands of water-powers, but the capacities of these are imperfectly known, and they are remote from any present market. Excluding these districts, it is estimated that 18,800,000 H.P. is available. This amount does not take into account the possibilities of storage for the improvement of present capacities. The power actually developed up to 1918 amounted to approximately 1,736,000 H.P. About 78 per cent. of this is used for electric light and electric railway and motive-power work, but some 250,000 H.P. is utilised in the manufacture of paper from wood pulp, and about 150,000 H.P. in electrochemical and similar processes.

Powers as yet undeveloped, but which are capable of rapid and easy development, aggregate 5,400,000 H.P. In addition to these existing plants could be extended so as to develop an additional 280,000 H.P. so that an aggregate of 7,500,000 H.P. is readily available within range of present markets. At the present accelerated rate of development it appears more than probable that the whole of this energy will be utilised within the next 20 years or so.*

To its wealth of water-power, the Dominion adds the advantage of a great share in the world's forest and mineral resources. Coal, iron, copper, nickel, gold, silver, cobalt, lead, asbestos, and mica are widely distributed, and the proximity of large hydraulic powers to the mineral deposits will prove a great stimulus to the development of both.

The policy of the Government in respect to the control and administration of water-powers is that the title should be retained by the Crown, that the public should be protected by securing the maximum possible advantageous development of each river, by control of the rates, by reasonable rentals, &c., and that at the same time the inducements should be such as to encourage legitimate enterprise for the development of power resources.

Newfoundland.—The water-powers of Newfoundland are known to be of considerable importance. So far about 6,000 H.P. has been developed for general industrial purposes and lighting. About 54,000 H.P. has been developed for use in the pulp and paper mills.

Australasia.—With the exception of New Zealand, the water-power resources of Australasia have never been systematically surveyed.

Estimates have been made of a few of the more promising hydraulic powers of Tasminia. The Agent-General (Sir John McCall) estimates the possibilities at about 400,000 H.P. The State Government proposes to utilise the water of the King River in the near future to supply some 40,000 H.P. to the mining districts in the West. So far only three hydraulic installations have been developed. These are the Great Lake scheme, at present developing over 12,000 H.P.; the South Esk scheme, developing 1,350 H.P.; and the Lake Margaret scheme of the Mt. Lyell Mining Co., developing 4,000 H.P. The Great Lake, with a head of 1,120 ft., is capable of developing 70,000 H.P. The plant is now being enlarged. Part of the power is to be used for zinc reduction and calcium carbide production.

In view of the shortage of water-powers in Australia, and of the future demand of the Commonwealth for nitrogen products, &c., there should be no difficulty in finding a market for the output of all the energy which can be developed in Tasmania. Though comparable in area with the United States, there has yet been no notable hydro-electric development in Australia. The only possibilities of considerable powers are to be found in the rivers draining the Great Dividing Chain of the East Coast. Probably the possibilities of the Australian Alps lie between 300,000 and 500,000 H.P.

The *Blue Mountains*, to the West of Sydney, form an important high-level catchment; the available power is likely to be between 25,000 and 50,000 H.P.

The *New England Range* in New South Wales and Queensland has available power probably between 200,000 and 500,000 H.P. The State Government has outlined a power scheme for the river Clarence capable of producing 150,000 H.P.

In Queensland, *Cairns District*, the available horse-power probably lies between 150,000 and 400,000 H.P. The Barron River Falls would yield at least 10,000 H.P. This district is favoured in respect of shipping facilities and is rich in copper, tin, and other minerals.

The aggregate power suggested as being capable of economic development in the Great Dividing Chain is from 625,000 to 1,300,000 H.P. In all cases the scheme would be somewhat expensive to develop, but in view of the general high cost of power in Australia, it would probably not be prohibitive.

New Guinea.—The physical characteristics of New Guinea offer exceptional facilities for developing water-power. There are numerous rivers of large volume and steep gradient, and there is evidence that in the aggregate, the available power

* Abstracted in the ELECTRICAL REVIEW, February 8th, 1918.

* An account of the Canadian water-powers was given in the ELECTRICAL REVIEW of February 23rd, 1917. See also ELECTRICAL REVIEW, May 18th, 1917.

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is enormous. German New Guinea, the territory occupied by the Australian forces during the present war, has also great prospects. Altogether the potential water-power in the section of the island now under the British flag may amount to as much as 15,000,000 H.P.

Some few of the islands of the South Pacific Ocean offer possibilities of hydraulic power on a fairly large scale in spite of their comparatively small size.

The physical characteristics of New Zealand render the country particularly well adapted for providing large stores of water power, and for facilitating their development. The backbone of high mountains leads to heavy precipitation from the moist westerly winds, and the mountain ranges are studded with extensive lakes, situated above a deeply indented coast line, and support many glaciers of large size which act beneficially in equalising the run-off throughout the year. A list of 72 important and promising schemes places the economically workable water-powers of the Dominion at 3,700,000 B.H.P. on the turbine shafts. Of this, 500,000 H.P. is found in North Island and 3,200,000 in South Island. The power actually developed and in use in 1916 is given in the Government returns as 42,600 B.H.P. Many other projects are, however, in course of construction or under consideration.

The Public Works Act of 1908 vests the sole right to use water-power in His Majesty, subject to any existing rights, and gives the Government the right to develop, or to delegate such power to any local authority, or, outside a mining district, to any person or company, subject to conditions. Advantage has been taken of this in several cases, the right in the case of local authorities being issued free of royalty, and in the case of private individuals developing water-power for electrical distribution, subject to a royalty of 0.05d. per unit generated.

The outlook for New Zealand, at the dawn of what promises to be an era of unexpectedly great electrochemical, and electrometallurgical activity, is most promising. As a centre for the manufacture of nitrogen products, aluminium, calcium carbide and the like, its situation is ideal. The fundamental requirement, a great excess of energy over the power needs of the country, is provided. Further, that power is convenient to the coast; in some of the largest schemes the generating plant will be actually on deep-water harbours.

South Africa.—Owing to the seasonal character of the rainfall throughout South Africa, the flow of the rivers either is greatly diminished, or entirely ceases, during a considerable period of each year, and their value as sources of power is correspondingly diminished. It is, however, known that a number of important falls occur, particularly on the eastern slopes of the Drakensberg Range, some of which are perennial and capable of development.

In Rhodesia the rivers capable of developing large powers are in general very remote from present centres of industry, and few powers have as yet been developed.

Assuming that 10 per cent. of the total power of the Victoria Falls can be usefully developed, the resources of Southern Rhodesia total about 220,000 E.H.P.

East Africa, West Africa, Egypt.—In East Africa many promising waterfalls occur in the vicinity of Nairobi and elsewhere. On the Gold Coast some 250,000 H.P. is available, and in Nigeria between 60,000 and 70,000 H.P. Some considerable amount of power might be developed from the regulated flow of the Nile, and it is hoped to obtain information regarding Egypt in the future.

MINING ELECTRICAL ENGINEERING.*

By CHRIS. JONES, M.I.E.E.

(*Concluded from page* 151.)

The question of applying the proper type of motor for various specific duties is of the greatest importance to all concerned. The two chief kinds adopted in the past were the squirrel-cage and slip-ring induction motors; the former in view of high efficiency, simplicity, mechanical strength, and absence of sparking (the three first items keep the maintenance costs down), and the latter makes it particularly suitable for installation in coal mines and other dangerous places. It has the disadvantage of having a low starting torque, and will not start against heavy loads, and causes disturbances in the lines when started up, but the latter is not serious. The writer has a large number of coal-cutters fitted with this class of motor, and can thoroughly recommend it for such purposes, all bearings being of ball and roller type. There are a great many other drives in colliery work where it can be used with advantage. The slip-ring type of motor is chiefly used for starting up against heavy loads and where speed variation is required, such as for main and tail haulages. The writer has a large number of these doing excellent work, the chief cause of the few troubles having been due to defective and weak bolting down girders and cast wheels on haulage gears causing excessive vibration. With substantial foundations and machine-cut wheels such troubles are greatly minimised. It is good practice to specify for the phase connections to be brought out to a terminal box, as this greatly assists fault-finding. The proper rating of motors is a question that is well worth ventilating.

In connection with A.C. motors and turbine pumps it is necessary to specify that the pump shall do its full load duty at a reduced frequency, for the duty of the pump is dependent upon speed, which, in turn, is dependent upon the frequency. Manufacturers would greatly assist users by standardising cable trifurcating boxes for stator connections. These are required to be easy of detachment, so that the cables and motor windings may be tested independently. In some designs this is not possible, and is the cause of great delays. Motors are supplied to collieries at the present time with plain terminal boxes suitable for rubber tails. Some makers have gone so far as to make them so large that a diagram of connections is cast on the front cover, and they are to be recommended. In one case recently inspected the bare terminal was such that it could be easily touched by the attendant. Users are often told that breakdowns of motors are due to dirt or inefficient protection, and breakdowns do occur owing to such neglect.

It is essential to specify that all windings should be impregnated with damp-proof varnish where in exposed position; it is well worth the extra cost. The question of the type of windings must also be given the best consideration when considering competition offers. A case in point is where three coils in a hand-wound motor were repaired, the cost being £24, whereas a former wound coil could be stripped and rewound for £4.

The author has experienced overheated motors on account of unstable conditions of transformers which had the primary and secondary γ connected. The question of the construction of motor houses, and transforming sub-stations underground, is worthy of special consideration as the designs, &c., have a great effect on the successful operation of such apparatus, which is frequently overlooked.

The tendency to-day is to install totally enclosed iron, or steel clad, oil immersed circuit-breakers for high and low tension, even for power house and surface, and underground sub-stations, &c. This is to be highly recommended in view of eliminating the possibility of contact with live conductors, the whole being surrounded by efficiently earthed metal cases. Oil switches should be large enough to open the circuit in safety under the worst conditions, which will probably be a short-circuit on the cables just beyond the switch. It is good practice to standardise oil switches for certain ampere and volt capacities, the rates being the same for 600 and 3,000 volts. Of course, the current transformers, trip coils, and meters are made to suit each individual feeder. For safety, the ideal gear is a draw-out panel, as this is specially recommended as affording the maximum protection to life. A clear understanding of the apparatus by those who are permitted to operate the gear is necessary. All electrical apparatus should be treated as if it were alive until positive proof is obtained that it is all dead. The writer has known cases of one-phase contact of an oil switch remaining in contact after the switch has operated. It is, therefore, best to install isolating links between line switches and apparatus in order to ensure maximum safety. There is room for improvement still in some designs. Some makers adopted alternative methods for cable leading in and out. Fig. 7 (p. 150) shows a good design which can be adapted to suit different conditions. In some makes it is only possible to lead in at the top, in which case a large bend in the cable has to be provided, which necessitates a great height of switch house, and which is impossible in some underground positions. Fig. 8 shows cable boxes standardised by the author in connection with switchgear, these being for types as shown.

The subject of standardisation of switchgear for mining work is one that deserves special mention. The writer suggests that this institution should endeavour to bring about standardisation of trailing cable plugs and sockets for portable machines and gate-end switches, &c. The author, when inquiring for switchgear, has often been informed that his requirements did not meet with the maker's standard design, with the result that gear has had to be purchased and altered on site. The use of discriminating leakage protective gear is to be highly recommended for mining purposes. The author has dealt fully with this subject in a paper read before the A.M.E.E. (see Vol. 4). There is a feeling that these are complicated devices, but this is not the case; current transformers and trip coils of the standard gear can be used, the only additional device being the relay, which is a very reliable piece of apparatus. The author favours the auxiliary source of supply for tripping purposes.

In connection with leakage trip gear, it is the writer's practice to install neutral point switches in conjunction with leakage indicators, so arranged that the leakage indicator is inoperative when the neutral switch is closed.

The use of liquid controllers has become greater of late, while they have, no doubt, their advantages as regards flexibility of control, they have their disadvantages for use while on auxiliary haulages in-bye in mines, owing to the amount of water required. In some cases they have been introduced in order to reduce the number of cable leads that require to be mechanically protected, but the writer's practice is to install metallic resistances, oil and air cooled with oil-immersed controllers of type as per fig. 8. Instances may

* *Proceedings*, South Wales Institute of Engineers. Vol. 34, No. 2. Abstract.

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be given of fairly large sizes where the cost of renewals has been practically nil for two years. With such types care has been taken to have contacts of liberal capacities, and care should also be taken that all such are in alignment, which is very important for the efficient working of such controllers. Interlocked type of control gear is highly recommended for all works and colliery practice.

It is necessary to rigidly define the requirements and conditions under which such apparatus has to work, otherwise short-time ratings are offered, which are cheap to buy, but most expensive to maintain. The contactor system of control is worthy of serious consideration for the control of large A.C. motors. It has numerous advantages over liquid starters when full speed of the motor is obtained. For instance, when the last rotor switch closes the motor is mechanically short circuited. This is a great advantage, because it

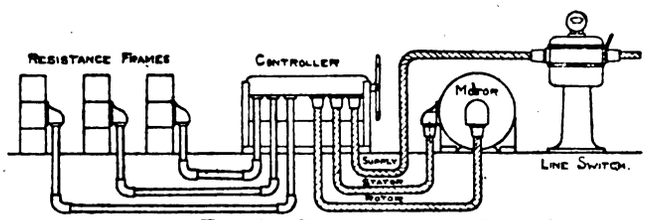


Fig. 8.—Controller and Cable Boxes.

is impossible to work with a less slip with liquid resistance than about 10 per cent. Contactors are very reliable and handy apparatus.

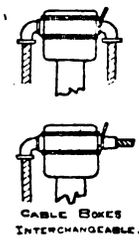
It has occurred to the writer that standard connecting socket plugs suitable for making quick connections for use with watt meters, power factor meters, &c., on motor line panels would be of great service in order that such measurements may be taken by a person on his routine periodical examination of electrical installation without having to make temporary connections, which is most difficult with fool-proof gear. It is also essential to give greater attention to the electrical conductance of metal parts and cases of instruments. It is quite common to find heavy current motors, line panels, controllers, &c., delivered with very small earthing lugs, and 3/16-in. and ¼-in. set pins supplied to secure them to the frames.

Earthing is now recognised as a necessary and important factor in connection with colliery electrical installations. A good method of earthing is to use three plates connected together to a common bus-bar to many circuits; by disconnecting from the bus-bar it is easy to make tests. The wires and connections to the earth plates should be insulated to obviate corrosion and to have an ammeter and voltmeter with, multiple-way switch, and so arranged that tests between plates may be easily effected. A good motto is to consider a broken earth wire as serious as a bare conductor.

It is very necessary that all persons in charge of electrical apparatus should be trained, and all men operating switchgear and other electrical apparatus should be properly instructed by an electrician as to the proper handling of same.

In order to obtain the maximum of safety, reliability, and economy in the installation and maintenance of mining electrical plant, colliery owners may well be advised to obtain practical and technical men, with good organising abilities, to advise them concerning their requirements, as by defining the requirements rigidly, quotations can be properly compared. One of the ways of gaining knowledge is to share with others what knowledge we possess. We cannot live to ourselves. If progress is to be made in any sphere of life, it must be by combined effort, and this is now being recognised in every direction. The writer will conclude by expressing his very best thanks to the management of the Cannock Chase Colliery for permission to put forward photographs, &c., and to others for assistance in connection with the paper.

Discussion.—In the course of his reply to part of the comments upon his paper, the author said that, with reference to the requests of Mr. Watkins and Mr. Forrest for more information in regard to the static condensers, he had not had the slightest trouble with any of the sets since their installation. The switch controlling the condensers from the bus bars was of the oil-immersed type, fitted with charging resistances on the contact finger. The efficiency of the condenser at ordinary frequencies and temperature could be safely accepted as 99.5 per cent. The condensers were made up of a specially selected tinfoil applied to a very thin tissue paper. The dielectric consisted of several layers of special interleaved tissue paper, and the whole was immersed in best quality oil. They were built in units of about one microfarad—the units being assembled in a strong, sealed metal case in such number as were required to make up the total microfarad capacity. The temperature rise did not exceed 20 deg. Fahr. He (Mr. Jones) was glad to inform the members that these condensers were now in satisfactory use on 3,000-volt circuits—a fact which should greatly assist engineers in improving the power factor of their systems. It would be noticed that lamps were used on the sets shown in the paper, in order to dissipate the charge which might be left in the condenser on switching off. The makers had now designed a special oil switch, by which the condenser was switched on or off through these resistances. As to the question of costs, the following might be of use: To improve the power factor of a 500-kw. load (working at 3,000 volts, 50 periods) from 0.6 to 0.9 a capacity of 1,500 microfarads would be required, having an output of 424 k.v.a. The cost would be £1,350, complete with switchgear. If the condenser was required to deal with a similar load, but 25-period instead of 50-period, its cost would be approximately double, as the amount of capacity required was inversely proportional to the frequency. For a 600-volt circuit the cost was approximately the same as for a 3,000-volt circuit. In the case of the power factor of a 40-h.p. motor working at a load of, say, 33 kw. and a power factor of 0.5 to be improved to 0.95, the capacity required would be 400 microfarads and the cost would be £50. If the motor was working at a power factor of 0.65, a capacity of 240 microfarads would be required—price, £48. As a power factor of 0.95 was higher than the usual specification, the following might be of interest: To improve the power factor of the load referred to from 0.5 to 0.9, the capacity required would be 270 microfarads, and the cost £54; or to improve from 0.65 to 0.9, 190 microfarads, at a cost of £38. It must therefore be seen that the difference in capacity to improve from 0.9 to 0.95 was very considerable, and the advantages gained might, in most cases, not be worth the increased expense. Replying to Mr. Watkins, who agreed with earthing the neutral thoroughly, but suggested that the main plant should work insulated, Mr. Jones thought this was not to be recommended in view of the fact that all faulty circuits should be automatically made dead, which was provided for with earthed neutral systems and leakage-protective gear.



Mr. Jones was pleased to hear that Mr. Forrest agreed with reference to earthing the neutral; his own practice was to put artificial faults on periodically, in order to test the system under working conditions as near as possible. It was erroneous to think that, once automatic protective gear was installed, less supervision was required.

REVIEWS.

Essentials of Electrical Engineering. By J. F. Wilson, B.S., E.E. London: Constable & Co., Ltd. Pp. 345+viii; 282 figures. Price 10s. 6d. net.

The greater part of this work is devoted to the study of direct and alternating current dynamos and motors; lamps, accumulators, meters, and switchgear are also investigated, though in a less complete manner. In the preface and throughout the book the author lays stress on the fact that direct and alternating current circuits are governed by precisely the same laws, thus in chapter 1, which deals with the laws concerning the flow of current in simple circuits, we find from the first that stress is laid not only on the effect of resistance, but also on the effects of inductance and capacity. We notice here, by the way, that one definition given of the power factor of a circuit is that it is equal to $\cos \phi$; it is desirable to point out the limitation of this statement even at this early stage.

The next chapter deals with electro-magnetism and its allied subjects, and would be more valuable if additional matter had been included dealing more directly with calculations concerning commercial types of field magnets. Chapter III is devoted to the constructional details of direct and alternating current machines, the treatment being quite brief.

The operation of direct current machines is considered in a much more comprehensive manner, and forms a valuable section of the book. The Tirrill automatic regulator seems to be almost invariably introduced in books of American origin, and it is remarkable how frequently the treatment is unsatisfactory. Thus, in the present work, an application of the regulator to a direct-current machine is given on page 72, and the descriptive matter does not agree with the diagram. In the former the relay is described as being differentially wound, but on referring to the diagram a single winding only is shown. Later in the book another diagram is given, the relay this time being shown with a differential winding.

In the chapter on current rectifying apparatus particular attention is paid to the rotary converter, and an interesting account of the mercury arc rectifier is included; no special mention is made of the motor converter, a type of machine which has many advocates in this country.

Synchronous and induction motors are dealt with at length, and a brief chapter is devoted to single-phase commutator motors. Transformers are dealt with in an adequate manner, special attention being paid to the interconnection of multiphase transformers for converter working.

In regard to work not directly connected with machines, chapters are included dealing with lamps, switchgear, instruments, transmission circuits, and accumulators. Of these,

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the chapters on instruments and transmission circuits are by far the best, the former giving an account of all the types of instruments likely to be met with and the latter including some valuable formulæ and tables. The chapter on lamps is probably the least satisfactory, the proportion of the matter dealing with types which are little used or are tending to disappear being far too large and tending to exclude work dealing with modern filament lamps.

There are four appendices dealing with harmonic quantities, inductance, capacitance, and complex quantities respectively, and these form one of the most valuable portions of the book, since much useful mathematical work is included which is rarely met with in ordinary text books.

The examples with which most of the chapters are furnished may be commended as being of a most useful and practical kind.

In one or two sections (notably in machine-starting gear and lamps) there is a certain lack of information in regard to the most recent work and methods, this perhaps being accounted for by the fact that the preface date is now nearly three years old.

The figures are well reproduced, though in some cases they are on rather too small a scale, and the book is well printed on excellent paper.

The work may be well recommended to day and evening students who have a reasonable mathematical knowledge, and also to men engaged in power station and transmission work who desire to improve their acquaintance with the mathematical side of the subject.

Mathematics for Engineers. Part I. By W. N. Rose, B.Sc. (The Directly-useful Technical Series.) London: Chapman & Hall. Pp. 510; figs. 257. Price 8s. 6d. net.

This book forms volume I of an ambitious treatise in which the author intends to cover all the mathematical work needed by engineers in their practice, and by students in all branches of engineering science. The volume under review includes elementary and higher algebra, mensuration, graphs and plane trigonometry; it is intended that Volume II shall complete the work and include the calculus and its practical applications, differential equations, harmonic analysis, spherical trigonometry and vector analysis.

It may be said at once that Mr. Rose's book will stand comparison with the many excellent text books of practical mathematics which are already in use, and the impression obtained on a first perusal is entirely a favourable one.

The first chapters deal with indices, logarithms and equations with considerable thoroughness. A great number of examples are given, the majority of which, both worked and set, have a direct bearing on engineering practice. Mensuration is treated very comprehensively in a chapter of about 70 pages, and here again excellent series of set and worked examples occur. The subject is taken as far as the rules of Guldinus, and also includes a brief treatment of elliptical and parabolic figures. Chapters 4, 9 and 10 deal exhaustively with graphical processes including the plotting of functions and statistics, the determination of laws and the solution of equations. The work on the construction and use of various diagrams used in the study of heat engines, notably the P V and T ϕ diagrams, should prove useful to students of thermodynamics. Graphical methods as applied to the construction of practical charts, and particularly alinement charts, are given special attention in a separate chapter.

In chapter 5 algebra is taken as far as the progressions, and more difficult equations involving logarithmic computation are dealt with. The seventy excellent examples which close this chapter may be regarded as ideal practice for the engineering student who lacks facility in the use of logarithms.

The section devoted to trigonometry follows more original lines than the rest of the book. Much of it is beyond criticism, and there are many useful examples, but the author diverges seriously from common practice when he uses the north and south line as the standard line of reference and the clockwise rotation as positive. Were it only trigonometry that would be affected we could see little harm and some advantage in the change; but so long established a usage has naturally taken its place in other branches of mathematics, and we shall await with interest the author's treatment of polar co-ordinates to which the same conventions apply. We are of the opinion that the inevitable confusion that would result is far too high a price to pay for so little advantage. The sections and examples on complex quantities and vector multiplication should prove of value to electrical students.

The various methods of finding irregular areas are treated fully in Chapter 7, the theory of the planimeter being left for treatment in the second volume. A unique chapter on the calculation of earthwork volumes serves to provide examples in the mensuration of both regular and irregular figures, and incidentally to give much information of a practical kind to the engineer who may be called upon to tackle surveying and levelling problems.

A final chapter extends the algebra to partial fractions, limits, permutations and combinations, the binomial theorem and the exponential and logarithmic series. The mathematical tables at the end of the book include four-figure logarithms, Napierian logarithms, natural and logarithmic trigonometrical ratios, and exponential functions. There are also answers to all the numerical examples and an index.

There is very definite evidence throughout this book that it is the work of an actual teacher who knows exactly where difficulties are likely to arise and how to elucidate them. The practical nature of the examples is also a recommendation, and altogether we are inclined to regard Mr. Rose's attempt to write a really practical book on sound theoretical lines as a distinct success. It is certainly worthy of careful perusal by teachers of practical mathematics.—P.H.S.K.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

12,725. "Electric cable conduits and their fittings." W. H. Beresford and J. McDougall. August 6th.

12,749. "Accumulators, storage batteries, &c." J. F. Hutchison. August 6th.

12,750. "Sparking plugs, &c., for internal-combustion engines." H. V. J. Jouffret. August 6th. (France, April 25th.)

12,765. "Dynamos for production of uniform continuous current." Eversshed & Vignoles. August 6th.

12,828. "Recording apparatus for electric current impulses." British Thomson-Houston Co. (General Electric Co., U.S.A.) August 7th.

12,839. "Magnetos for internal-combustion engines." A. Anzani. August 7th. (France, August 7th, 1917.)

12,869. "Automatic telephone systems." Automatic Telephone Manufacturing Co. August 8th. (U.S.A., October 13th, 1917.)

12,877. "Electric power systems." British Thomson-Houston Co. (General Electric Co., U.S.A.) August 8th.

12,932. "Electric incandescent lamp fittings." J. T. Jackson. August 9th.

12,949. "Automatic telephone systems." Automatic Telephone Manufacturing Co. August 9th. (U.S.A., September 19th, 1917.)

12,959. "Dynamo-electric machinery." J. H. St. H. Mawdsley. August 9th.

12,960. "Electrolytic method of cleaning iron or steel." Q. Marino. August 9th.

12,963. "Automatic regulators for dynamo-electric machines." British Thomson-Houston Co. (General Electric Co., U.S.A.) August 9th.

12,968. "Magneto-electric machines." B. Wolkoff & W. Wolkoff. August 9th. (France, August 9th, 1917.)

13,024. "Electric furnaces." T. Rondelli. August 10th.

13,025. "Holding electrodes in soldering and depositing metals by electric arc." E. H. Jones & Alloy Welding Processes, Ltd. August 10th.

13,026. "Manufacture of electrodes for soldering and depositing metals by electric arc." E. H. Jones & Alloy Welding Processes, Ltd. August 10th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

9,339 Terminal-box electrical cable or conductor insulators. British Insulated & Helsby Cables, Ltd., and R. W. Bladen. June 29th, 1917. (117,478.)

10,119. Means for the production of high-voltage discharges. N. F. S. Hecht and Creed & Co. July 12th, 1917. (117,480.)

10,317. Illuminating devices containing electric incandescent lamps. British Thomson-Houston Co. (General Electric Co., U.S.A.) July 17th, 1917. (117,490.)

10,443. Device for guiding the trolley pulley of an electric car into contact with its overhead wire. E. B. Moyse. July 20th, 1917. (117,498.)

10,448. Electric radiators. Simplex Conduits, Ltd., & L. M. Waterhouse. July 20th, 1917. (117,499.)

10,694. Electric drilling apparatus. H. Scholey & F. K. Woodroffe. July 25th, 1917. (117,505.)

10,843. Electric batteries. Syndicate Graaman's Patent. July 29th, 1916. (108,482.)

13,407. Liquid rheostats. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) September 18th, 1917. (117,532.)

13,441. Apparatus for the electrolysis of water. K. Kimura. September 20th, 1917. (117,533.)

13,788. Sparking plug for internal-combustion engines. M. Ferraris. September 25th, 1917. (117,537.)

13,990. Lanterns for incandescent electric lamps. H. T. Wilkinson and Wardle Engineering Co. September 28th, 1917. (117,538.)

14,025. Telephone exchange systems. Western Electric Co. October 11th, 1916. (110,354.)

15,228. Electric time relays. A. Englehard, and Soc. Automatisme et Appareillage. October 19th, 1917. (117,546.)

16,906. Thermo-electric generator. M. Peleumer. October 28th, 1916. (111,489.)

16,943. Electrically-heated sheets, rugs, mattresses, foot-warmers, and the like. C. S. Davidson. November 17th, 1917. (117,559.)

1918.

8,749. Terminal for the attachment of magnetic wires to sparking plugs of engines. E. Marazzi. March 21st, 1917. (116,496.)

Sweden.—Quite a number of companies, mostly small, have lately been formed in Sweden in connection with the supply of electricity for lighting and power purposes. Among them are the Landtbrukarna Elektrisk Aktiebolag, of Hallsberg, maximum capital, £28,000: the Asheda Electricitetsverk Aktiebolag, of Asheda, maximum capital, £2,800: the Massbacken Elektriska Aktiebolag, of Massbacken, maximum capital, £6,400: and the Edsbyns Electricitetsverk Aktiebolag, of Edsbyn, maximum capital, £3,400.

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THE

ELECTRICAL REVIEW.

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A GERMAN REDUCTION AND A BRITISH MORAL.

WE have not hesitated to give our support to reasonable demands for increased wages and salaries required to enable the production of war munitions to be satisfactorily maintained. It is deplorable, however, when demands are made which are not due to the altered cost of living, but are the outcome of differences of opinion among the workers as to the rights or merits of competing classes. Not less deplorable is it when organs of great influence foster the belief that all the workers have to do is to ask and they will receive. While we favour better pay up to a certain point, we believe that the utter prodigality which is present in the payment of wages and bonuses in many parts of the country just now is adding immensely to the industrial difficulties of the post-war period. We have no means to suggest whereby any alteration can be introduced at the present juncture; indeed, while the cost of certain articles of food continues to soar there will also continue a pretext for new demands. But there must come an end to these high wages sooner or later when the volume of war work falls away. They will not, in industries that we represent, fall to pre-war figures, nor does anybody wish them to do so, but the present high rates of pay are practically certain to leave a shadow over industrial conditions when we return to competitive and commercial days. The sooner the brake can be applied without too great friction, the better it will be for all in the future. Many will be the factors contributing to ultimate decrease—whether it come gradually or suddenly—and the process of readjustment will bring a multitude of problems in but this single connection.

Although wages are still rising in this country owing to the continuation of high-speed production of war requirements for our Allies and for ourselves, it will be well if those who are responsible for Labour movements acquaint themselves with what is happening in some parts of Germany even now.

It may be that reduction of wages of people already overburdened with the high cost of living and short of many of the necessaries of life will be one of the last straws which will bring about the end of the war, but the German people is still living under the accumulated influence of long years of State discipline. Be these things as they may, it is a fact, if we are to believe the *Vorwärts* of July 2nd, that various munition works in Germany report reductions in wages.

It is stated that the managers of the Gartenfelde Powder Mills, a branch of the Siemens-Schuckert Works, "have struck a violent blow at the existing wage rates." For some reason or other, there are "fewer orders and lower prices," and in consequence notice was issued on June 27th announcing that the said managers were "reluctantly compelled" to restrict their output and to introduce a "slight reduction" in wages as from July 1st, when the rate, compared with the old scale, would be as 5 to 7. A similar reduction here would mean that a wage would fall from 70s. to 50s. per week. We should like to think that such a drop would be accepted with a good grace when, if ever, it became necessary here. This rate of reduction is, of course, considerably less than the war-time increase; but its introduction while prices remained high would be sure to raise a pretty considerable storm. We have had a small experience of labour demobilisation already, when some thousands of women who were no longer required to work upon a particular class of munitions could not be found other occupation without a period of waiting. When the war is near its end the Ministry of Munitions will not find it so easy to negotiate such positions, for there will be no other branch of war requirements to which to transfer employés.

The peculiarity about the Gartenfelde development

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is that it is attributed to the lowering of contract prices. The *Vorwärts* calls this an "excuse," and in absence of the full particulars, a wage reduction of the proportion mentioned would seem to indicate a very considerable drop in contract prices, unless the volume reduction is large. In view of the big profits that have been made in Germany, where the manufacturers have been highly favoured with freedom from special taxation, the event has a slight trade significance. They have been able to build up huge reserves, which are labelled for "After-War-Trade" purposes, and many millions of marks have been invested in German War Loan. Now the *Vorwärts* suggests that the said manufacturers, "after the enormous profits that they have made," could "accept lower prices without feeling it"! Does that mean executing future war and other contracts at a loss in order to remunerate Labour, or does it mean drawing upon those reserves? Labour could hardly advance such a suggestion here after all the Excess Profits taxation that British works have had to carry; but we do well to note the German circumstance. It may be that German manufacturers will not find those immense reserves of very great value when they want to realise them for After-War-Trade schemes. Perhaps they will be not more than much depreciated little "Scraps of Paper," for Nemesis is relentlessly on the track of the Wrong-doer. If the German workers' claim for war profits to be disgorged were to become general, there would not be even those depreciated "scraps" left. Germany has to pass through more serious economic crises than have yet arisen; the whole future in that respect is very uncertain. The complaint of the *Vorwärts* is that "it is not fair on the workers" to suppose that "at a time when every commodity is becoming dearer, they should put up with a 30 per cent. reduction of wages." We rather fancy that such language is mild compared with what will one day be heard from the hungry workless multitudes of Germany. The shining sword of the War Lord is already failing to maintain the spirits of the industrial and trading classes, who contemplate the closing of thousands of factories and the emigration of the people, because the Civilised World is economically, as well as militarily, against Prussian Militarism and all its works. What will follow? Low wages with which the people will struggle to compete with the workers of such industrial nations as our own, whose wages even now continue to rise? The Allies must have their safeguards. This is no time to talk of the compassion of the Victor—we have to win the war.

Does not the foregoing episode of what is happening in Germany suggest the crying need for cautioning the industrial workers of England to be prepared for the less prosperous conditions that are developing in the womb of time? The profiteer in every department of activity will yet reap his reward, be he munition worker, adventurer, or capitalist. By whatever process that may happen in the case of the others, it will come as a self-imposed burden on the big wage-earner who spends excessive earnings with extravagant freedom, forming habits which the future will not be able to maintain. When the *Times* urges that Labour be given anything it pleases to ask for, does it not recognise that it is putting an axe at the very root of the industrial tree?

The A.E.G. and Manufacturing in Sweden.

The manufacture of electrical machinery and accessories in Sweden has undergone considerable development in recent years, the object being not only fully to satisfy the demand in the home market, but also to stimulate the export trade. According to the report for 1917 of the Allmänna Svenska Elektriska A.B., the company had on hand orders representing a value of £1,648,000 at the end of last year, and at the recent general meeting Mr. J. S. Edström, managing director, explained that the stock of orders had increased, notwithstanding the reduction in the value of the exports. The reason was to be found in the fact that the country's own requirements in electrical machinery and plant were now greater than at any previous period, as the use of electricity was extending in a measure which no one could have foreseen. It was, therefore, necessary for the company to exercise its forces as far as possible, in order to meet the demands made upon it. The question of raw materials represented a difficulty, but for a time the company had been fortunate in covering its needs by means of purchases from America and Russia, and at the same time great efforts had been made to render the undertaking independent of imported raw materials. It would, however, the directors stated, no longer be possible for the company to manufacture exclusively with the use of Swedish raw materials.

Another side of the question is represented by the announcement that the Elektriska Aktiebolag A.E.G., of Malmo, which is a subsidiary of the Berlin A.E.G., proposes to erect large works at Malmo harbour for the production of machines and transformers, at an estimated expenditure of £439,000. The Conservative newspaper *Allahanda*, which characterises this scheme as a menace to the position of the Swedish industry, states that the reason for the project lies in the import duties on machinery. Yet the promoters, it is said, can obtain from the Berlin company cheap machine parts upon which the duties are low, and also procure Swedish raw materials, which are superior. But the principal object of the proposed new undertaking is declared to be the production of machinery for export to Russia and South America, where the Swedes already have found a market, and where further competition would be encountered from this source in addition to that directly undertaken by German firms in the past. Despite declarations to the contrary, the newspaper submits that it is not certain that the company will not seek to conquer the Swedish market, and notwithstanding the increased strength gained in Sweden through the amalgamation of firms, it is suggested that both the electrical industry and the Government have every reason to devote the greatest attention to the plans of the A.E.G.

Hydro-electric Power.

In our last issue we concluded an abstract of the Report of the Water-Power Committee of the Conjoint Board of Scientific Societies on the water-power resources of the British Empire, which are shown to be of immense potential value; to-day we give an account of the development of the undertaking carried out by the Government of New Zealand at Lake Coleridge, showing how quickly a cheap supply of electrical energy is snapped up by an enlightened population, and how diversified are the innumerable applications to which it is put. These articles relate to the major water-powers; but the minor waterfalls are not to be ignored, for they also have useful functions to fill, and within their natural limitations they are just as effective in economising fuel and labour as the larger ones. What can be effected in this direction is admirably exemplified in our columns to-day by Mr. Thos. Smith's account of the work accomplished in Wales, where a single firm has covered the map with small installations, mainly on farms. No doubt there are very many more of the same kind—if not, there ought to be.

We have on previous occasions pointed out that, while this country is not blessed by Nature with many large water-powers, there are numerous opportunities for harnessing waterfalls of small capacity, the energy derived from which can be advantageously employed in the vicinity. The urgent necessity of employing mechanical power on farms needs no demonstration; the alternative to using water power is the consumption of fuel in some form, usually oil or petrol, both of which occupy cargo space which is so precious now. Hence, as Mr. Birks remarks in connection with the Canterbury scheme, the use of water-power to replace these fuels has an increased importance from the national point of view, while the fact that electricity is the only medium by which this can be done renders the subject of immediate interest to the electrical industry. Moreover, there is no source of power which is so easily controlled by the non-technical user. At the same time, the development of these small powers will assist our turbine makers in preparing to tackle the large ones in Greater Britain. We trust that in the future, with more intelligent co-operation between the Government, the financial world, and the *British* manufacturer, the harnessing of Imperial water-powers will be secured to this country—too often in the past such work has been thrown into the hands of foreigners by the short-sighted policy of our financiers and the contempt of Government Departments for British industry.

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HYDRO-ELECTRIC POWER IN CANTERBURY, NEW ZEALAND.

We are indebted to Mr. Lawrence Birks, B.Sc., M.Inst.C.E., M.I.E.E., electrical engineer to the Public Works Department, Christchurch, New Zealand, for the following particulars regarding the development of hydro-electric power in Canterbury, using the waters of Lake Coleridge.

The first proposal of this nature was put forward by Mr. A. D. Dobson in 1899, and contemplated the derivation of 5,000 KW. from the Waimakariri River, for the supply of Christchurch 30 miles away, at 30,000 volts; but the

Fig. 1.—View of Lake Coleridge, showing the Intake.

Government took up the matter, and the scheme assumed more imposing dimensions, becoming of provincial importance. Consequently, a much larger source of power had to be sought, and this led to the investigation of the capabilities of Lake Coleridge by Mr. P. S. Hay, then Engineer-in-Chief, in 1904. A partial supply of electricity had been provided by the Christchurch City Council from a refuse destructor in 1903, in which year Mr. Birks was appointed City Electrical Engineer, and the demand rapidly developed, necessitating extensions within the second year. The outlay on the City plant grew from £12,360 in 1904 to £88,691 in 1913, when the output had reached the value of 1¼ million units per annum, and the plant capacity was 950 KW.

The Tramway Board in 1905 started its own power station, which was equipped with three Curtis vertical 500-KW. turbo-dynamos; these machines are remarkable in that they are said to be the only D.C. sets of this type which have run for years, fully loaded, without the slightest hitch. In 1910 a horizontal 1,000-KW. set was added.

In that year it was decided that the City Corporation should retain the distribution of electricity within its area, and that the Government should develop the water-power scheme, supplying local authorities, &c., in bulk. By an Act passed in August, 1910, the Government was authorised to borrow £500,000 for the development of water-power throughout the Dominion, and in the following year Mr. Evan Parry, B.Sc., A.M.Inst.C.E., M.I.E.E., was appointed chief electrical engineer to design and carry out the works. In 1914 the Lake Coleridge installation was completed and put in operation.

The city system was supplied by means of two rotary converters, providing a load of 1,000 KW. for the water-power plant from the first day of operation. The output or 1916 was nearly five million units, but the large power users cautiously waited to see whether the system would prove satisfactory, so that about a year elapsed before the load began to go up rapidly. The output for the second year of operation was over 14 million units.

The Lake Coleridge power plant was designed for an ultimate capacity of four generators of 1,500 KW. capacity each and two of 3,000 KW. capacity each. Of these, three sets were erected and put into commission at the opening. The growth of the demand for power led to the installation of the fourth set, which was put into service in March, 1917, making a total installed capacity of 6,000 KW. A fifth set, of 3,000-KW. capacity, is now on order, but owing to war conditions it has been found impossible to get delivery of the steel for building the necessary pipe line. The rising prices of coal and gas have stimulated the demand, and in the meantime a definite restriction has had to be imposed so far as the consumers of day power are concerned.

Lake Coleridge has an area of about 13 sq. miles, lying at an elevation of 1,667 ft. above the sea, and at a distance of 65 miles almost due west of Christchurch. At the eastern end the Rakaia River bed is 500 ft. below the lake level, and less than 2 miles distant from the lake shore, giving an ideal opportunity for the development of hydro-electric power. The available power for future development is very high, running up to 20,000 KW. of continuous load, or 40,000 KW. on a 50 per cent. load factor.

From the lake the water is taken through the ridge separating it from the Rakaia River by a submerged tunnel, 7,000 ft. long, 8 ft. high and 8 ft. wide. The water is delivered into a surge-chamber, 35 ft. in diameter and 33 ft. deep. This is provided with four outlets, each with substantial cast-iron gates. Two pipe-lines are now in service, each 52 in. in diameter and 2,480 ft. long, and each capable of supplying 3,000 KW. at a working head of 480 ft. Provision is made for two similar pipe-lines, thus developing the tunnel to its full capacity, and involving the installation of 12,000 KW. of plant.

The power house is a substantial ferro-concrete structure, 180 ft. long, 70 ft. wide, and 40 ft. high, and is built complete to house the whole 12,000 KW. of plant. The

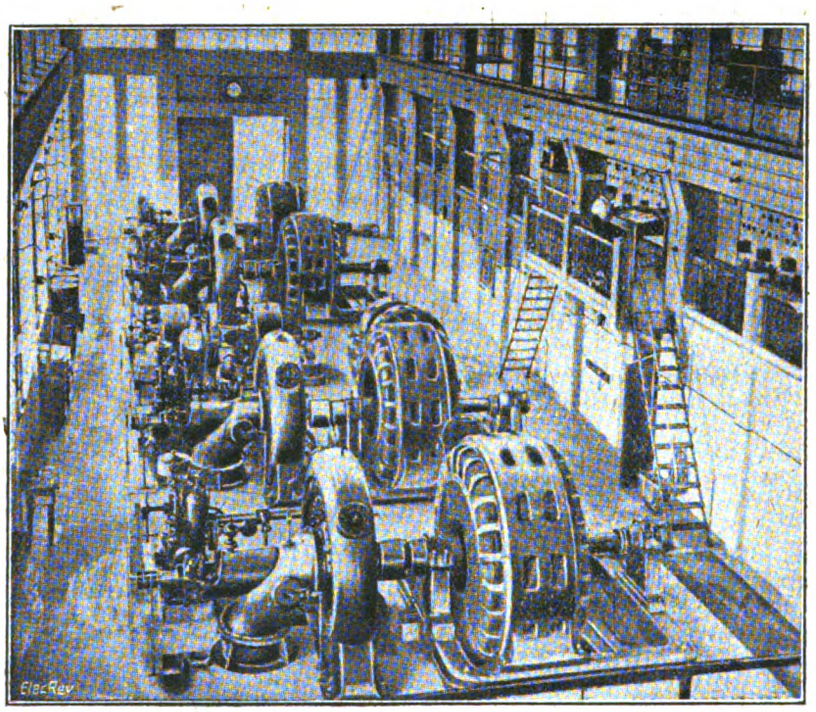

Fig. 2.—Interior of Power House.

two existing pipes supply four Francis turbines, coupled to 1,500-KW. alternators. Complete switchgear is provided, with remote-control oil switches for each circuit. The pressure is raised for transmission to Christchurch by means of two banks of step-up transformers, each bank consisting of three 1,500-KW. units, raising the pressure from 6,600 to 66,000 volts, at 50 cycles per second.

The power house is also provided with complete lightning-

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arresters, travelling-crane, compressed-air system, transformer-oil drying and filtering systems, machine shop, fitters' shop, blacksmiths' shop, stores, and garage.

The staff is provided for with 16 cottages, all equipped with complete electric lighting, heating, and cooking systems. A suitable school, a small farm, and an extensive plantation have been provided.

From the power house the energy is conveyed to Christchurch over two independent transmission lines, each 62 miles long, and terminating at the main distributing station at Addington. The poles are 42 ft. long, standing

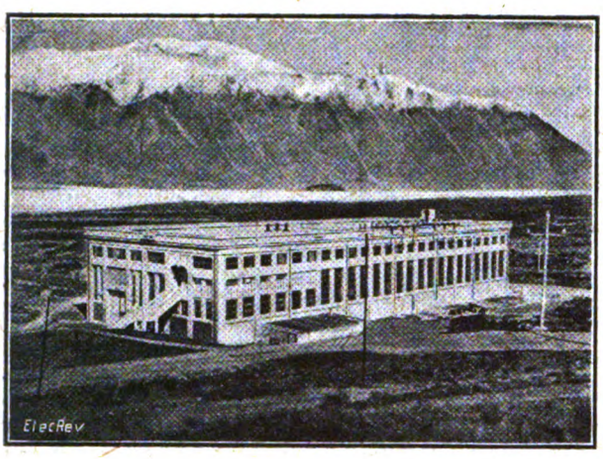

Fig. 3.—Power-house Building and Rakaia River.

36 ft. out of the ground, and spaced on level ground about 400 ft. apart. One span is as long as ¼ mile, and has given no trouble.

The lines consist of three cables per circuit, each cable being 7/·135, or one-tenth of a square inch of aluminium. A metallic telephone circuit is carried on each line, with telephone huts every 5 miles; each hut is equipped with line material and tools, thus serving as an emergency depôt, in which capacity they have proved invaluable.

The transmission lines are not yet tapped at any point *en route*, supply only being available hitherto on the primary feeders going out from the Addington distribution station.

For the first few months the lighting load exceeded the power load, but now that the larger factories have been converted to electric driving, the day load—8 am. to 5 p.m.—considerably exceeds the evening lighting load. The peak is usually between 8 and 9 a.m., being determined by the tramway load. There is a drop of about 1,000 kw. at mid-day for the lunch hour. The most striking feature of the load-curve is the high load-factor, which ranges on the weekly output up to 61 per cent.

At the main distributing station the pressure is transformed down to 10,500 volts, at which it is distributed over six primary distributors, each in duplicate and of 1,000-kw. capacity. Underground cables are employed in the city area, and overhead lines to outlying sub-stations, two of which are respectively 19 and 23 miles distant.

The Christchurch City Council purchases energy in bulk from the Department at 10,500 volts pressure, providing its own transforming and distributing stations, at which the pressure is reduced to 400/230 volts, three-phase, for retail supply. The peak load on the city mains in June, 1917, was 2,200 kw., of which 2,000 was supplied from Lake Coleridge, and the balance was taken by the city's own generating plant.

On the introduction of hydro-electric power in the city the Council's average charge for light was reduced from 5d. to 3d., and for power from 2½d. to 1d., with wholesale power rates down to ½d. for ordinary day work and to ⅛d. for night work.

In two years after a regular supply was obtained from Lake Coleridge the demand within the city had gone up from about 700 kw. to 2,200 kw., and was still increasing rapidly. During the same period the number of consumers within the city had gone up from 1,625 to 3,877, of whom 22 per cent. paid less than 3s. per month and 33 per cent. less than 4s. per month on the average. Electricity in Christchurch is thus distinctly the "poor man's light."

The next largest consumer is the Christchurch Tramway Board, with a normal day load of 1,400 kw. The effect of the introduction of Lake Coleridge power has been to reduce the cost of power for operating the tramways by over £2,000 a year, although the steam plant previously used was of a highly efficient type.

The next largest consumers consist of three large freezing works; their load consists mainly of large freezing motors of 100 to 500 h.p., running on a seasonal load from December to about July in each year, but running 24 hours per day during most of the killing season. They also have a general day motor load of 100 to 200 kw. during the killing season, falling off very much during the slack season.

The freezing industry thus leaves a slack period of four or five months from July to November, in which about 600 kw. will be available for the development of suitable industries, the operations of which can be adjusted to suit the slack season at the freezing works, and should consist in the working-up of their by-products by electrochemical methods, or of other electrochemical processes. Owing to the fact that the industries are already paying for the power they use in the killing season, it will be possible to continue this supply throughout the year for such purposes at a very small increased charge.

All the flour mills within reach of the present mains are taking a supply. The price at which energy is available from Lake Coleridge has enabled the cost of milling power to be reduced from about 4s. 6d. to about 2s. per ton. Moreover, the absolute uniformity of speed and rotating effort of the electric motor as compared with the steam or gas engine has made a great improvement in the operation of the milling machines, and there is a strong demand for extension of the mains to other milling centres.

Five out of eight tanneries and fellmongeries in the district, apart from the freezing works, are now supplied, and the other three will be connected up as soon as power is available.

All the dairies and butter factories within reach of the mains are now supplied, in spite of the necessity of raising steam for pasteurising, scalding, and washing. For separating

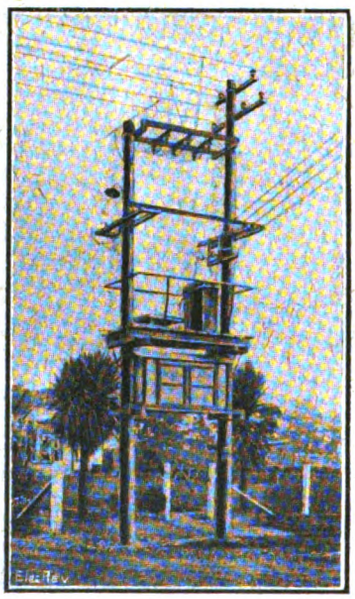

Fig. 4.—Sockburn Pole Sub-station—a typical cheap out-of-door Sub-station on 10,500-volt Line.

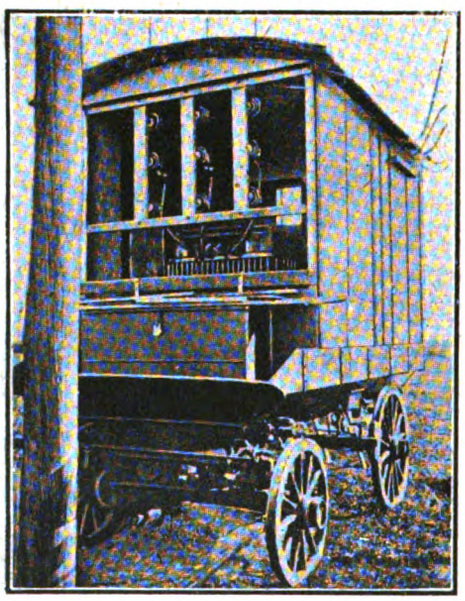

Fig. 5.—Portable Sub-station (50 kw.) for Builders, Farmers, and others requiring a Temporary Supply.

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and churning, the steadiness and uniformity of speed are of great advantage as compared with the steam engine. For milking machines the ease of starting and stopping, and the unattended operation of the motors, as well as the cheapness of the power as compared with petrol and kerosene fuel, determine the matter without question, and are making quite a revolution in dairying matters wherever the mains are accessible. A most striking development has been the success of the Tai Tapu Dairy Co. This company buys power in bulk for operating its butter factory in Tai Tapu, and also reticulates the district for retail distribution to its suppliers and consumers within its district. There are now 14 miles of 3,000-volt and 6 miles of low-tension line, supplying 76 consumers, including 25 milking machines. The financial results have been very satisfactory to all parties—the farmer, the dairy company, and the Department; production has been stimulated, and one of the comforts of the city has been carried out to the hard-working dairy farmer.

Two large quarries, three large brickyards, and one pottery are now driven by Lake Coleridge power, and others are waiting for a supply. In these cases the large instantaneous overload capacity of the electric motor is of the utmost value. It is found in nearly every case that the former engines were very much overpowered for their average work, owing to the necessity of their carrying an occasional overload without stopping, which the electric motor does without difficulty.

Six hospitals and similar institutions are supplied from the mains, in most cases on the maximum demand system, at £1 per month per kilowatt of maximum demand. This enables them to utilise the energy for a wide range of purposes with the highest economy. If used for lighting only, for an average of, say, 1,000 hours per year, it works out at under 3d. per unit. But up to the lighting capacity the energy can be used on this scale at other hours of the day at no additional cost. It is thus available for heating, cooking, refrigerating, pumping, milking, shearing, chaff-cutting, sawing, sewing, and ironing and other laundry work. Between 10 p.m. and 9 a.m. it is used for hot-water heating, at no additional cost. At Sunnyside Hospital, by combining all these operations and keeping a graphical record of the demand by means of a curve-drawing watt-meter, the energy is obtained for all purposes at a rate below two-thirds of a penny, which still yields to the Department a satisfactory return of £1 per month per kilowatt of maximum demand.

The retail supply in the suburban and country areas is, as far as possible, handed over, as in the city, to the local authorities. Three of them purchase their energy in bulk through the City Council. The others are supplied from the Department's mains, with an arrangement under which the Department and the local authority share the gross revenue, the local authority undertaking the complete installation, control, maintenance, and management of the reticulation in return for its share of the revenue, and the Department simply supplying the necessary power in bulk. In these cases the Department installs and maintains the necessary sub-stations to reduce the pressure from 10,500 volts to 230 volts for retail distribution. These are usually small—10 KW. to 50 KW. capacity—and for this purpose a cheap type of outdoor-pole sub-station has been developed. For temporary service or for emergency supply pending the installation of a permanent sub-station, a portable van has been equipped with a 50-KW. transformer and high and low-tension switchgear, and has proved of the utmost value.

There are in all 13 local reticulations, having a total connected load of 17,083 KW.; the diversity factor is 4·38, and the load factor 54 per cent.

Marked economy in the use of coal in Canterbury has resulted from the operation of the Lake Coleridge plant. The coal consumption in the most efficient and well-designed steam plant in Canterbury—the tramway power station—was over 5 tons per horse-power year, working on about a 50 per cent. load factor. The ordinary small commercial steam plant consumes from three to five times as much coal as this, though, as its low factor is low—usually 10 per cent. to 20 per cent.—the owner does not, as a rule, realise how much coal per actual horse-power-hour it is using. It is found in practice that the average power actually used in small factories is usually from one-half to one-quarter of what the owner estimates. The average small steam plant on a 15 to 20 per cent. load factor actually uses 6 to 8 tons of coal per horse-power per annum; and thus the Lake Coleridge plant, replacing such plants and working up to a 50 or 60 per cent. load factor, saves 15 to 25 tons of coal per annum per horse-power of its useful output. The aggregate saving is estimated at 50,000 tons, worth £75,000 delivered into the coal bins, or £100,000 delivered into the boiler fires, and represents the labour of nearly four hundred men, who are replaced by 60 to 80 men engaged on operating and maintaining the Lake Coleridge power plant, distribution, sub-stations, and reticulation.

To some considerable extent the electric power has replaced kerosene and petrol instead of coal; but to this extent the saving is of even greater national importance, in that it has substantially reduced ocean and railway transport, and has reduced the national liability to foreign creditors by probably £10,000 per year.

There are about a dozen electric vehicles in use in Christchurch for various purposes, and provision is being made in anticipation of this number increasing to 500 or 600 in the near future.

Lake Coleridge power has already enabled sulphate of iron, formerly imported by the gasworks for purifying the gas, to be replaced by hydrate of iron produced from the old tins from the destructor. A further development of the same industry will yield an iron-oxide paint that was previously imported. Arrangements are being completed for the local manufacture of caustic soda and hydrochloric acid by the electrolysis of common salt by means of Lake Coleridge power. Another industry in which hydro-electric power will take an essential part is the manufacture of calcium carbide, and thence calcium cyanamide, ammonia, and all the important group of nitrogenous products, including explosives. Already preliminary work is being done on the direct electrolysis of water on the large scale to yield oxygen for acetylene welding and hydrogen for the hardening of fats.

In Australia it is found profitable to smelt steel by means of the electric furnace even with electricity generated from steam at a cost of ⅛d. per unit. The product is of such high grade that it is used largely for purposes for which brass and gun-metal were previously required. Such furnaces can be conveniently operated at night, the moulding being done in daylight. This makes it possible to supply the power for them at a very cheap rate—less than one-third the rate at which it pays to buy energy for the same purpose in Australia. At the present prices of scrap steel and Lake Coleridge power it will be possible to smelt high-grade cast-steels at substantially less than the pre-war cost.

In these and other directions the introduction of cheap hydro-electric power is already resulting in Canterbury in a step forward in industrial and economic conditions more far-reaching in their results than the most sanguine predictions.

WATER-POWER.

By THOMAS SMITH.

THERE is a tendency on our part, when dealing with the question of the development of water-power, to take into account the comparatively large units only, and to regard small rivers and streams as not worthy of consideration. We are, to a very great extent, led to this conclusion by the reports of the magnitude of the works carried out in Canada, India, Australia, and other parts of the Empire, together with the lack of information about what is being done in our own country. While we have to admit that in this country suitable sites for units of 1,000 H.P. and above are not very numerous, we are apt to fail to realise that it is not the large units of power only that matter.

Agriculture, an industry the importance of which is more keenly appreciated in this country than ever before, demands a very considerable amount of animal and human labour. During the last few years the application of power to farming operations has been very much extended, this being not only a benefit to the industry itself, but a source of important national economy.

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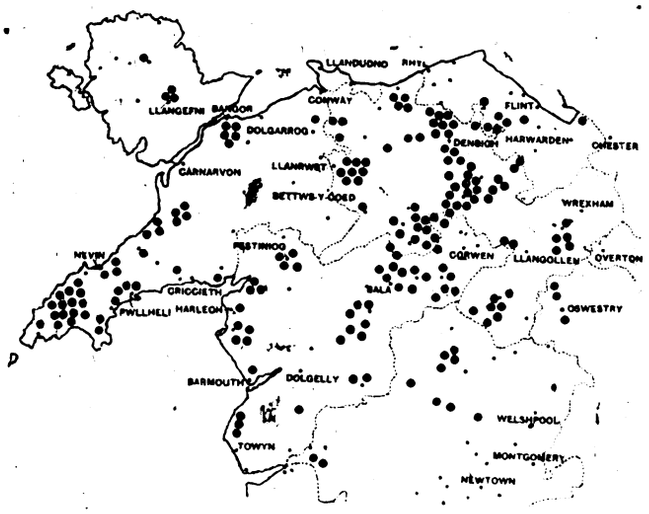
In this connection we have an opportunity of applying water-power in a direct manner, and on a very important, if small, scale. The turbines or water-wheels may be used for power purposes directly, or, what is much more profitable, for the generation of electricity for lighting, heating, power, and culture purposes.

If we omit traction and haulage work, we find that the requirements of the average farm comprising up to 100 acres are not more than 3 H.P., and that 10 H.P. will suffice for almost any farm. From available records of 234 British water-power installations used exclusively for farm purposes, it is found that the maximum horse-power of any unit is 9, and that the average is 3·6 H.P.

That North Wales is very much to the front in this particular work will be realised from the accompanying map. This shows what has been done by one engineering



Hydro-electric Installations on Welsh Farms.

firm during the past seven years. Messrs. Richards Edwards, Llanuwchllyn, with whom the writer is associated, have made a speciality of this class of work, and have carried out some very interesting installations.

The following table gives particulars of the installations put down between 1907 and 1917, and gives the sizes of the installations, together with the nature of the work for which the power is used :—

No. of installations.	Maximum horse-power.	Minimum horse-power.	Average horse-power.	Total horse-power.	Nature of work for which the power is used.
221	9	1	3·72	822	Farm power.
13	7	2	3·5	45·5	Farm lighting.
10	14	6	10	100	Corn mills.
8	9	1	3·75	30	Pumping.
6	16	7	11·2	67	Saw mills.
4	27	5	14	56	Public supply.
4	18	11	14	56	Quarries.
2	2	2	2	4	Pri. house lighting.
1	13	—	—	13	Bakery.
1	12	—	—	12	Clover mill.
1	8	—	—	8	Tannery.
1	5	—	—	5	Woollen factory.
1	2	—	—	2	Laundry.

The possibilities of this class of work are most extensive ; but under present conditions it is impossible to cope with even a very small fraction of the work in hand. It is to be hoped, however, that under the influence of the Water Power Committee, facilities will be granted to enable the work to be proceeded with, particularly in view of the necessity of increasing the output of our farms.

Engineman Fined.—For being under the influence of liquor while at his work, John Boyle, engineman, Irvine, was fined £5 at Ayr Sheriff Court. It was stated that he had ten pumps driven by electricity under his control, and was so much under the influence of liquor that he had to be taken away from his work.—*Scotsman.*

THE FARADAY SOCIETY.

The Society held its final meeting of the session on July 23rd, when a group of papers, mainly of metallurgical interest, was presented. Sir Robert Hadfield, the President, was in the chair.

The Chemistry of Aluminium—A New Aluminium Oxide.

Mr. John Rhodin, F.I.C., read a "Note on the Chemistry of Aluminium and Aluminium Alloys," which dealt with the sorting of various kinds of scrap, according to their aluminium content. The difficulty encountered was that there existed no direct analytical method of determining aluminium, and Mr. Rhodin has therefore evolved one, full details of which are given in his paper. It is based on the separation of aluminium metal from the oxide by dissolution in 10 per cent. Na OH_3, and subsequently dissolving the oxide in nitric acid. It must be added that the method was severely criticised by Dr. Seligman and Dr. Gwyer, but supported by Mr. Geitin, who claimed that it yielded reliable results in practice.

Of more general interest is Mr. Rhodin's claim to have isolated a new oxide of aluminium, $Al_3 O_4$. It is well known how rapidly aluminium sway or powder, and, more particularly that formed from the alloy duralumin, will oxidise in moist air. When the sway is melted the oxide is held in the melt, but the $Al_3 O_4$ is supposed to be soluble in the aluminium, and only to be detected by removing the excess of aluminium with an alkali. Another point of interest touched on by Mr. Rhodin is the use of specific heats as a guide to finding the composition of aluminium alloys. The method has not yet reached a practical stage, but it is promising enough to deserve further study.

A paper on the metallography of aluminium was presented at the same meeting by Mr. Robert Anderson, of Cleveland, U.S.A. The paper describes recrystallisation and grain-growth phenomena as observed to take place in rolled aluminium sheet or annealing, and it must be studied in conjunction with the photomicrographs printed with the paper. Generally speaking, aluminium is observed to behave much as other metals ; annealing restores the crystalline structure destroyed or distorted by mechanical working, but the process of recrystallisation is comparatively slow in the case of aluminium.

The Action of Sea Water on Reinforced Concrete.

The possibilities of reinforced concrete ships render the question of the action of sea water on the iron reinforcements a matter of great practical importance. Prof. H. J. M. Creighton, of Swaithem College, U.S.A., has been investigating this matter. He has embodied the results of his studies in a paper which he has communicated to the Faraday Society through the President. Of course, if the concrete is quite impermeable to water, no question of corrosion arises. As a matter of fact, in this country, as was pointed out by Dr. Desch, the quality of the concrete seemed to be such that whereas some reaction took place with sea water in the outer layers, the dense products prevented further penetration, and saved the reinforcements from corrosion. Striking examples adduced by Prof. Creighton, however, showed that this was not always the case. Once the sea water gets to the iron, electrolytic action is bound to be set up, and the large volume of the products, iron oxide and hydrated oxide, develops an enormous expansive force that causes great cracks to form in the concrete. The problem is, therefore, how to keep out the sea-water. Waterproof paints are not satisfactory, in Mr. Creighton's opinion, and he makes the striking suggestion to coat the concrete with a very thin layer of metal by means of the well-known Schoop metal-spraying process. It is to be hoped that this idea will be put into practice and tested on a practical scale. Such artificial protection, however, must not give rise to the use of inferior concrete ; and for the construction of ships it is essential to use a pure cement of fine pulverisation, low in alumina (which reacts in sea-water) and high in silica, absolutely free from lime, slow in setting and quick in hardening.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Combined Ignition, Lighting, and Engine-Governing Set.

One of the features of the automobile movement on the other side of the Atlantic which is also becoming prominent in this country is the increasing use of petrol motor tractors in hauling ploughs and other agricultural machinery. So extensive has the business in tractors become, that several of the concerns producing electrical fittings and apparatus for motor vehicles are now devoting attention to similar requirements for agricultural tractors. The Remy Electric Co., of Anderson, Ind., has lately introduced a device which not only provides for the ignition of the explosive charge in the engine combustion chambers and for the lighting of the vehicle when used at night, but also acts as an engine speed-controller or governor.

The governor acts on the following principle :—Any rotating apparatus which absorbs power must have at least two members, one rotating, the other stationary, the absorption of power being due to the reaction between the two. In order that the apparatus

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may absorb power, it is necessary by some means to resist the turning action on the stationary member. An electric generator absorbs mechanical energy, and changes a large proportion of it into electrical energy, the two essential members being the rotating part—the armature, and the stationary portion—the field. At a given armature speed, the tendency to turn on the part of the stationary field depends on the amount of mechanical energy absorbed, which in turn depends upon the amount of electrical energy produced. Therefore, by varying the output of electrical energy, either the resistance to turning or the speed at which this resistance will be realised will be varied.

In the new equipment this principle is utilised by having the stationary or field-magnet member rotatably supported, and the tendency to the rotation resisted by a spring of predetermined resilience. The field-magnet remains in its normal position until the speed of rotation has become such that the reaction between the field and the armature overcomes the spring, whereupon the field magnet commences to move in the same direction as the armature, the degree of movement being through an arc of 30°. A connection is provided between the generator and the carburettor throttle, whereby an angular motion in the same direction as the armature tends to close the throttle, thereby slowing down the engine.

If a different controlled engine speed is desired, it is necessary to change the magnetic strength of the field, and this is done by inserting resistance in the field circuit or cutting it out. With increased resistance in the field circuit the reaction at a given armature speed is less, so that the spring causes a retrograde movement of the field magnet, opening the throttle, and, by admitting more fuel to the engine, allows the speed of the latter to increase. On the other hand, with reduced resistance in the field circuit the reaction will close the throttle against the action of the spring.

The range of speed control is from about 500 revolutions to 1,500 R.P.M.

The generator employed is a simple shunt-wound machine. The current output is automatically controlled at, approximately, 6 amperes at all operating speeds. It is stated that 1½ amperes are utilised for ignition while the engine is running, and that 4½ amperes are constantly going into the battery. The motor for starting the engine is a separate unit.

B.T.H. Lever Switches.

We have received from the British Thomson-Houston Co., Ltd., Rugby, the new illustrated descriptive list No. 4110 on lever switches for main circuit, field, starting, and isolating switches. The accompanying illustration (fig. 1) shows a plain lever switch (Type H) for heavy currents, 2,000 to 10,000 amperes; it is of laminated construction and is designated form L. The copper strips furnishing the contact faces on the front of the panel are carried through the panel direct to the cable socket or bus-bar

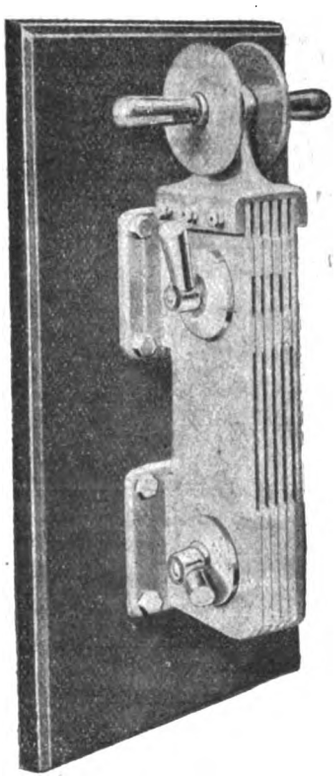

Fig. 1.—B.T.H. 10,000-amp., 250-volt, Laminated Lever Switch.

connection without the intervention of round stems and connecting nuts. These switches can be supplied for single or double-throw; they are single-pole only, and suitable for mounting on 2 in. and 2½ in. panels.

The contact surfaces are furnished with bolts and locking handles, by which they may be slackened for manual operation and tightened for carrying current. To hold the double-throw switches in the "off" position, the hinge contact bolt should be screwed up after the switch has been opened. Switches for 2,000 amps. are made with 4-in. blades for A.C. and D.C. circuits; those for 3,000, 4,000, and 5,000 amps. are constructed with either 4-in. or 6-in. blades, and are suitable for A.C. or D.C. circuits; while those for 6,000, 8,000, and 10,000 amps. are constructed with 6-in. blades only, and are suitable for D.C. circuits.

A New Electric Truck.

The Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester, is putting on the market a handy electric truck suitable for factory and warehouse use. It will carry 1 ton, and is fitted with a crane to lift 3 cwt.

Magneto Condenser Plates.

As a substitute for the mica used alternately with tinfoil to form the plates of magneto condensers—mica being at the present time very difficult to procure—Mr. F. R. Simms, in conjunction with Simms Motor Units, Ltd., has lately taken out a patent in respect of a method of insulating the tinfoil plates from one another by coating them with an enamel consisting of non-conducting material, more or less flexible, such as is sometimes used as a coating for conducting wires.

FUEL ECONOMY IN ELECTRIC POWER STATIONS.

At the last meeting of the Council of the I.M.E.A. the question of the inferior quality and reduced supplies of the coal that was used by electricity supply undertakings was discussed, and the secretary, Mr. H. Faraday Proctor, was instructed to lay before the Controller of coal mines the following matters for his consideration, and to ask whether anything could be done on the lines suggested to improve existing conditions, with a view to the better and more economical utilisation of the coal, reduction in transport, and increasing the production:—

Quality.—The slack coals that were now being supplied contained a considerably larger percentage of ash, and also a larger percentage of fine dust, than used to be the case. There was less heat value in the coal, and the amount of ash to be disposed of was greater than need be.

Additional transport was required both for coal and ash, which added to the congestion of the railways and canals, and increased the labour difficulties.

The proper consumption of the coal in the boiler furnaces was impaired, and a loss of efficiency resulted. This was one of the most serious aspects, having regard to the great shortage of electricity generating plant throughout the country. On account of the low grade of fuel supplied, the output of existing boilers was considerably reduced, and thus much more boiler plant was required to be manufactured to deal with the power demands; the cost of generation was also greatly increased due to the loss of efficiency in the boilers. A larger grate area was required, which meant the use of additional boilers, and extra labour was required for handling the increased quantities of coal and ashes, as well as for the running and upkeep of the additional boilers.

It was suggested that if greater care were exercised in getting the coal by eliminating the dirt, most of the above disadvantages would disappear; also that if all coal produced were to be crushed to a standard size, say, 2 in., the dirt would be evenly distributed amongst all users, and its effect would then hardly be felt. At present the least important users were in many cases receiving the best coals.

The large coal now being supplied for household purposes, for instance, was of the best quality having regard to its calorific value, and actually in practice a larger percentage of smalls or slack was made in the average household by the process of hand breaking than would prevail if the coal were broken by mechanical means. It was felt that if all coal were broken by machinery at the pits, and if one grade only were distributed, the percentage of slack used in the households would not be more than at present, and the electricity undertakings, who were the more important users, would be able to obtain a higher grade fuel, which would result in higher efficiency. The cost and labour involved in crushing the coal would be extremely small compared with the value of the results attained.

Reduced supplies.—The Council viewed with alarm the recent and rapid depletion of the stocks of coal held by electricity supply undertakings; in some cases the stock in hand only represented one to three days' supply, and deliveries were being still further restricted. It was in most cases impossible to discriminate between consumers engaged upon work of national importance and those who were not, and any interference must equally affect both. Supplies of electrical energy should be maintained at all costs, and it was suggested that preference in coal deliveries should be given to electrical undertakings, so that a minimum of at least three weeks' supply might be kept in stock.

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The opinion was expressed by colliery managers that the present shortage could be practically met if the eight hours' day were suspended, and the men allowed to work nine-and-a-half hours a day; that would probably increase the present output by 20 per cent.

In reply to the above, Mr. D. Wilson, technical adviser to the Controller of coal mines, stated, in regard to the question of quality, that, owing to the very large number of miners who had been withdrawn from the industry for military service, and also to the greatly increased demands for fuel of all descriptions in this country, as well as by our Allies, all collieries were working under very considerable pressure. In these circumstances, it was unavoidable that a larger percentage of ash, and fine dust, should be turned out than used to be the case. The various points raised had been fully realised by the department for a very considerable time, and while pointing out the difficulty of avoiding entirely that particular trouble at the present moment, every effort was being made, and would continue to be made, to effect an improvement.

For several months now a special representative from the production department had been detailed to take up with the collieries, and also directly with the miners themselves, the question of effecting an improvement, particularly in slack fuels sent out from the various collieries, and there had already been numerous instances where, as a result of definite complaints, some improvement had been effected. One of the objects of the department was to obtain from electric power stations a monthly record of the average calorific value of the fuel they received, which would be a most valuable guide and of considerable assistance in dealing with the question of deterioration.

He was in agreement that it was inefficient to carry much of the low-grade fuel over long distances, but at the present moment the shortage of coal of all descriptions was so pronounced that it was not possible to make arrangements for only the graded and better quality fuel to be supplied. Wherever this could reasonably be done, however, suitable arrangements would be made.

The suggestion with regard to installing crushers at the various collieries was particularly interesting, but there were practical difficulties in the way of installing new machinery of any sort just now.

With regard to the general question of supply, the whole question of coal stocks at electric power stations was at the present moment under review, and every effort was being made to ensure that in the very near future at least three weeks' stock should be on hand. The importance of the electricity supply industry was very fully appreciated, and its requirements would continue to receive special consideration; at the same time it was imperative that the demands from those undertakings should be reduced to the lowest possible minimum. With regard to the suggestion respecting an increase in the working hours of miners, that was a question of high policy in which a very large number of factors had to be taken into consideration.

The Controller appreciated the interest the association was taking in this matter, and all the points raised would continue to receive his earnest consideration.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Telephone Maintenance.

Through the medium of your valuable paper, may I call the attention of British manufacturers to the value of turning out every instrument with a wiring diagram attached. During my experience I have found that the absence of wiring diagrams has been responsible for unnecessary scrapping of telephones, simply because the maintenance man would not go to the trouble of tracing out the connections, in order to obtain a complete knowledge of the working of the instrument.

The skilled telephone maintenance man at home encounters various makes and types of telephones, and in order to carry out his work efficiently, it is necessary for him to carry wiring diagrams about with him, but it frequently happens that he finds he has left them behind just when they are required. In many cases at home, and in the majority of cases abroad, the maintenance is in the hands of semi-skilled men to whom a diagram of connections would be of considerable assistance. It is surely in the interest of the manufacturer that the purchaser should be in possession of as much information as possible relative to the maintenance of the apparatus, and although to my knowledge one enterprising firm has, within recent years, turned out all its manufactures with diagrams and working instructions, the majority have persistently ignored the recommendations made by the maintenance contractor.

Within the last few days, in the East, I have rescued from the scrap heap a number of portable signalling sets of excellent, but rather complicated, design. These instruments were dispatched by the manufacturers two years ago, as an improvement on the older pattern. In the absence of any working instructions or diagrams, the engineer condemned them as "not suitable for the system," and pursued the easy policy of ordering a number of the older type, rather than spend an hour or two tracing through the mass of connections. This type of individual is one which is often encountered in the telephone world, and manufacturers assist him by withholding reasonable and time-saving information.

Telephone Engineer.

June 16th, 1918.

Trade Unions: Past, Present, and Future.

The E.T.U. has tackled with courage and vim the thousand and one problems which have risen since the beginning of the war, with a success which has staggered even the most pessimistic in the electrical trade. The general secretary of the E.T.U. has acted with keen discrimination and a strong hand in his negotiations with employers, Government officials, and the like, during the present war.

The E.T.U. claims to be, and is, a democratic body, with possibly the freest expression of opinion and action available to any trade unionist, hence the reason for the fact of men acting on their own.

"The Writer of the Article" airily quotes Mr. A. Henderson, M.P., stating "The idea that the relationship between Capital and Labour must necessarily be antagonistic must be abandoned." Quite so, but we are dealing with the cold, hard fact of the present time, and the writer's experience is antagonism from the employers' side on any question—economic, social, or moral.

The antagonism can only be abandoned when one deals with employers who know they have solid value for their money, and have the necessary experience, ability, and brains to judge the same.

When the E.T.U. has reached the desired goal of solely controlling the industry, then will it expel, or not expel, but certainly not at the employers' behest, and what is, and what is not, fair output will be decided by the E.T.U.

Some of our gallant lads are already back, and they are as keen as mustard for "the Home Front," and have asked us what we have been doing to allow D.O.R.A. and Munitions Bill to trifle with our liberties, particularly in reference to trade upion action and liberty, for which they have been fighting.

As a "student" of trade unionism, Mr. John A. Tasker appeals strongly to the writer, and his offer to take "an active and prominent part in the reconstruction of at least the trade union for electrical industries" is indeed a charitable one, but why the touching modesty as to the past of John A. Tasker?

J. W. Woolley,
Electrical Trades Union.

Whitley Bay, *August 19th*, 1918.

[This letter has been shortened.—EDS. ELEC. REV.]

Motor Problems.

With reference to your editorial in your issue of August 23rd, we enclose our List No. 304.

If you will refer to the marked paragraph on page 5 you will see that we have gone into the question of voltage rise on breaking the motor circuit, and allowed for it in rating the switches dealt with in this list.

We also enclose descriptive matter regarding our discriminating controller, and you will see, by reference to the marked paragraph on the first page, that we already practise what you preach, and supply a controller fitted with a locking coil which ensures precisely the result described in the last five lines of your article.

The device is described in conjunction with the discriminating controller, but it can be applied to any controller for any service arranged to operate on any or all of the notches.

For **George Ellison,**
J. G., *Sales Manager.*

Birmingham, *August 24th*, 1918.

[The first reference above mentioned relates to the rise of voltage experienced on breaking an inductive circuit, such as that of a stalled series motor, a brake magnet, or a field winding. Messrs. George Ellison give figures for the breaking capacity of 750-volt switches ranging up to 2,000 volts, and state that the pressure rises liable to occur with series motors (from ¼ to 35 B.H.P.) on a 500-volt circuit are calculated to amount to 550 volts, while the voltage rises in the field windings of shunt motors of similar sizes may run to from 1,600 to 23,000 volts.

The second reference is, perhaps, more directly relevant to the subject of our comments; it relates to the use of a safety coil in series with the armature of a series motor, which, when used for *lowering* a load, has the armature and field connected in parallel, as in the case of a shunt motor. The safety coil operates a detent which determines the highest notch, and therefore the maximum speed at which the load can be lowered, the speed varying inversely as the load.

These features are extremely interesting, and in this particular connection Messrs. Ellison appear to have succeeded

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in attaining to the mistake-proof quality that we advocated, while they are fully alive to the importance of pressure rises in motors, &c. At the same time, we must point out that we made no reference to inductive pressure rises in magnet coils; our remarks related to excessive E.M.F.'s in armatures, due to their continued rotation in a strong magnetic field.—Eds. Elec. Rev.]

Our Friends at Ruhleben.

In view of the belief apparently held at home that technical papers no longer reach us, I beg to state that 14 copies of the 1918 Review have reached me to date (the last received being a copy of May 3rd). We regret exceedingly that by no means all the copies you have sent have arrived, but you will realise that the Technical Circle keenly appreciates every fresh item of news, and we are very grateful to you for your continued efforts to keep us in touch with the world outside.

Wm. Eric Swale,
(*Hon. Sec. to Comm. of T.C. Ruhleben.*)

July 19th, 1918.

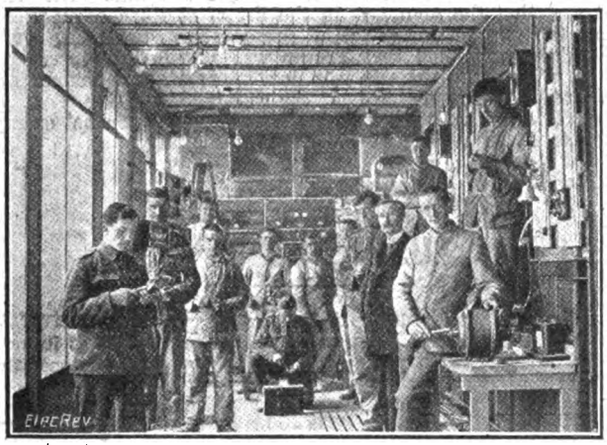
Technical Instruction for British Interned in Switzerland.

Instruction Centre,
Seeburg, Lucerne.
Saturday, August 17th, 1918.

I send herewith two photographs of the shops here. Having now been here six months, I am in a position to gauge the great use and benefit these classes will be both to the individual men, the trade, and British enterprise after the war.

The course consists of, in the following order:—

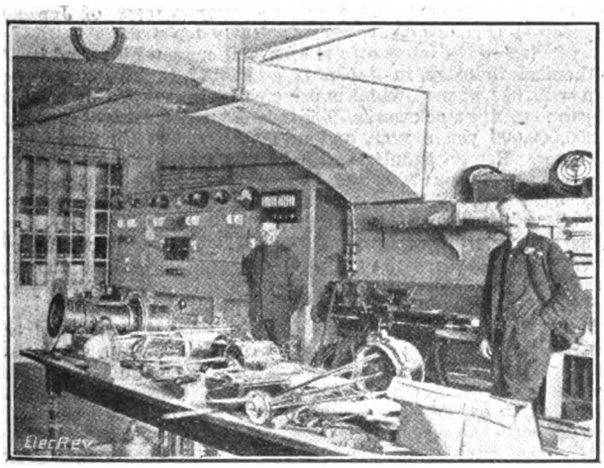
Magnetism; wiring for bells, alarms, small telephones; wiring for light and power in tube, casing, lead-covered, and on



British Soldiers Learning Electrical Work.

insulators; running small plant; accumulator and switchboard attending; meter-reading; electrical drawing; simple lathe work, and making small instruments, galvanometers, and voltmeters.

The number of men I have had through the class is 30, who were mostly of the Old Army, and I must say the spirit



Another of the Workshops at the Instruction Centre.

they have shown here leaves no doubt as to their future success in the trade if they go into it on their return home.

Great thanks are due to Major Mitchell, C.B.E., for the placing of such an ideal place at our disposal, as well as a good deal of plant; and also to the following firms in England: Messrs. the General Electric Co., Ltd., and Mr. Hibbert, of the Regent Street Polytechnic; and in Switzerland to Messrs. Brown, Boveri & Co., Ateliers de Construction Oerlikon, Westinghouse Lamp Co., Swiss Cable Co., and Trub, Tauber & Co.

In conclusion, I may say that I think the trade will be neglecting its opportunity if it fails to give both material and financial support to so worthy a cause with such far-reaching results.

William Harris-Crisp,
Electrical Instructor.

[We are heartily glad to learn that our comrades of the incomparable "Old Army" are doing so well in Switzerland, though we would rather have them at home again. We commend the last sentence of Mr. Harris-Crisp's letter to the notice of our readers.—Eds., Elec. Rev.]

COAL CONSERVATION.

The Final Report of the Coal Conservation Committee, which was recently issued (Cd. 9,084. 1s. net), merely relates the course of procedure since the appointment of the Committee in July, 1916, as a sub-committee of the Reconstruction Committee. Sub-committees were appointed to report on the subjects respectively of Mining, Power Generation and Transmission, Metallurgy, Carbonisation, and Geology. The Carbonisation and Metallurgical Sub-committees amalgamated in January, 1917. Owing to the necessity of research and surveys, negotiations were entered into with the Department for Scientific and Industrial Research, which led to the establishment by the Government of the Fuel Research Board. The formation of a Ministry of Mines and Minerals is recommended.

In February, 1917, the Interim Report of the Geological Sub-Committee was received, and in April, 1917, that of the Power Generation Sub-committee on Electric Power Supply in Great Britain; both were immediately submitted to the Prime Minister as matters of urgency. These reports, together with those of the other sub-committees, are submitted as forming the substantive report of the committee itself.

The report on electric power supply was abstracted in our issues of January last; the other reports contain little of direct interest to electrical engineers as such. In the final report of the Mining Sub-committee, the waste of coal at collieries is commented on, and reference is made to the economy that could be effected by the development of a cheap supply of electricity in industrial areas. The loss of coal underground is also dealt with at considerable length. The increasing cost of production is discussed, and it is held that the cost will continue to be high after the abnormal conditions due to the war have passed away. Between 1906 and 1913 the output of coal per person employed underground fell from 360 to 321 tons per annum, and was less than half that obtained in the United States. The report states that it is only by increased production per head that our trade position can be maintained and that improved conditions of employment can be secured. The use of labour-saving appliances to a greater extent is advocated, and it is pointed out that there is room for considerable improvement in underground haulages in accordance with well-conceived plans and a systematic policy. Mining scholarships are recommended to assist in raising the standard of education of the workers and officials.

In the report of the Carbonisation Sub-committee the manufacture of gas is briefly discussed, but this subject being in the hands of the Fuel Research Board, is not dealt with at length. The coke industry, which is closely linked with the iron and steel industries, receives more detailed treatment; special reports have been drawn up by Prof. W. A. Bone and Mr. Ben. Talbot respectively, on the manufacture of coke for metallurgical purposes and on fuel economy in steel works, which are reproduced as appendices to the report. Prof. Bone shows that at present three-quarters of the metallurgical coke consumed in this country is made in by-product recovery ovens; in November, 1917, some 8,700 of these ovens were ready or in operation, and many more were being erected; the coke from these ovens is as satisfactory for smelting purposes as that obtained from bee-hive ovens. There is a substantial margin for economy in the fuel consumption of iron and steel works, and Mr. Talbot outlines a concrete scheme which the sub-committee regards as making out a strong case on practical as well as theoretical lines for the erection of economical "unit" works near coalfields, with shipping facilities, for steel production. With regard to fuel economy in power stations, the report indicates that the question of carbonising and gasifying coal as a preliminary to its use for steam raising is still open, pending further research on all the issues involved. The sub-committee considers that there is a definite field for the use of gas engines in special circumstances, where the most suitable units are of relatively small size—say, under 3,000 or 4,000 kw. A strong opinion is expressed in favour of the creation of a body of trained experts in order to further the use of more scientific methods for the preparation and use of fuel; whether these experts would be employed as agents

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of a Government department, as agents for the manufacturers of plant, or as members of the staffs of industrial concerns is a matter left for future settlement. The Fuel Research Board hopes to be able to provide facilities for obtaining such training.

Mr. Talbot, in his report, advocates that a modern steel plant should produce from 300,000 to 500,000 tons of steel a year, and that the one establishment should comprise by-product coke ovens, blast furnaces, steel furnaces, and rolling mills, turning out finished steel sections so as to use up the surplus power and heat generated at the ovens and furnaces. He discusses the organisation of such a plant in detail, assuming that gas engines fed with blast-furnace gas will be used for driving the blowing engines and for generating electric power. With a weekly output of 6,000 tons of pig iron, the blast engines would have to be of 8,250 I.H.P., and the auxiliary power would require 1,080 KW. In the steel works the auxiliary machinery would require 535 KW. For driving the rolling mills 10,817 KW. would be needed. Various openings for economy are referred to. The author also states that the export of coal admirably suited for making the best coke should be prohibited, as it places our iron and steel industries at a disadvantage. The linking up of iron works by an electrical network would provide an additional means of economy, the surplus energy being sold to outside consumers. A possible saving of fuel aggregating 7½ million tons per annum is suggested, but to achieve this would involve the entire or partial scrapping of most of the existing works, and a large capital outlay.

WAR ITEMS.

Members of the I.E.E. and the Military Service Act, 1918.—The Council of the Institution has been in communication with the Ministry of National Service with reference to the utilisation, with due regard to their skill, of members of the institution called up for military service under the above Act. With a view to their being posted, as far as vacancies are available, to technical units, members of the new military age, on being called up for military service, are therefore invited to communicate with the Secretary of the Institution, who will supply them with the form and certificate approved by the Ministry for this purpose.

Our Letters from France.—A Major, writing from France under date August 25th, 1918, says:—

"Please accept my thanks for sending me the ELECTRICAL REVIEW during past month. Am very pleased to see that you are endeavouring to get a move on with the manufacturers as regards the pushing of British productions for after the war. As far as this country is concerned, there should be a very large market here for electrical gear of all kinds. It is sad indeed to see the valuable machinery absolutely wrecked beyond all possible repair; turbines pierced by shrapnel and hit by H.E., large three-phase generators with a big hole where a shell has gone through, switchboards merely a heap of scrap, transformers merely tangled wire. The Boche has found some of this gear very useful, inasmuch as he has transported a lot of the stuff away either for shell production, or else to fit up his wonderful underground quarters, generally well lit up, at least sixty feet below the surface. He usually takes away all bearings, &c., from the large steam engines, which are, as a general rule, of the horizontal type, and in many instances, very modern. It will take years to get this country into good shape once more, as everywhere is battered beyond all knowledge, merely tangled wreckage, so that the English manufacturers should get busy, so as to give good delivery.

"We are still as busy as ever out here, and our special type of work does not put us very much in the lime-light, so that our exploits will have to be written up *après la guerre* as we shall have plenty of time whilst waiting for jobs, which problem, it is to be hoped, the institutions will tackle, and are now making arrangements to cope with, after the war. It is to be hoped that manufacturers and other employers will realise what various phases one has been through out here, in order to assist in a small way."

Reconstruction Measures Abroad.—Firms who desire to know what their rivals, notably those in enemy States, are doing and planning, and what are the economic conditions and trading prospects in foreign countries, can now obtain two valuable War Office publications issued fortnightly, the Economic and Reconstruction Supplements to the *Daily Review of the Foreign Press*. The price of these supplements will be 6d. The Economic Supplement deals with trade and commerce, railways and shipping, banking and finance, labour conditions, social and economic policy, and legislation, &c. The Reconstruction Supplement describes the measures being taken or suggested in Germany and elsewhere in connection with the return to peace conditions. These publications will be issued by His Majesty's Stationery Office, and can be purchased through any bookseller, or directly from H.M. Stationery Office.

Thyssen's War Profits.—According to the "Norddeutsche Allgemeine Zeitung," the balance-sheet of the Thyssen Steel Works at Hagendingen, which has a capital of marks 1 mill., has made a gross profit of marks 16 mill. With a capital of marks 1 mill. the total assets stand at marks 83 mill.! The Thyssen group, who own all the shares, have a balance due to them of marks 35 mill.

Trading with the Enemy.—The "London Gazette" for August 23rd contains further lists of bodies and persons in the following countries with whom trading is prohibited:—Argentine; Bolivia; Brazil; Chile; Columbia; Costa Rica; Cuba; Ecuador; Guatemala; Honduras; Mexico; Morocco; Netherlands; Netherland East Indies; Nicaragua; Peru; Salvador; Spain, and Sweden.

Exemption Applications.—At Oxford, Messrs. J. E. Elliott and Co., electrical engineers, appealed for C. J. Manley (50, grade 1), manager, and two months' temporary exemption was conceded.

Bath Tribunal has granted three months' exemption to Radcliffe Dodd (43, grade 1), employed with the Electric Tramways, Ltd.

At Cranbrook (Kent), an appeal filed by B. A. S. Rowles (48), electrician, was allowed to be withdrawn, as he has taken up work of national importance.

At Ryde, exemption until February 1st has been granted to A. F. White (27), engineer, with the Isle of Wight Electric Light Co.

At Mansfield Woodhouse, exemption was applied for G. Harling (34, grade 1), electrician with Mr. H. Rouse, the only man left, and who is working 78 hours per week. He was granted six months, and excused Volunteer serivce.

At Maidstone, six months' exemption has been granted to E. J. Freed (42, grade 3), tramway inspector with the Corporation.

At Barnes, S.W., Mr. C. S. Davidson, electrical engineer to the U.D.C., applied for exemption for A. J. Trump (47, grade B1), boiler cleaner at the electricity works. The clerk advised that the man was in the list of certified occupations, but the National Service Representative dissented. Mr. Davidson contended that Trump was a skilled labourer, and came within the list. It was decided to ask the Tribunal at Richmond-on-Thames to hear the case.

Guildford Rural Tribunal has granted two months' exemption to E. A. West (47), electrician, of Albury.

BUSINESS NOTES.

Co-operative Electric Lamp Users.—The Registrar of Friendly Societies has given notice of the cancellation, at its own request, of the registry of the Electric Lamp Users' Co-operative Society, Ltd. (Reg. No. 1,265 R., Dublin).

Japanese Electrical Trade Activity in China.—Japanese electrical engineers have an ambitious scheme for replacing the German electricians in the market in China, and, after the war, trying to contest that big commercial theatre with American and British engineers. Recently a party of Chinese business men and journalists arrived in Tokio in compliance with an invitation from the organisers of the Electrical Exhibition which took place at Uyena Park. Japanese electrical industries have so far supplied China with electric lamps, wires, and cables through their establishments at Shanghai. One of the latest of them has also the supply of these goods in sight. But the opportunity offered by the German withdrawal and the stoppage of the supply from Great Britain and America of electrical machines are now being seized on, and in the Electrical Exhibition the preparedness of Japanese engineers in this new campaign was clearly depicted.

According to the latest official census the capital invested in the mechanical industry in Japan is estimated at 180,000,000 yen (yen = 2s. 0½d. at par), which is principally represented by machine shops and rolling stock works. The total estimated value of turnovers is 300,000,000 yen a year, and no small part of the figure is in machines. Power supply and electric transportation systems number more than 700, and the capital invested amounts to 600,000,000 yen. The power generated is above 1,000,000 H.P., and the mileage of railways is upwards of 1,000 miles.

The exports from Japan of electrical lamps and apparatus are estimated at 7,300,000 yen a year, which, considering the fact that Japan was dependent entirely on foreign supplies several years ago, is regarded as showing satisfactory progress.

At the Uyena Park Exhibition almost all departments of the electrical industry and science were covered, and the exhibitors, numbering 227, included almost all the leading manufacturers. In the first department, dealing with the domestic uses of electricity, several firms exhibited their products. The second department, dealing with the electrochemical industry, showed the rapid development of this new line in Japan, showing chemical and other products of various companies. This department contained the exhibits of steel works and alkali works which have been started under the stimulating influences of the war. The third and fourth departments dealt with electrical apparatus and the modern development of communications by means of electricity. In these sections Japan-made wireless telegraph apparatus, telephone apparatus, and all kinds of apparatus are shown, their manufacturers including several big firms.—*Board of Trade Journal.*

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Bankruptcy Proceedings.—J. R. Whitehouse, Golders Green, managing director of an electrical engineering company.—Release of trustee, August 16th, 1918.

Non-Ferrous Metal Industry Act.—Further names of those to whom licences have been granted under this Act appear in the *London Gazette* for August 27th.

Book Notices.—*List of Electrical Undertakings in India.* Calcutta: Supt. Government Printing, India. Pp. vi. + 64. Price Rs. 4 or 6s.—This statistical return has been compiled in the office of the electrical adviser to the Government of India, Mr. J. W. Meares, and is corrected up to 1916-17. Small installations have been omitted. Part I deals with public supply undertakings, which number about 28, having a total installed capacity of 104,270 KW., total connected load 129,531 KW., and an output of 154 million units sold per annum. Of the total load connected, private lighting and fans account for 57,000 KW., traction for 7,000 KW., and other power uses for 64,000 KW. The generating plant comprises 6,713 KW. D.C. and 97,557 KW. A.C.; 48,703 KW. is driven by steam, 1,942 KW. by oil, and 53,625 KW. by water power; The total number of consumers is 37,260, and the total output 154 million units sold. Part II shows that there are six tramway undertakings, carrying 126 million passengers per annum, with 14 million car-miles. Part III deals with private electrical installations over 200 KW., which aggregate 80,317 KW., used mainly for power. Part IV relates to undertakings in Native States, aggregating 26,210 KW. of plant, and having a total output of 103 million units per annum. This is nearly all A.C.

In all, the generating plant capacity amounts to 215,400 KW., mainly A.C., of which 129,400 KW. is driven by steam and 78,000 KW. by water; the total load connected is 235,000 KW., and the total units generated are about 500 millions per annum. Small factories, &c., under 200 KW. would probably add 18,000 KW. and 40 million units per annum.

Financial and technical details are given of a number of undertakings concerned. Notwithstanding an editorial reference to cost and shortage of paper, at least thrice as much of that precious material is used as would have amply served to contain the data, many pages being practically blank and others "sparsely populated." The plant, we are pleased to notice, is mainly of British origin. The tables will be of great use to exporting firms, who are constantly inquiring of us as to the voltage and frequency of supply of foreign undertakings.

Statistical Report of Electric Undertakings in Japan. Tokio, Japan: Direction General of Electric Exploitations, Department of Communications. Pp. iv. + 20.—This report gives data of undertakings of various descriptions, which total 2,617, of which 1,195 are operated by water power, 854 by steam, and 568 by gas; 2,445 stations have a capacity less than 1,000 KW., 1,717 of these being below 50 KW.; 25 are over 10,000 KW. Of 546 undertakings of which the ownership is stated, 26 are owned by municipalities and 499 by joint-stock companies. Classified with regard to motive power, the hydro-electric stations have a plant capacity of 424,247 KW.; steam, 252,599; gas, 26,329; total, 703,175 KW. Hydro-electric generating stations number 363; steam, 133; gas, 135; total, 631. Presumably many of the undertakings take bulk supply from others, as there is a very great disparity between the number of undertakings and the number of generating stations tabulated. Other tables relate to the length of electric lines and number of supports; mileage of tramways (1,368 miles single track) and number of cars (total 4,492); number of lamps connected (average 18 lamps of 135 C.P., or 362 watts, per 100 of population); number of motors, &c., connected (total motors 466,335 KW., other appliances 78,183 KW.); power supply to industries (625,286 H.P.); tariffs; capital, revenue, expenditure, &c.; and progress tables, from 1903 to 1916, in which period the total KW. capacity has increased from 44,252 to 805,289 and the capital invested from £180,000 to 11 millions sterling.

Metals and Alloys. London: *The Metal Industry.* Price 5s. net.—This is a set of tables containing the percentage composition and other particulars of over 500 metals and non-ferrous alloys: the data include particulars of all the known metals, breaking strengths, specific resistances, specifications of bronze and brass castings, melting and boiling points of metals, electrochemical equivalents, and data relating to Admiralty alloys.

Bradford Engineering Society: Journal of Proceedings.—Although the Society has been established since 1899, this is the first occasion on which its proceedings have been recorded in the form of a journal. Judging by the contents of this volume of some 140 pages, the lack of a permanent record of the previous proceedings has been a distinct loss to our technical literature; we congratulate the Society on its excellent work during the Session 1916-17, and cordially endorse the Editors' hope "that this volume will be the first of a long series of useful publications." Amongst other papers which it contains are the following:—"Some Modern Developments in Steam Engine Practice," by Mr. W. Eastwood: "Submarines," by Prof. G. F. Charnock: "Principles of Continuous Current Motor Starters," by Mr. W. Howard Brown: "Testing of Steam Plant," by Mr. R. K. Derbyshire: "Economical Steam Raising," by Mr. C. E. Stromeyer: "Economical Working of the Boiler House," by Mr. W. Holehouse; and "Rope Driving," by Mr. E. Hart. In these papers there is a store of valuable information, and we have no doubt that the Journal will be a source of added strength to the Society, and profit to its members.

The Place and Importance of Science in Education. By Ed. C. Reed. From the author.—In this address, held before the "Association for the Scientific Development of Industry," Manchester, the author urges the importance of taking the current while it serves, and forestalling any possible reaction, by incorporating in our educational system a proper course of training in science and scientific methods.

The British Scientific Products Exhibition. Pp. xxiii + 236. London: The British Science Guild. Price 2s. 6d. net.—The descriptive catalogue of the Exhibition organised by the British Science Guild, and held at King's College, Strand (August 12th to September 7th), is a publication possessing permanent value. It is not merely useful as a guide to, and souvenir of, the Exhibition, but is an authoritative record of the development of products and appliances of scientific and industrial interest which prior to the war were obtained chiefly from enemy countries, but which are now being produced in the United Kingdom. Apart from the descriptive notes on the products exhibited, there are highly interesting and instructive articles dealing with recent developments in the various branches of industry, contributed by the leading authorities in their respective spheres. As only a limited number of catalogues has been printed, early application should be made for copies.

Trade Announcements.—Mr. George Boorman has removed from Stamford Street, S.E., to 38, Brooke Street, Holborn, E.C. 1. Telephone: "Central 11610."

We learn from Mr. Herbert H. Berry that he has purchased from Messrs. Ferranti, Ltd., of Hollinwood, Lancs., the whole of the patents, stock, and tools in connection with their electric heating and cooking business. Mr. Berry has transferred the whole of this heating and cooking business to the Jackson Electric Stove Co., Ltd., of 38, Blandford Street, W., who will continue to deal with all inquiries and orders arising therefrom. Mr. Berry has acquired an interest in, and has been appointed a director of, the Jackson Electric Stove Co.

Messrs. "Lamlok," of 36, Rusthall Avenue, Chiswick, announce that they have disposed of the sole manufacturing and selling rights in the Lamlok Adjustable-cord Grip Patent 10,423/17 to the Edison Swan Electric Co., of Ponders End.

F.B.I.—The Federation of British Industries has invested a further £50,000 in National War Loan.

Catalogues and Lists.—Messrs. Broom & Wade, Ltd., High Wycombe.—Catalogue No. 11, of 24 pages, containing full illustrated information respecting Hyatt roller bearings as applied to cranes, trucks, and transportation appliances generally; also particulars of load capacities, limits of measurements, directions for installation and lubrication, lists of installations, &c. Copies may be obtained on application.

Vislok, Ltd., 3, St. Bride's House, Salisbury Square, E.C. 4.—List of users of Vislok safety lock nuts.

Liquidations.—British Telegraph Instrument Co., Ltd.—In voluntary liquidation. Liquidator, Mr. J. H. Webb, 4, Ruskin Walk, Herne Hill, London, S.E.

Frictionless Bearing Metal Co., Ltd.—A petition for winding up this company has been presented to the Court by M. Harris & Son, Ltd., judgment creditors, and it is to be heard on October 15th.

LIGHTING AND POWER NOTES.

Armadale.—Mains Extensions.—The Scottish Central Electric Power Co. is erecting an overhead cable through Armadale for the purpose of connecting several public works.

Carrickmacross (Co. Monaghan).—E.L. Charges.—On the E.L. Co. tendering for the supply of electricity during the winter season at 10d. per unit, members of the U.D.C. objected, on the ground that the charge for private lighting was 8d. per unit, and a deputation has been appointed to wait on the company.

Continental.—Switzerland.—A new company has been formed under the name Schweizerische Kraftübertragung, A.-G. für Verwertung und Vermittlung von Elektritzitäts. This is a fusion of the North-East Swiss and the Berne generating stations, with the object of making it possible to utilise the stations of the two companies to the fullest extent. The networks of the two undertakings are to be connected by a high-tension line at 100,000 volts. This line will have the further advantage that other supply stations within reach will be able to draw energy from, or supply energy to, the combined network. The interconnection of the system will provide a common network over the principal areas of Switzerland.—*Elektroindustrie*, May 15th.

Sweden.—The Alglunds Elektriska Kraft Aktiebolag is a new undertaking which has lately been formed at Anaset to undertake the supply of electrical energy for lighting and power purposes in the Alglund district. Another new concern is the Burlidenskraft-stations Aktiebolag, organised in Burliden for a similar purpose. In both cases the capital is relatively small.

Dunfermline.—Price Increase.—The Fife Tramway, Light, and Power Co. has increased its charges for electricity for power and lighting by a further 16⅔ per cent., making 50 per cent. over pre-war prices.

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Glasgow.—Sub-stations.—In view of the early completion of the new power station at Dalmarnock, a Committee has been appointed to report on the necessity of additional and enlarged sub-stations.

Huddersfield.—Price Increase.—From the end of September the T.C. has decided to increase the charges for electricity by a further 12½ per cent., making 50 per cent. over pre-war charges.

Kingswinford.—Price Increase.—The Midland Electric Co. has raised the price of electricity to the U.D.C. by a further 35 per cent., making an advance of 75 per cent. over pre-war rates.

London.—Islington.—Year's Working.—The annual accounts of the electricity undertaking for the year ending March 31st last, show capital expenditure of £591,779, an increase of £13,839; income, £87,339, an increase of £5,252; expenditure, £55,147, an increase of £4,018; gross profit, £32,192, an increase of £1,234; net profit, £2,522, an increase of £449. The units sold numbered 9,554,210 (public lighting, 1037,440; private, 2,378,014), a decrease of 90,038: average price obtained, 2·29d.; cost per unit sold, 2·03d. The number of consumers was 3,863; load factor, 17·94; maximum load, 6,077 K.V.A.; and the capacity of plant, 9,800 KW.

Maidstone.—Year's Working.—The report of the Corporation electricity undertaking for the year ending March 31st shows a net surplus for the year of £745. The sales for lighting only account for 7·24 per cent. of the total sales; average total cost per unit sold was 1·53d., against 1·52d. last year, and the average revenue was 1·66d., against 1·69d. Total capital expended was £110,518, an increase of £4,409, and that outstanding was £54,534, against £60,890. Total capital charges were £7,285, an increase of £197; total revenue £26,630, an increase of £3,894; total costs £18,600, an increase of £4,237; and gross profit £8,030, a decrease of £244. Number of units sold was 3,866,684, an increase of 629,943; number of consumers connected 1,133, an increase of 41; maximum load recorded 1,643 KW., an increase of 397 KW.; and load factor 32·8 per cent., against 29·6 per cent. The units sold were:—Private lighting 306,711, a decrease of 7.012: public lighting 34,941, an increase of 21,487; power 2,963.529, an increase of 528,496; traction 354,937, an increase of 17,955; heating 164,916, an increase of 57,762; and cooking 41,650, an increase of 11,155. Hitherto the supply has been low-pressure D.C.; but during the year the Committee decided to install high-tension, three-phase, A.C. plant. The contracts already placed include one 30,000-lb. water-tube boiler with superheater and mechanical stokers; one 1,500-KW. Ljungstrom turbo-alternator with condensing plant and auxiliaries: E.H.T. and L.T. switchgear: one 1,000-KW. rotary converter; E.H.T. cable, and a new balancer of 100 KW. capacity.

Oldham.—Wages.—In accordance with the award of the Committee on Production, the Electricity Committee has granted its employés who are members of the E.T.U. an increase of 3s. 6d. per week.

South Africa.—According to *U.S. Commerce Reports*, electricity has come into extensive use in South Africa for lighting and power purposes, especially in the Transvaal. Apart from the power generated at the mines, 836,437,817 KW.-hours were supplied during 1916 by the various stations of corporations and municipalities and by the public-supply companies in the Union. Of the total, 784,847,599 KW.-hours were alternating-current, of which 783,689,784 KW.-hours were used for lighting and power, and 1,157,815 KW.-hours were converted into direct current for tramways. In the mines and industries of the Transvaal, Cape Province, Orange Free State, and Natal there are in use 782 direct-current generators having a total capacity of 65,039 KW., 240 alternating-current generators of an aggregate capacity of 255,697 KW., 4,367 direct-current motors having a total capacity of 85,347 H.P., and 7,377 alternating-current motors totalling 462,848 H.P. capacity.

Southend.—Price Increase.—From the next reading of the meters, the T.C. has increased the charges for electricity for lighting, power, and tramways by 15 per cent.; consumers by contract have been given three months' notice of the increase. No more slot-meter consumers are to supplied at present.

Stirling.—Price Increase.—The T.C. has increased the charges by 1½d. per unit for private lighting, and by 2d. per unit to slot-meter consumers—making the present price 7d. per unit in each case.

Welshpool.—E.L. Scheme.—The T.C. proposes to appoint a Sub-Committee to consider an electric lighting scheme.

TRAMWAY AND RAILWAY NOTES.

Aberdeen.—Food Delivery Service.—The Corporation Tramways Committee proposes to extend the present facilities for carrying parcels to include the delivery of bread and meat from shops. by means of messengers who would leave the cars at certain points.

Accrington.—Year's Working.—The total income of the Corporation tramway department for the past year amounted to £36,791, an increase of £5,360 compared with the preceding year, and the expenditure was £33,451, an increase of £2,020. The gross profit of £3,340 compares with a deficit of £977 in the previous year. Debt repayment amounted to £4,073, interest to £4,782, and income-tax to £554; £4,558 has been transferred from the borough funds to the tramway account since the inauguration of the system. The depreciation and renewals fund stands at £19,606.

Australia.—Melbourne.—Control of Tramways.—A deputation which waited on the Minister of Public Works to discuss the question of the control of the tramway undertaking was informed that the accumulated profits (approaching £500,000) must not be used for the reduction of the rates, that the tramways must submit to some restrictions, and that, as they compete with the railways, they must contribute £50,000 per annum to the Government, which is the estimated loss caused to the railways through tramway competition. These proposals are not acceptable to the municipalities concerned.

Sydney.—New Cars.—A new style of tramcar is being constructed by the tramway department, and has so far been found satisfactory. The car is of the "Dreadnought" type, the top is entirely covered in (instead of the ends being covered with canvas blinds), and the trucks are made lighter, so that the cars can run coupled together. If the public trials are satisfactory, this style of car will probably be adopted as a standard pattern for the whole of the N.S.W. tramway system.

Bath and Weston-super-Mare.—Strike.—The women employés who have been on strike have been given the 5s. per week bonus which they demanded.

Croydon.—The Ministry of Munitions has issued a certificate placing the Corporation tramways under the Munitions Act. It is explained that this has nothing to do with the strike, and is the result of prolonged negotiation. The Sunday morning service has been resumed.

Dewsbury and Spen Valley.—Fare Revision.—The Heavy Woollen District Electric Tramways Co. has increased the original 1d. fares to 1½d., and reduced the number of cars in service.

Electric Vehicle Progress.—Sheffield Corporation has approved of an arrangement whereby two British-built electric chassis are to be purchased instead of those on order.

In consequence of the increased cost of coal, Walsall Corporation has raised the price of energy for electric vehicle battery-charging by 20 per cent.

Glasgow.—Wages.—The Tramways Committee has refused to grant applications for the following increases in wages: Traffic and other male staff, women drivers, conductors, and other grades, £1 per week over pre-war rates; male drivers, conductors, semi-skilled workers, and labourers, 3s. 6d. per week.

Ilford.—Strike.—Owing to the strike of women employés the Council tramway service ceased work last week; but with the help of members of the staff, several cars were run for the convenience of workmen. Mr. Harvey, tramway manager, and Mr. Owen Walters, chairman of the Tramways Committee, acted as driver and conductor respectively several times last week.

Keighley.—Railless Traction.—Owing to the difficulty of effecting repairs to the motors of the cars, two of the railless services have been discontinued.

Leeds.—The suggestion of the B. of T. Tramways Committee that employers of labour should arrange various times for starting and finishing work and for meal times, in order to relieve the congestion of traffic on the tramways, has not met with any encouraging response. The employers have not yet replied to the suggestions, and representatives of the workpeople say they are not prepared to accept any alteration unless accompanied by a scheme of shorter hours.

London.—Traffic Obstructors Fined.—Fines of £2, with costs, were imposed at a police court recently on each of two defendants for being the owners of vehicles which, owing to their defective condition, broke down and caused an obstruction to the traffic on the L.C.C. tramways.

Highgate.—Runaway Tramcar.—A tramcar which got out of control on Monday was pulled up by another car pursuing it, from which a chain was thrown and fastened to the runaway. What might have been a serious accident was thus averted, but a police officer who helped in the feat was seriously injured and is in hospital.

Strike.—The women strikers on the tramways and omnibuses resumed work on Friday, last week, pending the decision of the Committee on Production on the following points:—Whether Clause 14 of the award of July 9th is intended to nullify any previous awards; equal total payments for women and men for equal work; the present change of payments to date from July 9th, and future changes to take place conjointly for men and women.

In the Provinces generally work was resumed on the same day. In the case of the Southend Corporation undertaking, the employés refused to take the cars out on Thursday morning, but on the Corporation agreeing to pay the 5s. per week increase the usual services were running by 10 a.m.

As the result of a meeting on Friday night, about 1,000 employés of the underground railways, male and female, ceased work on Saturday morning. The lines chiefly affected were the Piccadilly and Brompton, Hampstead and Highgate, Bakerloo, and City and South London. The strike was not authorised by the National

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Union of Railwaymen, the secretary of which informed the Strike Committee that he was not prepared to negotiate for a settlement until work was resumed. On Monday the Strike Committee recommended a return to work whilst the negotiations were taking place. This was agreed to, and a resolution that a holiday should be taken on Tuesday and work resumed on Wednesday was carried unanimously. Meanwhile all the lines were kept open and a restricted service was run. A number of stations were closed, and the others greatly congested.

Mr. Wyatt, of the Electrical Trades Union, is reported to have said that he had no fear that the trouble would involve the employés at the generating stations, although the Union supported the principle of equal pay for equal work.

Middlesbrough. — Proposed Purchase. — A special meeting of the T.C. is to be held to consider the question of exercising its right to purchase the portion of the Middlesbrough, Stockton, and Thornaby tramway undertaking belonging to the Imperial Tramways Co., which is within the Borough of Middlesbrough. Application for purchasing powers has been made to the B. of T., and the company has been informed by the Council of its intention.

Oldham.—Year's Working.—The annual report of the Corporation tramway department shows a total revenue of £151,411, against £127,284 in the previous year; working expenses and war allowances increased from £85,443 to £106,937. The car-mileage was 2,121,092, against 2,010,604, and passengers carried numbered 28,703,000, an increase of four millions. The number of units used was 3,653,455, against 3,349,666. The average traffic revenue per car-mile was 16·8d., and the working expenses, including power, were 12·1d.

Omnibuses on Tramway Routes.—Replying to a question by Mr. Gilbert in the House of Commons, Sir A. Stanley, President of the B. of T., stated that omnibus companies had been requested not to increase their services on tramway routes where, to secure reduction in the consumption of fuel, tramway services had been reduced.

Rawtenstall.—Year's Working.—For the year ending March 31st, the income of the T.C. tramway department amounted to £35,261, or 14·69d. per car-mile, compared with £30,169 in the previous year. Working expenses amounted to £21,279, or 8·86d. per car-mile, against £17,952. Energy cost £4,924, or 2·05d. per car-mile. Capital charges absorbed £12,694, or 5·41d. per car-mile, against £12,490, and included interest on loans, £5,869; sinking fund, £5,732; and interest on accumulated fund, £1,362. The net profit was £1,187, which, with £3,000 transferred to the accounts from the borough rates, was placed to the renewals fund. Since the undertaking was commenced in 1908 it has received financial aid from the borough funds to the extent of £16,954. Passengers carried numbered 6,062,849, and 576,175 car-miles were run; 874,071 units were used during the year, or 1·52 per car-mile.

Rio Janeiro.—Electric Omnibuses.—The Brazilian Traction, Light, and Power Co. has obtained from the Commercial Truck Co., of Philadelphia, some electric accumulator omnibuses to be used on routes not served by its tramways. The omnibuses are of the single-deck type, and have a seating capacity of 32 passengers. The vehicles are equipped with an Edison battery of 72 cells, with a rated capacity of 350 ampere-hours. Motors are placed on each of the four wheels, the drive being through concentric gearing with a ratio of 12·14 to 1. With a full load on good level roads the vehicle can run 35 miles on a single charge, and with half load, 40 miles. Each vehicle can make 12 round trips of 2·26 miles during the day, giving a total daily mileage of of 27·12, the running time being four hours, or 20 minutes per trip, with a total of 24 stops. During the tests the power consumption worked out at 294 ampere-hours, the initial voltage of 89 dropping to 73 at the completion; the running time was 3 hours 59 minutes. At the start the battery temperature was 100° F., and at the finish 105° F., the air temperature being steady at 58° F.

Sunderland.—Fare Increase.—The T.C. has increased the existing 1d. tramway fares to 1½d., and also proposes to reduce the services.

West Ham.—Strike.—The workers who were on strike have returned to work, the Corporation having granted the increase of 5s. to those workmen who did not receive a recent advance in wages.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—Owing to the scarcity of materials, new telephone and telegraph services and transfers have been restricted to cases in which the material already installed can be utilised.

Broken Insulators.—During the hearing of a summons against a young boy at Preston for having attempted to damage the insulators on a telegraph pole by means of a catapult, it was stated that it cost £577 to replace broken insulators in that area in 1916, but, thanks to the assistance of the police, the number was reduced from 3,300 to 1,500 last year, at a cost of £262, and for eight months this year the number was 750, costing £131. Even these figures were serious, in view of the difficulty of finding labour and materials.

Canada.—Ninety-nine per cent. of the telegraph operators throughout Canada have voted in favour of the acceptance of the minority award of the Board of Conciliation, and have threatened to strike if that award is not adopted.—*The Times.*

Holland.—The Amsterdam *Telegraaf* states that the new long-distance wireless station is to be situated at Hoogburlo, near Apeldoorn; the Indian station will be erected near Banddeng, Java. The distance between the two is 11,000 km.

CONTRACTS OPEN AND CLOSED.

OPEN.

Atherton.—September 16th. U.D.C. Two 110-kw. single-phase transformers. See "Official Notices" to-day.

Johannesburg. — September 16th. S. African Railways and Harbours Administration. Supply, during 1919, of electrical cables and wires and bare copper wire (tender No. 163). A copy of the specification, &c., may be consulted by British manufacturers at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence).

Manchester.—September 13th. Corporation Electricity Committee. 3½-ton electric tipping wagon. See "Official Notices" August 23rd.

Spain.—The municipal authorities of Lillie (Province of Toledo) have recently invited tenders for the concession for the electric lighting of the town during a period of 19 years.

NOTES.

Boys' Escapade.—Before Bailie Sinclair, at a Juvenile Court in Aberdeen, five Woodside boys pleaded guilty to a charge of having entered the tramway depôt at Woodside and seized an electric car, with the intention of driving it off. It was stated that the boys not only took possession of the car, but started it, driving through the doors, and they were proceeding on their way when the trolley became detached, bringing the adventurous crew to a halt. The car was then recaptured. One of the culprits was put on probation, and the others were dismissed with a warning.

Mica in Australia.—Supplies of imported mica in Australia are almost exhausted, and efforts are being made to develop the Australian deposits. Unfortunately, they are a long way from the coast, and labour is scarce. The Government of Western Australia is offering a bounty for mica, and operations have been commenced. It is urged that either a tariff of 25 per cent. on imported mica or a bounty on Australian mica plus a lower duty on imports is necessary to maintain the industry after the war.

Engineers' Wage Bonus.—In accordance with the national agreement in the engineering and foundry trades, the Committee on Production issued one of its periodical awards on July 24th, imposing on firms which are members of the Engineering Employers' Federation an advance of 3s. 6d. per week to men over 18 and 1s. 9d. per week to boys and apprentices under 18, from the week ending August 10th. As provided by the Munitions of War Act, 1917, the Ministry of Munitions is now issuing an Order which applies the provisions of the award to a large number of non-federated firms in the engineering and foundry trades.

Whitley Councils.—Speaking at Norwich last Saturday, Mr. G. H. Roberts, Minister of Labour, said complaint was made that progress in establishing these Councils was slow; but it was a difficult task. Many parties had to be considered, and some time must elapse before a Council was provided in every trade. Nine Councils were now in existence, 19 more were in various stages of formation, and 20 preliminary conferences had been held. The movement was receiving a good deal of support from both employers and organised workmen. If we could establish a proper spirit between the two sides we should make profound changes in the structure of society and in the development of industrial processes. Efficiency could be promoted and productivity stimulated without casting any additional burden on the workers as a whole.

Electric Pumping Machinery.—A large dry dock is nearing completion at Hunters' Point, South San Francisco, which is 1,050 ft. long. The dock will be able to accommodate any vessel afloat, and is described as the largest in the world. Powerful electrical pumping machinery has been provided by the Westinghouse and General Electric Companies, and in every respect the equipment is believed to be of the most modern and efficient type.

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Fatality.—An electrical engineer, Cecil Walton Eddowes, of Bradford, was knocked down by a goods train at Hirst Lane Bridge, near Saltaire. He was on the staff of the Bradford Corporation as a switchboard attendant. A verdict of "Suicide" was returned.

Fuel Economy.—Referring to the article by Mr. W. H. Booth on fuel economy which appeared in our issue of the 9th inst., Capt. W. P. Durtnall writes that if this country is to compete successfully with other countries it must scrap steam power and immediately get to work on the proper installation of gas-power generated electrical energy, as this will allow supply to be given at least at half the price that any steam plant can possibly do it at.

Sending us a drawing of the "Paragon" gas motor, which was designed to form the prime-movers of a great scheme for supplying London with cheap power in 1915, he states that the features of improvement are (1) reduced surface exposed to the burning fuel, and (2) greater expansion of the gases, resulting in a brake thermal efficiency of at least 40 per cent., with a silent exhaust at a temperature of only 300° to 400° F.

The generating set shown is made up of two 2,000-B.H.P. units, direct-coupled to a special induction-type alternator; the 16 cylinders are of the double-acting type, fitted with piston valves, and give a uniform turning moment; the expansion is taken down almost to atmospheric pressure, providing a very silent exhaust, whilst the compression pressure is only 300 lb. per sq. in.

The engine is designed for operating on gas at 400 lb. pressure and with a calorific value of 1,000 B.TH.U. at atmospheric pressure; the jacket-heat loss is transmitted at boiling temperature and exposed to the atmosphere by means of small water or air-cooled steam condensers, the water being returned by gravity to the engine.

No ignition apparatus is required, as sufficient heat is contained in the compression and incoming gas to secure rapid and efficient combustion.

Standardisation of Aircraft Materials and Parts.—The standardisation of aircraft materials possesses two aspects—namely, the national effort at drawing up specifications for aircraft materials and parts for *immediate* use, and the more difficult problem of attempting to arrive at truly international specifications. With regard to the specifications in use in this country, the work commenced in the first instance by the Technical Department of the Air Board has resulted in the well-known Air Board Specifications, a very large number of which are in use throughout the aircraft industry. Towards the end of 1917, however, at the request of the British aircraft constructors, the British Engineering Standards Association appointed a representative Sectional Committee to take up the standardisation of aircraft materials, and at the beginning of the current year the Air Ministry, subsequently to the reorganisation of the Department of Aircraft Production, reviewed the whole situation regarding the procedure adopted for the drafting of specifications, and decided to place entirely in the hands of the British Engineering Standards Association, as a war measure, the standardisation of aircraft materials for the Services. Since January, 1918, therefore, the work has been under the auspices of that Association.

The Sectional Committee, which is now under the chairmanship of Sir Arthur Duckham, K.C.B., Director-General of Aircraft Production, governs the whole of this work, and has some 60 Sub-Committees and Panels under its jurisdiction engaged in drafting specifications, including the revision of many of the old Air Board specifications. This work is being carried out as a war measure for the Department, and consequently these specifications are not issued to the general public, but to the Department itself for distribution to manufacturers.

The subjects being dealt with cover practically the whole field of materials employed in aircraft production (some 40 British standard specifications).

With reference to the more difficult question of arriving at international agreement regarding aircraft specifications generally, at the request of the Ministry of Munitions the British Engineering Standards Association has nominated the British Section of the International Aircraft Standards Commission, brought into being at the Inter-Allied Aircraft Conference held in London in March last. The British National Committee is under the chairmanship of Sir Arthur Duckham, K.C.B., and is fully representative of all interests concerned.

National Committees are being formed in America, Canada, France, and Italy. The Inter-Allied Conference held in March is to be considered as the first meeting of the Commission; the second meeting is scheduled for the beginning of October next, and will be held in London.

At first sight it may be asked: What has the electrical industry to do with aircraft? The reply is found in the fact that out of the 41 specifications which have already been issued by the Department of Aircraft Production, no fewer than 15 deal with electrical materials or appliances—such as low-tension flexible cables, electric supply potential and system of distribution, high-tension cables and connectors, plugs and sockets for electrically heated clothing, wireless apparatus, accumulators, and incandescent lamps for navigation and recognition lights.

It will be seen, therefore, that the electrical industry is materially interested in aircraft manufacture, and we understand that the Sub-Committee on "Electrical Parts" (chairman, Mr. C. C. Paterson, O.B.E.) is so busy that, in view of the rapid extension of the use of electrical appliances on aircraft, demands for specifications have made it necessary for seven Panels to be at work.

There is a special Sub-Committee on sparking plugs (chairman, Brigadier-General Sir Capel Holden, K.C.B.), by which recommendations as to the leading external dimensions of sparking plugs for stationary and rotary aircraft engines have been made.

Another Sub-Committee on Magnetos (chairman Lieut.-Commander E. S. Saunders, R.N.V.R.) has drawn up standard dimensions and limits for the various types of magnetos used for aircraft work. This report is practically completed.

At the request of the Ministry of Munitions, the Main Standards Committee has nominated the Sectional Committee as the British National Committee of the recently formed International Aircraft Standards Commission. The French National Committee has been also formed, and the American, Canadian, and Italian are in process of formation. Specifications are being exchanged officially, and it is hoped that much good will accrue through this organised interchange of ideas.

The International Aircraft Standards Commission will issue as agreement is reached International Specifications for Aircraft Materials.

Institution and Lecture Notes.—Electrical Power Engineers' Association.—On Thursday, the 22nd inst., a general meeting of the Glasgow Branch (Northern Division) was held at Glasgow. The progress of the Branch was reported to members both as regards work done by the Committee and acceptance of new members. There was a good attendance, and Mr. Clayton, of Manchester, addressed the meeting.

Junior Institution of Engineers.—A paper on "Static Transformers," read by Mr. S. A. Stigant before the North-Eastern Section on June 11th, is printed in the August issue of the *Journal*.

Appointments Vacant.—Women tracers for the Admiralty Department of Electrical Engineering; shift engineer (£156 to £175) for the Kilmarnock Burgh Electric Lighting and Tramways Department; switchboard attendant (43s. 6d. + 12½ per cent.) for the Leith Corporation Electricity Department; charge engineer (67s. 6d.) for the Bedford Corporation Electricity Works; visiting lecturer and demonstrator in electrical engineering for the Wolverhampton Corporation Education Committee. See our advertisement pages to-day.

Employment of Disabled Sailors and Soldiers.—Two useful publications have just been issued by the Ministry of Labour dealing with openings in industry suitable for disabled men. They have been prepared by the Trade Advisory Committee (Shipbuilding and Engineering Trades). No. XV, "Engineering. Part I." deals with schemes for training men in certain light machine operations and trades; the processes suitable for partially-disabled men are analysed, and the instructions issued by the Ministry of Pensions to regulate the training are appended, together with particulars as to the maintenance allowances during training, technical school fees, &c. Applications from men or employers should be addressed to the nearest Local War Pensions Committeee. No. XVII, "Engineering, Part II," deals with electrical engineering, in four sections:—Dynamo and Motor Manufacture, Cable Manufacture, Switch and Control Gear Manufacture, and Instrument Manufacture. An exhaustive list of minor operations and skilled trades is given, followed by a detailed statement of the degrees of disablement which would not debar employment in each case. The prospects of continuity of employment are stated to be good, and full particulars of the approved training courses are given.

These reports will be of the utmost value both to disabled fighting men and to employers; they can be obtained from H.M. Stationery Office or any bookseller, price 1d. each.

Multifilament Incandescent Lamp.—A new incandescent lamp has been designed by T. B. Rider, of Los Angeles, the filaments of which are so arranged that in case one of them breaks or burns out another filament of the same candle-power is connected into circuit. The lamp has 12 filaments of 25 C.P. each, of which four are lighted at a time when the lamp is turned on, and the next four come into action in sections of 25 C.P. as each of the four originals is lost. Thus the lamp always gives 100 C.P. until the last substitute is used. When this is the case there are still the auxiliary filaments left, so that the life of the lamp is three times that of an ordinary lamp, or still greater than this if it is operated at reduced candle-power, when most of the filaments have failed. A filament when in action is held taut by a spring at its base, and the failure of the filament allows the spring freedom to move far enough to touch a contact in connection with the next substitute filament, and so on.—*Electrical Review and Western Electrician*, May 25th.

Effect on the Eye of Different Illuminants.—Experiments to test the effect on the eye of different illuminants are described in the *Transactions* of the American Illuminating Engineering Society by Messrs. C. E. Ferree and G. Rand. They include various electric incandescent lamps—carbon, tungsten, tungsten with blue bulb—and a kerosene lamp. Results are plotted in terms of "time clear to time blurred" to indicate the degree of fatigue as in previous work. The results suggest that the colour is an element of some consequence. The loss of efficiency of the eye, on the above criterion, was least with a tungsten lamp giving a "white" light, greater with a carbon lamp and a kerosene lamp, and highest with the lamp with a blue bulb. It thus appears that the least fatigue was sustained with the light approaching nearest to white.

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Inquiries.—Correspondents ask for the names of makers of the "Lowa" dimming switch, of an electrical baling press, and of electric switch dials.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Corps Orders No. 35, by Lieut.-Colonel C. B. Clay, V.D., Commanding:—
Captain of the Week.—Capt. W. Darley Bentley.
Next for Duty.—Capt. E. G. Fleming.
Sunday, September 1st.—Commandant's Parade, Waterloo Station, 8.45 a.m., opposite No. 9 Platform, for work at Esher. Dress: Drill Order, without rifles. Mid-day and tea rations to be carried.
Monday, September 2nd, to Friday, September 6th.—Drills as usual.

C. Higgins, *Capt.* R.E., *Adjutant.*

Electrical Methods of Killing Sharks.—It is reported that the fishing fleets in the Northern Atlantic Ocean have instituted a new method of killing sharks that have lately caused considerable trouble on the fishing grounds. It appears that the bait hook is connected by an insulated cable to one pole of an electric generator, the other pole of which is connected to the hull of the ship. When the drum on which the cable is wound is revolved by a pull by the shark, the cable is touched by a rubbing contact which connects it to the source of supply and kills the shark electrically.

Electrician Rewarded.—Mrs. Kean, Kilmarnock, has received a cheque for £50 from the Admiralty as an award to her husband, Adam A. Kean, motor mechanic, for his "coolness and promptness in the handling of his engine" during an attack by an enemy submarine in the East. Prior to enlisting Mr. Kean was employed as chief electrician and motor mechanic with the Dunlop Motor Co., Ltd., and at present he is acting as chief motor mechanic on a submarine chaser.

Improvements in Telephone Cables.—French Patent No. 482,722 of the French Thomson-Houston Co. describes a telephone cable in which the insulating material is coated with a very thin layer of metal that is deposited by electrolysis or by a hot metallic spray. The layer of metal carries away disturbing currents and also affords an effective protection against the oxidisation of the insulating material.—*Revue Générale de l'Electricité*, May 25th.

Electrical Training of Discharged Soldiers.—The third half-yearly report of the Middlesex War Pensions Committee states that 103 discharged soldiers have been given trade instruction during the past six months. Of this number 10 were trained as electric sub-station attendants; 1 chose kinematography, 14 electrical engineering, and 4 electrical testing.

The Prince Albert City Default.—The *Financial Times*, referring to the default on the July coupons of the Prince Albert City debentures, says that Prince Albert City "spent over £200,000 on a hydro-electric plant that had to be abandoned, and the population, which was 11,000 when the bonds were issued in 1913, fell to 8,500 in 1916."

Vladivostok Tramways.—Reuter's agent at Vladivostok states that it is reported that by a private deal between the Americans and the municipality, 3,500,000 roubles (£350,000) have been lent to the town on the security of the tramways.

Electric Steel in Australia.—The Victorian Iron Rolling Co., Melbourne, will shortly install a 6-ton electric steel furnace of the Héroult type. The transformers and a supply of electrodes have been ordered in America. Energy will be taken from the Melbourne City Council's station.—*Commonwealth Engineer.*

The Australian Electric Steel Co. is opening a branch smelting works at Midland Junction, Western Australia, for the purpose of converting the large quantities of available scrap into steel ingots for local use and for export. For some time past the company has been supplying the Government tramways with electric steel for axles and wheel centres. The furnace that is being installed is one of the largest yet attempted by the company. The whole of the power will be derived from the Government power house at East Perth, some 10 miles from the works; about 1,000 kw. will be required.—*Australian Mining Standard.*

Educational.—Manchester Municipal College of Technology.—In February last we announced the decision of the Governing Body of the College to set up a Lectureship in Industrial Administration; the City Council is now inviting applications for the appointment, at a salary of £600 a year for five years. It is also proposed to institute a series of afternoon or evening lectures on the subject during the coming winter session. Particulars will be found in our advertising pages to-day.

Waste Heat.—According to the *Daily Telegraph*, in a recent lecture at Charlottenburg, the economical use of coal for domestic purposes was discussed, and an example of the utilisation of the waste heat from a generating station was given, in which complete heating arrangements had been carried out in 300 workmen's dwellings by the waste heat of a neighbouring power station, the annual saving of fuel being estimated at 3,000 tons. Obviously much depends upon the effective transmission of hot water through a system of well-lagged pipes. If this can be accomplished, then the delivery of water at a moderate temperature of, say, 120° F. should suffice for most domestic purposes. It is hot enough for cleansing purposes, and, where necessary, can be raised to boiling point with a limited supply of heat. In carrying out such a system it is claimed that water can be transmitted in a 12-in. main suitably lagged at a temperature of 100° F. above ordinary temperature at the rate of 3 linear ft. per second, with a loss of 1·65 to 3·3 per cent. of heat per mile, giving a total loss of 6·6 to 13·2 per cent. over a 4-mile radius.

Private Arrangements.—Landaulet Co., Ltd., Upper Manor Street, Chelsea.—Pursuant to Section 188 of the Companies (Consolidation) Act, 1908, a meeting of the creditors of the above-named company was held on August 26th at 20, John Street, Adelphi, W.C. 2, having been called by the liquidator, Mr. R. G. Sidford. It was stated that a petition had been filed by the largest creditors, Messrs. Bowley & Son, whose debt was about £400, for the compulsory winding-up of the company, but this firm, who were represented, intimated that the reason of this was because they wished an independent liquidator to be appointed. In that event they were prepared to withdraw the petition, but otherwise they would ask the Court to make a winding-up order. After discussion it was, therefore, resolved that application should be made to the Court to appoint the nominee of the petitioning creditors, Mr. W. Viney, C.A., as liquidator in the place of the existing liquidator, and it was understood that the petitioning creditors would apply to the Court for an order to this effect. It appeared that the company was registered on February 24th, 1902, with a nominal capital of £50,000, divided into 5,000 shares of £10 each. The total number of shares issued subject to payment wholly in cash was 3,928. The name of the company in the first place was the Electric Landaulette Co., Ltd., but this style was changed to the Landaulet Co., Ltd., on January 3rd, 1911, the registered offices of the company being Upper Manor Street, King's Road, Chelsea. The business of the company consisted mainly of letting out motor-cars on hire, and in May, 1917, when the Government made an Order restricting the use of petrol and also the letting out of motor vehicles except for certain purposes, the business was practically brought to a standstill, and the debenture holders, who then wanted £4,000, appointed Mr. Sidford to act as receiver. The receiver has paid off the debentures with the exception of a small sum.

Amalgamation of Technical Workers in Germany.—According to the *Vorwärts*, the directors of the Association of Technical Minor Officials and Employés (the B.t.A.) recently recommended their members to accept the proposals for amalgamation which were the upshot of the negotiations with the Association of Technical-Industrial Employés (the B.t.i.B.), and instituted a ballot to ascertain the wishes of the members. Some 80 per cent. of them voted, and the proposal was accepted with only one dissentient. The result shows how the large majority of the members were in favour of amalgamation. Since the amalgamation is to be carried out in such a way that there will be no change in the position or management of the B.t.i.B., it was not necessary to take the votes of the members of the latter association on the matter. It is clear, however, that the amalgamation of the two associations means more than the avoidance of a regrettable split in organisation. It is to be hoped, says the *Vorwärts*, that it is the precursor of an era of prosperity and agreement. Such amalgamation does not presume that divergencies of opinion must be suppressed, but disputes on facts must be settled as such, and must not entail personal quarrels.

Standardisation of Voltages.—With regard to the proposed standardisation of voltages, both for lighting and power circuits, we are informed that the Tungsten Lamp Association has formally endorsed the standards advocated by the B.E.A.M.A. and the British Engineering Standards Association, *i.e.*, 100, 110, and 115 volts (for low voltage), and 200, 220, and 230 volts (for high voltage). The association, however, does not propose an immediate alteration to these limits, but for the present intends to adopt the following as the standard voltage range:—

Under 100 volts: 25, 50, and 55 volts.
Low voltage: 100, 105, 110, 115, 120, and 125 volts.
High voltage: 200, 210, 220, 230, 240, and 250 volts.

Lamps of these voltages will be supplied at standard prices, but an extra charge will be made for all lamps of intermediate and higher or lower voltages. These voltages are adopted as a start towards the standardising movement recommended by other prominent associations, and comprise a much larger number of voltages than it is intended ultimately to adopt.

Such standardisation would secure tremendous advantages for the electrical manufacturer, while factors, contractors, and dealers, and even consumers, would benefit. At the present time the variety of voltages in actual use constitutes a serious disadvantage, seeing that the manufacturer is committed to the multiplicity of types, and the trade is compelled to carry an unnecessary variety of stocks of similar material. Further, it very seriously interferes with the continuity of manufacture, delays production, and inevitably increases the cost of manufacture.

In Continental practice the number of voltages in regular demand is limited to one or two in both high and low voltage ranges, while in the U.S.A. and Canada an effective movement has been made during the past four or five years to reduce the number of standard voltages to not more than three, such as the present policy of the T.L.A. aims to secure. Manufacturers of all classes of electrical material realise the necessity for a similar standardisation in this country, and the Tungsten Lamp Association considers it desirable to associate itself with the movement. The lamp manufacturers hope that this very necessary restriction will be generally supported by all electrical interests both on the power and lighting sides of electrical work.

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An Electrically-operated Shipyard.—Lord Pirrie, who is on a tour of inspection through the shipbuilding areas of the North-East Coast, visited the Egis Yard on Monday, August 26th. This yard, on which work was begun in November, is now nearly completed. It covers a site of nearly 16 acres on the banks of a North-East Coast river, and is entirely driven by electricity. It has four berths, each capable of building a ship 430 ft. long by 56 ft. beam, and of about 10,000 tons deadweight. The principal buildings are erected on each side of the berths. On the south is a platers' shed, 532 ft. long by 100 ft. broad, which contains all the most up-to-date electrically-driven machinery for working the steel material. Direct gas-firing furnaces for frame and plates are installed. The means of erecting the material when worked on to the slips is provided by 20 steel derrick posts 98 ft. long with 35-ft. derricks, four on each side of each ship, with an independent electric winch capable of lifting 3 tons to each derrick. Six other portable electric winches are also provided for use where required.

On the east side of the yard are the general stores, joiners' shop, mould loft, mast shed, with machines for making all masts, derricks, ventilators, &c., and a carpenters' shed. On the north-east side is a fitting-out quay 466 ft. long, where the vessels will be fitted out after launching. Along the quay is a 30-ton electrically-driven travelling crane capable of lifting 30 tons at a radius of 54 ft. and 10 tons at a radius of 90 ft., the height above crane wheels being 98 ft. On the west side are the beam shed, smiths' shops, finishing shops, plumbers' shops, &c., all equipped with the latest and most efficient machinery. Electric power and lighting, pneumatic piping, water pipes, &c., are taken down between each berth, and every facility is provided for utilising pneumatic power to the greatest possible extent. The shipyard is driven throughout by electricity supplied on the three-phase system. (See also Elec. Rev., August 16th, 1918, p. 164.)

The Growth of Electrical Refrigeration.—One of the most remarkable new applications of electrical energy is that of refrigeration and cold storage. This growth is well emphasised in developments in Southern California. Converts to the electrical method were slow at first, but the increase now seems to be in the geometric ratio. In fact, since September, 1917, the commercial department of the Southern California Edison Co. reports that several plants have been induced to electrify, amounting in all to about 4,000 h.p., one alone being over 2,000 h.p. This class of energy is better than an annual load factor of 80 per cent. and a power factor close to unity, on account of synchronous motors, is most ideal. The use of refrigeration as a whole is on the increase. The building of a series of cold storage plants at shipping ports is part of the present national food conservation plan and a campaign is being conducted in this connection to break down public prejudice. On the other hand, the domestic possibilities in electrical refrigeration have not begun to be realised—and the development of an inexpensive household equipment is one of the most fascinating problems remaining to the experimenter. The United States probably uses ice in the household to a greater extent than any other country. In Europe, for instance, the domestic ice box is almost unheard of, there are no "consumer's" ice companies and the general practice is to boil the milk and to do without such meats as will not keep in the summer. In America however, the demand is already created, and it remains only to turn it into electrical channels—a feat which is fast being accomplished in the commercial line, as pointed out in the two articles on refrigeration appearing in the August 1st issue of the *Journal of Electricity*.

Temperature Measuring Apparatus. — According to *Elektrotechnic und Maschinebau*, special apparatus has recently been contrived to measure rapidly fluctuating temperatures such as an ordinary thermometer is too sluggish to record. At the point of measurement, wires of platino-iridium, 0.02 mm. diameter, are inserted and are connected to a galvanometer. The deflection varies with the resistance of the wires, and it is stated that variations in temperature with a frequency of ten per second may be noted. It is anticipated that the apparatus will be specially useful for studying cyclical variations in temperature in the cylinders of steam engines and combustion engines.

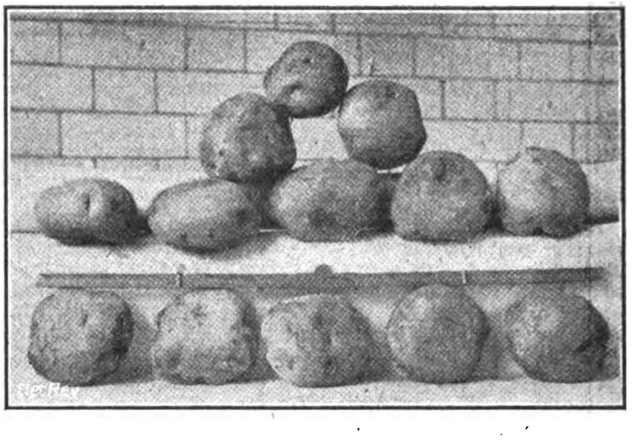
Fuel Economy in the U.S.—State Administrative Engineers of the United States Fuel Administration held a Conference in Washington, on June 28th and 29th, discussing the plan of organisation in connection with the conservation of fuel in power plants throughout the United States. An Administrative Engineer will be appointed for each of the States in the area mentioned. The object is to operate all industries at full capacity, but to make every lb. of fuel perform maximum service.

The National plan comprises certain fundamentals, as follows:—(1) Personal inspection of every power plant in the country. (2) Classification and rating of every power plant, based upon the thoroughness with which the owner of said plant conforms to recommendations. (3) Responsibility of rating the plants will fall upon the Administrative Engineer in each State; the rating to be based upon the reports of inspectors, who will not express opinions, but will collect definite information. The State Fuel Administrator, in his judgment, may entirely or partially shut off the supply of coal to any needlessly wasteful plant in his territory. (4) Inspectors are to be furnished from one or more of the following sources: inspectors of the steam-boiler insurance companies; State factory inspectors; engineering students from technical colleges; volunteers and others.

The ratings will be based upon recorded answers to questions, each of which will be given a value depending upon its relative importance to the other questions. Depending upon the efficiency of methods in use in any plant, it may be rated in Class 1, 2, 3, or 4.

The Administrative Engineer in each State will have supervision of electrical and mechanical problems connected with fuel conservation activities contemplated under this plan. The ratings will be based upon existing equipment. The difficulty, delay, and expense involved in the installation at this time of improved power equipment is fully recognised; but experience has proved that 10 to 20 per cent. of the fuel now used in power plants can be saved by improvements in operation alone. It is recommended that a Board of competent engineers be attached to the Conservation Committee in each State; also a corps of lecturers to arouse public interest and disseminate engineering information. The Fuel Administration has prepared a 50-minute film of moving pictures showing good and bad operation in the steam-boiler plant, methods of testing boilers, &c. These pictures will be available to each State in connection with educational propaganda. The Administration is also preparing a series of official bulletins on engineering phases of steam and fuel economics. As the work develops, still further constructive assistance is contemplated for helping owners to bring their plants up to a high plane of economic operation.—*Electric Traction.*

Electroculture.—To those who take an interest in electroculture the accompanying illustration of a few of many similar potatoes recently lifted at Chester will be of interest. The potatoes are of the "Great Scot" variety, and the photograph with the



Potatoes grown under Electric Discharge.

2 ft. rule gives an idea of the size of the tubers. The individual potatoes weigh from 1 lb. 1½ oz. to 1lb. 4 oz. Mr. S. E. Britton, city electrical engineer, who sends us the photo., is not yet in a position to give comparative results, which, however, we shall await with interest.

Electrically-driven Rolling Mills.—At the annual meeting, last week, of the Sheffield Forge and Rolling Mills Co., Mr. C. E. Siddall, who presided, said that the new electric mills, which the company had been putting down for the past two years, were not yet running, owing to the delay in obtaining the necessary permits, but he hoped that the first mill would be running within a week. The adoption of electric drive had been severely criticised, chiefly by people who knew nothing about it, but who were the first to copy it immediately it was got going; in adopting electric drive, the right thing was being done. There was no better illustration of that than the fact that that morning the electric sheet mill was running in spite of the coal strike. If the two electric mills could have been running, it would not have mattered about the rest of the works—everybody would have been satisfied. The electric drive had been given a fair trial, and it had proved successful. The sheet mills had paid for themselves during the three years they had been running. The running cost was less than steam, and it was intended gradually to electrify the whole of the works; this would not mean any diminution of dividends, but rather the opposite.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Greenock Corporation has increased the salary of the borough electrical engineer, Mr. F. H. Whysall, by £100 per annum.

Mr. H. P. Stokes, general manager and electrical engineer to the Bexley Council Electricity and Tramways Department

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and Dartford Light Railways, has been appointed district engineer in connection with the coal economy campaign.

According to the *Commonwealth Engineer*, Mr. J. C. Lane, superintendent of the Melbourne City Council electric power station, was severely burned by an explosion of gas which occurred in one of the boiler furnaces in May during an investigational run with brown coal.

General.—The marriage took place at Edinburgh, on August 24th, of Mr. J. H. Bunting (general manager of Bruce Peebles & Co., Ltd.) and Janet (Nettie) Rintoul, eldest daughter of Mr. and Mrs. Henry Mitchell, Edinburgh.

Mr. P. A. Spalding, engineer and manager of the Dundalk electricity undertaking, has been appointed by the Controller of Coal Mines a district engineer to assist in the coal economy campaign.

A commission in the Indian Army has been granted to Mr. C. H. Bransom, who was prior to the war an electrician with Messrs. Joslins, Ltd., of Colchester. He has served in India with the East Surrey Regt. since early in the war.

A farewell luncheon in honour of Mr. R. W. Dalton, H.M. Trade Commissioner for New Zealand, was given at Wellington, N.Z., last week. The luncheon was given by representatives of British manufacturers.

Mr. R. N. Tweedy has received a commission (technical) in the R.A.F., A.O.S. branch. He will be stationed at headquarters in Dublin, 65, Fitzwilliam Square, in charge, under the C.O., of the power and lighting installations at all the aerodromes in Ireland. In consequence, he has resigned the appointment as manager of the Dublin and South of Ireland branch of Messrs. Wm. Coates & Son, Ltd., which he has held for nearly 12 years.

Roll of Honour.—Corporal J. Regan, Manchester Regiment, posted missing in October last, and now reported killed, was employed by Messrs. Ferranti, Ltd., Hollinwood.

Private J. H. Bailey, Dragoon Guards, killed in action, was with Messrs. Royce, Ltd., Trafford Park.

Private A. Samyn, 6th Belgian Chasseurs, who was in the electrical department of Messrs. Vickers, Ltd., of Sheffield, has been awarded the Belgian Military Medal for saving the life of his colonel; he has also received the French Military Medal, and the Belgian War Cross.

Private Gale, who has died in Egypt from malarial fever, was manager of the electric light station at Topsham (Devon).

Sergeant T. Standing, R.W. Kent Regiment, who was for 17 years with Messrs. G. Weeks & Sons, electricians, Bromley (Kent), has fallen in action.

Major B. S. Benning, R.A.F., of Dunstable, who has been awarded the Croix de Guerre with the palm leaf, was formerly engaged in wireless work with the Marconi Co.

Lieutenant H. B. Wilson, R.A.F., who has been accidentally killed whilst flying in Wiltshire, enlisted whilst engaged at Aden with the Eastern Telegraph Co.

Private F. B. Woffenden, Durham Light Infantry, and prior to last September employed by Messrs. Sykes & Sugden, electrical engineers, Huddersfield, has died of wounds received in action.

Private L. T. Seed, West Riding Regiment, who was an electrical engineer at Halifax, was killed in action on July 28th.

Corporal A. Shutt, Royal Fusiliers, Lewis Gun Section, who has been killed in action, aged 20, was with Messrs. Bottomley & Frampton, electrical engineers, Blackpool. He was the only son of Mr. Edgar Shutt, of the Blackpool Corporation Electricity Works.

Private A. H. Bowery, who was formerly employed in the glass-blowing department of the Westinghouse Cooper-Hewitt Co., Ltd., has been awarded the Military Medal for gallant conduct in the field.

Pioneer A. Gregory, R.E., who is a prisoner of war at Giesson, Germany, was an employé of the St. Helens Cable and Rubber Co., Ltd.

M. C. Espir, son of M. Lucien Espir, managing director of the General Electric de France, Ltd., has been awarded the Croix de Guerre for energy and bravery, in ensuring the liaison under violent bombardment in July between an American battalion and the French troops close by.

Colonel Bertram Hopkinson, F.R.S., C.M.G.—Few of the gaps that the war has caused in the engineering world will be so difficult to fill as that which follows the loss of Colonel Bertram Hopkinson through a flying accident in north-east London on Monday last. Among the engineering professors of the day few were more distinguished or seemed to have greater careers before them. He was the eldest and last surviving son of the late Dr. John Hopkinson, F.R.S., who was killed in Switzerland in 1898. After that sad event, which many in the electrical world will remember so well, Bertram, who had been called to the Bar in the previous year, entered into consulting engineering partnership with Mr. Charles Hopkinson and Mr. E. Talbot, and various electric traction and other public works were carried through by them. About fifteen years ago Mr. Bertram Hopkinson became Professor of Mechanism and Applied Mechanics at Cambridge University, and in 1914 he was elected to a professorial chair at King's College. For some years Professor Bertram Hopkinson held a prominent and respected position in Section G. (engineering) at meetings of the British Association for the Advancement of Science, at which he submitted the gaseous explosions reports. For several years past Professor Hopkinson had been an officer in the Royal Flying Corps, and he had been in charge of experimental work for the R.A.F. for some time. He has laid down his life for the Allied cause in a branch of the service where his specialised knowledge could not fail to be of great value, but while his loss is deplorable on that account, it is equally regrettable on personal grounds, for he was a man of attractive personality and bore certain marked resemblances to his distinguished father. Colonel Hopkinson married the eldest daughter of Mr. Alexander Siemens in 1903. A military funeral takes place at Cambridge on Friday (to-day). A special train is being run from Liverpool Street Station at 11.50 a.m.

Obituary.—Mr. G. Simon Cullum.—Mr. G. S. Cullum, who has passed away, had for over 50 years been engaged at the Charlton works of Messrs. Siemens Bros.

TRADE STATISTICS OF NEW ZEALAND.

The following figures, showing the imports of electrical and allied goods into New Zealand in 1916, are taken from the official statistics which have recently reached this country. The figures for the previous year are given for purposes of comparison, and increases or decreases noted. In each year the country named is the country of origin of the goods.

	1915. £	1916. £	Inc. or dec. £
Leather belting.—			
From United Kingdom ...	4,000	4,000	—
,, United States	2,000	1,500	– 500
,, Other countries	2,000	2,500	+ 500
Total	8,000	8,000	—
Belting, other than leather.—			
From United Kingdom ...	22,000	39,000	+ 17,000
,, Australia	1,000	2,000	+ 1,000
,, United States	2,000	3,000	+ 1,000
Total	25,000	44,000	+ 19,000
Scientific instruments.—			
From United Kingdom ...	4,000	4,000	—
,, United States	1,000	2,000	+ 1,000
,, Other countries	1,000	1,000	—
Total	6,000	7,000	+ 1,000
Telegraph and telephone wires, iron.—			
From United Kingdom ...	9,000	1,000	– 8,000
,, United States	—	1,000	+ 1,000
Total	9,000	2,000	– 7,000
Engine packing.—			
From United Kingdom ...	11,000	13,000	+ 2,000
,, Australia	1,000	3,000	+ 2,000
,, United States	5,000	7,000	+ 2,000
,, Other countries	1,000	1,000	—
Total	18,000	24,000	+ 6,000
Generators, motors, and transformers.—			
From United Kingdom ...	44,000	46,000	+ 2,000
,, Germany	2,000	—	– 2,000
,, United States	26,000	38,000	+ 12,000
,, Other countries	2,000	2,000	—
Total	74,000	86,000	+ 12,000
Electric batteries and cells.—			
From United Kingdom ...	5,000	10,000	+ 5,000
,, United States	1,000	7,000	+ 6,000
,, Other countries	1,000	2,000	+ 1,000
Total	7,000	19,000	+ 12,000
Other electrical material.—			
From United Kingdom ...	67,000	78,000	+ 11,000
,, United States	30,000	52,000	+ 22,000
,, Australia	2,000	2,000	—
,, Sweden	4,000	1,000	– 3,000
,, Other countries	5,000	7,000	+ 2,000
Total	108,000	140,000	+ 32,000
Carbons and insulating material.—			
From United Kingdom ...	4,000	7,000	+ 3,000
,, United States	—	3,000	+ 3,000
,, Other countries	2,000	1,000	– 1,000
Total	6,000	11,000	+ 5,000

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	1915. £	1916. £	Inc. or dec. £
Telephones and accessories.—			
From United Kingdom ...	—	13,000	—
,, United States	—	11,000	—
,, Other countries	—	1,000	—
Total	—	25,000	—
Meters, electricity.—			
From United Kingdom ...	8,000	12,000	+ 4,000
,, Other countries	1,000	2,000*	+ 1,000
Total	9,000	14,000	+ 5,000
* United States £2,000.			
Lamps, electrical.—			
From United Kingdom ...	23,000	29,000	+ 6,000
,, Holland	—	9,000	+ 9,000
,, United States	7,000	8,000	+ 1,000
,, Other countries	11,000	—	- 11,000
Total	41,000	46,000	+ 5,000
Steam engines.—			
From United Kingdom ...	13,000	11,000	- 2,000
,, United States	—	2,000	+ 2,000
Total	13,000	13,000	—
Boilers.—			
From United Kingdom ...	13,000	10,000	- 3,000
,, United States	2,000	—	- 2,000
Total	15,000	10,000	- 5,000
Gas and oil engines (except for motor cars).—			
From United Kingdom ...	43,000	41,000	- 2,000
,, United States	14,000	21,000	+ 7,000
,, Other countries	1,000	6,000	+ 5,000
Total	58,000	68,000	+ 10,000
Insulated cable and wire.—			
From United Kingdom ..	102,000	156,000	+ 54,000
,, United States	3,000	6,000	+ 3,000
,, Other countries	2,000	10,000*	+ 8,000
Total	107,000	172,000	+ 65,000
* Japan £9,000.			
Mining machinery.—			
From United Kingdom ...	15,000	11,000	- 4,000
,, Australia	2,000	3,000	+ 1,000
,, United States	15,000	6,000	- 9,000
,, Other countries	13,000	2,000	- 11,000
Total	45,000	22,000	- 23,000
Railway and tramway plant.—			
From United Kingdom ...	56,000	73,000	+ 17,000
,, Australia	4,000	10,000	+ 6,000
,, Other countries	1,000	11,000	+ 10,000
Total	61,000	94,000	+ 33,000

NEW COMPANIES REGISTERED.

Sheffield Ball Bearings Co., Ltd. (151,218).—Private company. Registered August 17th. Capital, £3,000 in £1 shares. Manufacturers of and dealers in ball and roller bearings, mechanical, electrical, motor and general engineers, etc. The subscribers (each with one share) are: P. Thomson, Ashfurlong, Dore, near Sheffield, retired Army officer; A. Fletcher, Summerley House, Instone, Sheffield, mechanical engineer. The first directors are: A. Fletcher, P. Thomson and W. Fowler. Registered office: St. James Chambers, 38, Church Street, Sheffield.

A. Lege & Co., Ltd. (151,226).—Private company. Registered August 20th. Capital, £2,000 in £1 shares. To take over the business of mechanical and electrical engineers and scientific instrument makers, carried on at 47, Lofting Road, London, as "A. Lege & Co." The subscribers (each with one share) are: Mrs. E. Lege, 11, Milner Street, Chelsea, S.W.; W. Jepson, 3, Walton House, Thane Villas, Holloway, N., engineer. The first directors are: W. Jepson, F. H. Bailey and A. E. Walker. Registered office: 47, Lofting Road, Islington, N.

Charles Winn & Co., Ltd. (151,156).—Private company. Registered August 10th. Capital, £50,000 in £1 shares. To take over the business of manufacturers of, and dealers in steam, gas and electric fittings, lamps, pumps, tools, etc., formerly carried on by the late O. Winn and P. Winn, in Birmingham, as "Charles Winn & Co." The subscribers (each with one share) are: P. Winn, 149, Granville Street, Birmingham, engineer; G. J. Withington, 29, Bowyer Road, Saltley, Birmingham, solicitor's clerk. P. Winn is governing director. Solicitors: Pinsent & Co., 6, Bennetts Hill, Birmingham.

Electro-Medical Treatment, Ltd. (151,203).—Private company. Registered August 16th. Capital, £3,000 in £1 shares. Objects as indicated by the title. The subscribers (each with one share) are: F. Sugden, 90, Dudley Road, Whalley Range, Manchester, produce merchant; E. O. Walker, 16, Wellington Road, Whalley Range, Manchester, electrical engineer. The first directors are: F. Sugden and E. O. Walker. Registered office: 12, Exchange Street, Manchester.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Faringdon Electric Light & Power Co., Ltd.—Notice of the appointment of W. A. Henderson, of 29, Gracechurch Street, E.C. 3, as receiver on August 9th, 1918, under powers contained in instruments dated February 11th, 1916, and August 25th, 1916, of first and second mortgage debentures, filed pursuant to Section 94 of the Companies (Consolidation) Act, 1908.

Portable Searchlight and Signalling Co., Ltd.—Notice of the appointment of E. J. Allcard, of 28, Throgmorton Street, E.C., as receiver, by Order of the Court dated July 26th, 1918, filed pursuant to Section 94 of the Companies (Consolidation) Act, 1908.

Fisher, Humphries & Co., Ltd.—Third mortgage debentures, dated July 26th, 1918, charged on the company's undertaking and property, present and future, including uncalled capital, to secure all moneys which may become payable under a guarantee to bankers by Col. H. Edzell, C.B., of Ystrad Mynach, and Col. A. P. James, of Cardiff.

Portable Utilities Co., Ltd.—Debenture dated August 2nd, 1918, to secure £1,600, charged on the company's undertaking and property. Holders: Electric Appliances Co., Ltd.

Hooper's Telegraph & India Rubber Works, Ltd. (40,947).—Capital, £50,000 in 1,000 preference and 4,000 ordinary shares of £10 each. Return dated July 23rd, 1918. 1,000 preference and 2,500 ordinary shares taken up. £25,000 paid on the ordinary; £10,000 considered as paid on the preference. Mortgages and charges: Nil.

Birmingham District Power and Traction Co., Ltd. (19,077).—Capital, £700,000 in £1 shares (250,000 preference and 450,000 ordinary). Return dated May 21st, 1918. 146,846 preference and 412,934 ordinary shares taken up; £559,780 paid. Mortgages and charges: £381,381.

Altrincham Electric Supply, Ltd. (40,795).—Capital, £50,000 in 49,650 preference shares of £1 and 7,000 deferred share of 1s. Return dated May 6th, 1918. 45,000 preference and 7,000 deferred shares taken up; £1 per share called up on 42,450 preference; 1s. per share on 2,550 preference and 1s. per share on 7,000 deferred shares; £42,297 10s. paid. Mortgages and charges: £45,000.

A. Hirst & Son, Ltd. (57,889).—Capital, £5,000 in 100 preference and 400 ordinary shares of £10 each. Return dated July 23rd, 1918. All shares taken up. £2,000 paid on 100 preference and 100 ordinary shares; £3,000 considered as paid on 300 ordinary shares. Mortgages and charges: Nil.

CITY NOTES.

Brown, Boveri & Co.

We referred in our issue of August 9th to the annual report and accounts of the Société Anonyme Brown, Boveri & Compagnie, of Baden, Switzerland, for the year 1917-18. Supplementing the information then given we learn from the directors' report that the company's sales in the home market were favoured by the importance which the utilisation of electrical energy has assumed in Switzerland under existing circumstances, although the establishment of new hydro-electric works does not proceed without many difficulties. In this respect present events demonstrate the manifest mistakes which 15 years ago caused nationalisation ideas for the equipment and working of the Swiss waterfalls to be extolled, and which thus arrested the development of private enterprise which was providing the country with cheap energy. Many works, the erection of which had been already assured, consequently remained merely as paper projects, and to-day their absence was not only seriously felt, but they can never be constructed on such favourable terms in the matter of prices. The report for 1916-17 made mention of a new driving system for electric locomotives, recommended by M. Tschanz, chief locomotive engineer of the Federal Railways, and it is now stated that the trials which are being continued on the Loetschberg railway, have fully answered expectations. Concerning the company's business with Russia, the report states that this came to a complete standstill, and it was to be feared that material losses might be incurred on the credits in that country. The prudence observed for a long time past in regard to increasing the risks incidental to Russia, however, would permit of the losses being borne without their reacting seriously on the balance-sheet. This state of affairs shows clearly the risks with which the industry has to reckon, and how essential it is for the firm to be always ready to meet them. This is why it is absolutely necessary that fiscal measures and the imposition of excessive taxes should not come further to restrict the industry's freedom of action and its resources to the point of even compromising its existence. Respecting the company's subsidiaries abroad, the report mentions that all of them are realising fairly satisfactory profits, which, however, are reduced by the large losses on exchange. All these companies are constantly endeavouring to develop their normal manufacturing branches, and they are succeeding, thanks to the continued relations which they maintain with the parent company and to the support rendered to them by the latter. This will certainly enable them, immediately after the war, to respond to the requirements of their respective markets, and ensure a sound basis for their future activity.

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Belgian Companies.

The financial statement of *Siemens et Halske, of Brussels*, which is only now available for the year ended July 31st, 1917, exhibits gross profits of £3,340, as compared with £466 in the preceding year. The net profits amounting to £660 have been carried forward, as against £140 in 1915-16.

The accounts of the *A.E.G.-Union Electrique, of Brussels*, in which German capital is also interested, show a loss of £21 for 1917, as compared with a loss of £197 in the preceding year, on an ordinary share capital of £140,000. The loss, as well as the general expenses, has been defrayed out of the reserve fund.

The *Société Financière de Transports et d'Entreprises Electriques, of Brussels*, which is an investment company, 25 per cent. of whose ordinary share capital of £1,000,000 is said to be held by German banks and the A.E.G., reports net profits of £78,000 for 1917, being practically the same amount as in the previous year. A dividend of 7 per cent. has been declared, being the identical rate paid in each of the previous years of war.

The *Compagnie Générale de Railways et d'Electricité, of Brussels*, which is a holding company in Belgian and foreign transport and supply companies, received interest amounting to £48,000 in 1917, as contrasted with £51,000 in the preceding year. After meeting general expenses, providing for depreciation, and paying interest on the loan capital of £1,159,000, the balance of £700 has been carried forward, the ordinary share capital of £1,329,000 again not participating.

The *Société Belge d'Eclairage de St. Petersbourg, of Brussels*, announces the impossibility of submitting accounts for 1917; as was also the case for the preceding years of war. The company holds a concession for the lighting of a part of the Russian capital, although its works were taken possession of by the Russian authorities in May, 1917, and it is also interested in the Imatra Co., which proposed to transmit power to Petrograd from hydroelectric works utilising the power of the Wuoxen, Finland.

German Companies.

The directors of the *Elektro-technische Fabrik Rheydt Max Schorch & Co.* recommend a dividend of 20 per cent. for 1917-18, this contrasting with a rate of 15 per cent. in 1916-17.

The *Bau Ges. fur Elektrische Anlagen, of Aix-la-Chapelle*, reports net profits amounting to £10,000 for 1917-18, as contrasted with £8,600 in the preceding year. A dividend of 6 per cent. is proposed, being the same rate as in 1916-17.

The *Deutsche Magneta A.G., of Cologne*, manufacturer of electric clocks, reports net profits of £790 for 1917, as against £1,200 in the previous year. The former is carried forward, whereas the latter was devoted to the payment of a dividend of 5 per cent. for 1916.

The accounts of the *Wolfram Lampen A.G., of Augsburg*, show net profits and balance forward of £5,600 for 1917, as compared with £14,000 in the previous year. It is proposed to pay a dividend at the rate of 6 per cent. on the preference shares for each of the past three years, and transfer the balance to the next account.

The *Continentale Isola Werke A.G., of Birkesdorf, Duren*, after allocating £16,000 to depreciation in 1917-18, as against £13,000 in the previous year, reports net profits of £33,000, as compared with £27,000. It is intended to pay a dividend of 10 per cent., being the same rate as in 1916-17.

The report of the *A.G. fur Elektrizitats Industrie, of Hamburg*, states that it was possible further to extend the business in 1917-18, despite the scarcity and dearness of materials. The net profits were £5,200, as compared with £4,300, and the dividend is at the rate of 7 per cent., as contrasted with 6 per cent. in 1916-17, on a share capital of £50,000.

The accounts of *Menowsky & Co., of Porz on the Rhine*, makers of insulating materials, show net profits of £40,000 for 1917-18, as compared with £15,000 in the preceding year, the sum of £23,000 and £14,000 having previously been written off for depreciation in the two years respectively. The method of disposing of the profits is not disclosed; in 1916-17 a dividend of 9 per cent. was paid on the share capital of £150,000.

The *A.G. Korting Elektrizitats Werke, of Berlin*, reports an aggravation of the difficulties experienced in maintaining the various electricity works in operation in 1917-18 owing to the scarcity of skilled men and the use of inferior fuel, which resulted in interruptions in the working of the plant. After writing off £15,000 for depreciation, as in 1916-17, the accounts indicate net profits of £10,000, as against £10,700 in the previous year, and the directors recommend a dividend of 4 per cent., as in 1916-17.

Stock Exchange Notices.—The undermentioned securities are to be quoted in the Official List:—

Edison Swan Electric Co., Ltd.—100,000 first preference shares of £1 each, fully paid (Nos. 1 to 100,000).

Howard & Bullough, Ltd.—250,000 additional ordinary shares of £1 each, fully paid (Nos. 750,001 to 1,000,000).

Madras Electric Supply Corporation, Ltd.—6,000 additional ordinary shares of £1 each, fully paid (Nos. 180,001 to 186,000).

County of London Electric Supply Co., Ltd.—Interim dividend on the preference shares at the rate of 6 per cent. per annum, less income-tax, and on the ordinary shares at the rate of 5 per cent. per annum, less tax, for the June half-year.

Fraser & Chalmers, Ltd.—The secretary has issued a circular to shareholders stating that, according to the preliminary statement, in the negotiations with the General Electric Co., Ltd., the mining machinery section of the business was excepted from the arrangement. It was found, however, on drafting the sale agreement that the retention of the mining machinery business presented so many difficulties in definition that a modification of the whole basis of the sale had to be adopted. The agreement which is now completed provides for the transfer to the G.E.C. of the entire works at Erith and all the manufactures hitherto conducted therein, together with the goodwill. The scope of the Fraser and Chalmers operations in future is thus limited to the merchanting business. An offer has now been received from responsible parties for the purchase of the whole of the South African business which has in the past carried very large stocks of machinery and merchandise. That offer has been accepted provisionally, and when the sale is completed the company will be left with only the stocks of its branch offices in Australia, Canada and elsewhere, for disposal. The total sum receivable has not yet been ascertained and cannot be for some time. Later on a statement will be made, together with the directors' recommendations with regard to future policy.

New Issue.—The Fellows Magneto Co., Ltd., is offering to shareholders, at par, £40,000 capital in 8 per cent. cumulative participating preferred shares.

Waste Heat and Gas Electrical Generating Stations, Ltd.—Interim dividend of 2½ per cent., less income-tax, for the half-year ended July 31st, 1918.

Canadian General Electric Co., Ltd.—Quarterly dividend of 2 per cent. on the Common stock.

STOCKS AND SHARES.

Tuesday Evening.

Conditions of Stock Exchange business remain much the same as they were last week. In some directions activity has shaded off, this applying to the electrical manufacturing shares which were given a good run earlier in the month, and the interest in which has now died down to some extent. This is explained in the market by reference to the holiday season, and to the fact that prices have risen sufficiently high to check fresh purchases, while, at the same time, previous buyers are not averse from taking profits. Therefore, Ediswan "A" shares have come down from 51s. to 47s. 6d., British Westinghouse preference from 31/16 to 2¾, and so on down the list. At the same time, the reactions have been small as compared with the previous rises, and in some cases prices are extremely well held, an illustration being afforded by Electric Constructions, which keep hard at 27s. 6d.

Dealings have just started in the bonus shares of the General Electric Co., so that at the present time there are three classes of ordinary shares being dealt in. There are the old ordinary, standing at 18¼, the new bonus shares, at 17¾, and the new shares which were offered for public subscription, and which stand at 5 premium. Those who wish to buy or sell General Electrics should make a point of specifying which issue they wish to deal in, otherwise there is scope for mistakes and friction. The new preference shares stand at 1/16 premium, and the market in the various issues is described as being a firm one.

The conclusion of the 'bus strike was marked by rises in several of the Underground issues. Districts and Metropolitans both advanced, but the full extent of the rise was not maintained. Activity in Underground Electric Railways of London descriptions has given way to a more placid market, and because of this and a certain amount of profit taking, the quotations are rather easier, 'Bus "A," for instance, being 8s. There is not much doing in the list of steam stocks, and the inactivity is a disappointment to those who were hoping that the strength of gilt-edged issues, fostered by the splendid news from the Western Front and the advances in Consols, War Loan, &c., would be extended to Home Rails. No doubt the public are disposed to view very warily the outlook in regard to labour, and for this reason are not eager to put money into the railway stocks at present.

There has been a further move-up, followed by reaction, in Mexicans. The recent raising of the export duty on oil can scarcely fail to make substantial difference to the revenue of the country, and this, it is held, will react favourably upon all Mexican industries. On the strength of these arguments, Mexican utilities were put up in price, though here again the strength evaporated, and prices gave way from the best. On the week there is not much change, and the big rises secured some ten days ago have mostly been held. Other foreign stocks are inclined to improve, and advances have been scored by Rio de Janeiro first mortgage bonds at 89 and by San Paulo bonds at 91. The firmness of Anglo-Argentine Tramways is also worth mentioning. Brazilian Tractions rose to 46. Bombay Electric preference have had a mysterious rise of 30s. to 10¾.

The market in English electricity supply shares remains dormant. Indeed, it might almost be worth while having

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this sentence set up as a standing contribution to our weekly article. Debenture stocks and preference shares are as scarce as ever. The County of London Electric has declared an interim dividend on the ordinary shares at the rate of 5 per cent., which is the same as that of a year ago. The preference shares have weakened ⅛, and so have City preference, though the ordinary shares in the latter company are a similar fraction to the good.

The telegraph and telephone market is firm as a whole, and Globe preference stiffened to 10¼. Westerns rose 5s. to 16⅜, but some of the shares in which there has been a fair amount of speculative business doing recently, have reacted, West India and Panama, for instance, lost 3/16 of their previous 9/16 advance, and Marconis at 3⅛ are 5s. down. American Marconis keep tolerably steady at 27s. Interest in the group as a whole has ebbed to some extent, and there has been a good deal of profit-taking.

India Rubber shares continue their steady rise, this week's gain being 10s., and Telegraph Constructions at 45½ are equally higher. British Insulated rose to 2⅛. Babcock and Wilcox keep about 3⅛, and British Aluminium, after a decline, recovered to 40s. Fraser & Chalmers have issued a long circular with reference to the taking-over of the company by the General Electric. In brief, the proposals amount to a sale of the Fraser & Chalmers' assets, the bulk of them going to the General Electric, and by degrees the company will be dissolved. The price of the shares hardened to 32s. 6d. on the announcement. Rubber shares continue to dwindle in price. Indian gold mining shares have stiffened by reason of the statement just issued showing what substantial economies have resulted from the introduction of a large scale some years ago of electrical installations. In other mining sections there is not much doing.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Aug. 27. 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6⅜	—	£7 17 0
Charing Cross Ordinary	5	4	3½	—	6 8 0
do. do. do. 4½ Pref.	4½	4½	3⅝	—	6 18 6
Chelsea	8	5	3½	—	7 13 10
City of London	8	8	11⅛	+ ⅛	6 19 2
do. do. 6 per cent. Pref.	6	6	9⅜	— ⅛	6 8 1
County of London	7	7	10⅛	—	6 17 7
do. do. 6 per cent. Pref.	6	6	9⅜	— ⅛	6 1 6
Kensington Ordinary	6	7	5⅛	—	6 17 7
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3½	—	7 18 10
Metropolitan	3	4	3⅜	—	6 8 0
do. 4½ per cent. Pref.	4½	4½	3⅝	—	6 18 6
St. James' and Pall Mall	8	9	6⅝	—	7 1 2
South London	5	5	3	—	6 18 4
South Metropolitan Pref.	7	7	21/-	—	6 18 4
Westminster Ordinary	7	9	5⅞	—	7 13 3
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	97½	—	6 3 0
do. Def.	1½	1½	23½	—	6 7 8
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10	—	*7 0 0
Eastern Extension	8	8	15⅛	—	*5 3 3
Eastern Tel. Ord.	8	8	158½	—	*5 1 0
Globe Tel. and T. Ord.	7	7	14⅜	—	*4 17 5
do. do. Pref.	6	6	10½	+ ⅛	5 17 1
Great Northern Tel.	24	22	87½	—	5 17 4
Indo-European	13	—	57½	—	5 12 6
Marconi	15	20	3⅛	— ¼	5 3 3
Oriental Telephone Ord.	10	10	3⅜	—	3 4 0
United R. Plate Tel.	8	8	7½	—	*5 6 8
West India and Panama	6d.	9d.	1½	— 1/16	*2 2 0
Western Telegraph	8	8	16⅜	+ ⅛	*4 17 9
Home Rails.					
Central London Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	1	1	27	+ ⅛	3 14 1
do. District	Nil	Nil	24	+1	Nil
Underground Electric Ordinary	Nil	Nil	2⅛	— ⅛	Nil
do. do. "A"	Nil	Nil	8/-	—3d.	Nil
do. do. Income	6	4	85½	—	*4 18 6
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅜	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3⅛	+ 1/16	—
do. do. 2nd Pref.	5½	—	2½	—	—
do. do. 5 Deb.	5	5	66	—	7 12 2
Brazil Tractions	—	—	46	+ ½	—
Bombay Electric Pref.	6	6	103½	+1½	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	60½	— 1	8 5 4
do. do. Preferred	Nil	Nil	44	— 1	Nil
do. do. Deferred	Nil	Nil	39½	— 1	Nil
do. do. Deb.	4½	4½	60½	—	7 0 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	50	—1	Nil
do. 6 per cent. Bonds	Nil	Nil	42	—	Nil
Mexican Light Common	Nil	Nil	27	+1	Nil
do. Pref.	Nil	Nil	41½	—2	Nil
do. 1st Bonds	Nil	Nil	54½	—2	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅛	—	8 17 2
British Aluminium Ord.	10	10	2	—	5 0 0
British Insulated Ord.	20	20	2⅛	+ ⅛	4 14 1
British Westinghouse Pref.	7½	7½	3⅜	— ⅛	5 9 1
Callenders	20	25	11½	—	6 4 6
do. 5 Pref.	5	5	4½	—	5 17 8
Castner-Kellner	22	20	3⅜	—	5 10 4
Edison-Swan, fully paid	—	—	3⅛	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	10	1⅜	+ 1/16	7 5 6
Gen. Elec. Pref.	6	6	10½	—	6 5 4
do. Ord.	10	10	18½	— ½	*5 8 1
Henley	25	25	3½	—	5 16 0
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17⅛	+ ½	*5 16 9
Telegraph Con.	20	20	45⅛	+ ⅛	*5 5 3

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, August 28th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£100	£20 inc.
a Ammonia, Muriate (large crystal)	,,	£75	..
a Bisulphide of Carbon	,,	..	..
a Borax	,,	£48	..
a Copper Sulphate	,,	£65	..
a Potash, Chlorate	per lb.	2/4	2d. dec.
a ,, Perchlorate	,,	2/-	..
a Shellac	per cwt.	£17 5/-	..
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	,,	£35	..
a ,, Lump	,,	£25	..
a Soda, Chlorate	per lb.	1/1	..
a ,, Crystals	per ton	17£/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 3" to 12" basis)	per lb.	..	..
c ,, Tubes (solid drawn)	,,	..	..
c ,, Wire, basis	,,	..	..
c Copper Tubes (solid drawn)	,,	1/8½ to 1/9	
g ,, Bars (best selected)	per ton	£161	..
g ,, Sheet	,,	£161	..
g ,, Rod	,,	£161	..
d ,, (Electrolytic) Bars	,,	£137	..
d ,, ,, Sheets	,,	£161	..
d ,, ,, Wire Rods	,,	£145	..
d ,, ,, H.C. Wire	per lb.	1/5½	..
f Ebonite Rod	,,	8/-	..
f ,, Sheet	,,	2/6	..
n German Silver Wire	,,	2/6	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	8/3	3d. inc.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£37	..
g Lead, English Pig	,,	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	6d. to 8/-	..
e ,, ,, ,, medium	,,	2/6 to 6/-	..
e ,, ,, ,, large	,,	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/10	1½d. inc.
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	,,	..	..
n ,, Wire, Nos. 1 to 16	per lb.	5/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Protecting the Panama Lock Valves against Electrolysis.—Electrolytic corrosion, acting in an unexpected manner, caused serious damage to the valves in the Panama Canal locks, and threatened to put them out of service in a period much shorter than that for which they were designed. There is in the behaviour of these valves a lesson which has application to numerous metal structures subject to the action of salt water. The flow of water in the culverts of the locks is controlled by sets of valves which during operation are always immersed in more or less salty water. After 15 months it was discovered that corrosion caused by galvanic action owing to the presence of different metals in salt water had caused considerable pitting in some of the valves, the rivets being partially eaten away in some cases. It was decided to paint with bitumastic solution and enamel nine of the valves. In 1916 some valves which had been immersed for approximately two years and four months were removed. Inspection showed deterioration, not only of the valve, but of the fixed irons as well. The bottom babbit seat in which the valve rested was removed and wooden seats of greenheart were placed in the fixed irons. The removable side steel strips had been so badly eaten away by action with the bronze seals on the valve that they no longer came in contact with them, and tests showed that the leakage had increased to nine times normal in about six months. It was decided to replace the steel strips with strips of lignum vitæ. The lead used for caulking the fixed irons and for leading in bolts was replaced with cement. Zinc electrodes were placed at the bottom of the bronze seals to assist in overcoming action between the bottom of the valve and the seals. All parts of the valves, with the exception of the bronze seals and rubbing surfaces, as well as the fixed irons, were coated with bitumastic solution and enamel. To protect the bearing surfaces, pipes have been placed leading from the operating tunnel to below the roller trains in the culverts, with the intention of forcing crude oil through these pipes, in the expectation that when the oil rises through the water it will come in contact with the rollers and bearing surfaces and adhere to them, lubricating them and protecting them from further corrosion.—*Engineering News-Record*, June 27th.

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TURBINE HOUSE PLANT OPERATION.

By T. G. OTLEY, M.I.E.E., and V. PICKLES, A.M.I.E.E.

(*Abstract of paper read before the* South African Institute of Electrical Engineers, *May*, 1918.)

We propose in this paper to discuss some of the salient points connected with the efficient operation of turbine plant and its attendant auxiliaries. These have particular reference to the plant installed in the power stations of the Victoria Falls and Transvaal Power Co. and the Rand Mines Power Supply Co., Ltd., a subsidiary company of the Victoria Falls Co.

The following schedule shows the number and size of the turbines installed at the four steam stations—Rosherville, Simmerpan, and Brakpan—situated along the reef from west to east, and Vereeniging Power Station situated on the Vaal River, about 36 miles south of Johannesburg. All four stations feed into a common network.*

Main Turbines.

		Maker's normal ratings. KW.	Revs. per minute.	
Rosherville	...	5 × 9,600	1,000	turbine generators.
"	...	5 × 3,000	3,000	turbine compressors.
"	...	3 × 7,000	3,000	" "
Vereeniging	...	2 × 12,000	1,000	turbine generators.
"	...	2 × 9,600	1,000	" "
Simmer Pan	...	2 × 11,000	1,500	" "
"	...	6 × 3,000	1,500	" "
Brakpan	...	2 × 12,000	1,500	" "
"	...	2 × 3,000	1,500	" "
"	...	1 × 1,500	3,000	turbine compressor.
"	...	1 × 3,000	3,000	" "
Total	...	31	203,700 KW.	

There are also three steam reciprocating air compressors installed at Brakpan, and 47 small turbines for driving condensing auxiliaries and feed pumps at the various stations.

In the turbine house we are concerned with two efficiencies, namely, turbine and steam efficiencies.

Within the usual working range the performance of a steam turbine follows Willans's law, that is, the relation between the total energy put in and the total energy got out is a straight line of the form $y=a+bx$, where the ordinates are total steam KW. and the abscissæ total electric KW. The former figure is obtained by multiplying the total lb. of steam used per hour by the available energy in KW.-hrs./lb. It will be noted that we have used the expression KW.-hrs./lb. as being more convenient for use in connection with power station working than the more usual B.TH.U. or calories. We use a modified Mollier diagram with the energy scale divided into KW.-hours instead of the more usual form.

The Willans line for each machine is obtained by test, the load being maintained constant and other conditions as steady as possible. In nozzle-governed machines there is no appreciable departure from this line in commercial working, but in throttle-governed machines there is. This is because the pressure is measured before the throttle valve, and hence the energy available for work in the turbine is not always correctly returned. There is also a slight change with the temperature of the circulating water. With steady working conditions, however, the line is practically straight from no-load to a reasonable overload. It is a striking fact, and contrary to what one might reasonably expect, that the condition of the blading can deteriorate to a very considerable extent without materially affecting the efficiency of the turbine, and maintenance in the way of reblading is usually dictated more by considerations of safety than of efficiency, that is to say, before the blading has deteriorated to such an extent as to affect the efficiency of the machine, it has probably become unsafe to run. A number of tests have been made with old and new nozzle segments and guide and moving blades, which, when taken out, appeared to be on the point of breakdown, but which, when renewed, made no appreciable difference in the efficiency of the machine.

If any qualification in the above general statement is necessary, it is that the condition of the blading in the L.P. stages is of greater importance than in the H.P. portion of the machine, because losses at the H.P. end may be in part recovered at the L.P. end. In putting forward these views we have particularly in mind the Curtis-Rateau type of machine. The question of maintenance of blading is also affected by coal costs and load factor; the higher these factors the greater is the money value of any loss in efficiency. It becomes therefore a question of simple arithmetic as to how far a machine may be allowed to deteriorate.

Within the range over which a turbine is commercially operated its efficiency rises with the load it carries, but it does not follow that it is most economically loaded at its normal full rated capacity. Maximum economy is reached when the product of turbine and steam efficiencies is greatest, and as the steam efficiency falls with a rising load, this product may be greatest at some point below its full rated capacity. In general, however, we may assume that it pays in all cases to run with as high a plant load factor as possible.

Steam efficiency is the variable which has to be given the greatest attention. This is determined by the inital and final conditions of the steam, and is therefore dependent on boiler house operation and the efficiency and maintenance of the condensing plant. Steam is supplied to our turbines at a pressure of approximately 200 lb./sq. in. with boiler pressures of 220-240 lb./sq. in., and a temperature of 320 deg.-360 deg. C. The pressure is somewhere near the limit imposed by the design of the plant, while the temperatures are as high as we can safely work at.

It has been found by test on one of our Vereeniging sets that the over-all efficiency is affected to the extent of 1 per cent. by a change of one atmosphere in the steam pressure. Another series of tests to ascertain the effect of steam temperature shows that the over-all efficiency is improved by 1 per cent. if the initial temperature of the steam is increased by 7 deg. C. Part of the gain in this case is due to improvement in turbine efficiency and part to an increase in steam efficiency. The results of these tests are quoted as confirmation of the importance of supplying turbines with steam at as high a pressure and especially at as high a temperature as practicable.

With the exception of the six 3,000-KW. machines at Simmer Pan and the two 3,000-KW. machines at Brakpan, all the condensing auxiliaries are steam turbine driven. There is no doubt that the efficiency of this arrangement is at least equal to that of electrically driven auxiliaries, and it is certainly more reliable in times of trouble. All the condenser auxiliary turbines are designed to take steam at full pressure and temperature, and to exhaust into the space between the last row of the Curtis wheel and the diaphragm carrying the first row of Rateau guide blades of the main turbine. This arrangement is satisfactory, and gives no trouble, but unless the auxiliary turbine is designed on liberal lines it has the serious disadvantage that as the load on the main machine increases and the intermediate steam pressure becomes higher the back pressure on the auxiliary turbine also increases, with the result that the speed of the pumps tends to fall and less water is passed through the condenser.

From a mechanical point of view, we have experienced singularly little trouble with our condensing plant, except in the case of the two condensers for the 12,000-KW. generators at Vereeniging. These each have 4,162 tubes 21 ft. 6½ in. long of the standard diameter 23-21 mm. There are two centre stay plates across the length. The trouble took the form of the tubes wearing down very badly and becoming perforated where they were held by the stay lace packing, this resulting in a very considerable leak into the steam space, which necessitated the machines being frequently taken out of commission for renewal or plugging of condenser tubes. The cause of the perforation was vibration caused by the impact of the steam among the top nest of tubes, the trouble being confined to the top half of the condenser. The remedy that we have decided upon is to remove the top third of the tubes and rethread them through the centre tube plates one hole out of pitch vertically so that each tube is slightly hogged. We believe that this arrangement has proved satisfactory where similar trouble has been experienced.

As an example of how not to do it, we may quote the case of a 4,000-H.P. turbine compressor intercooler where similar trouble was experienced. The tubes in this case were expanded into the tube plates, and in order to overcome the vibration trouble the contractors (A.E.G., Berlin) expanded the tubes into the centre tube stay plate, using a special tool for this purpose. It can be imagined, when these tubes had to be replaced, as, ultimately, a number of them had to be, what difficulty was experienced as a result of this impracticable and barbarous remedy.

We have also experienced some difficulty due to the condenser tubes bulging inwards, as a result of the ferrules being tightened down on the stay lace packing. All the condenser tubes are 23-21 mm. diameter, the walls being 1 mm. thick. As a result of this it has been found almost impossible to keep the condensers tight for any length of time. This has been overcome by very lightly expanding the condenser tubes into the ferrules so as to make a metal to metal joint. The expansion is not carried so far as to prevent the ferrule being turned and tightened down on the packing, but it was found unnecessary to screw them down as tightly as before, and since adopting this practice the condensers have remained almost absolutely tight. We pay particular attention to condenser leakage, every condenser on the system being tested three times a day by means of a Dionic water tester.

Some eighteen months ago a factor was introduced into our returns which we call the condenser coefficient. This factor is one of vital importance in power station economy. The steam energy available for work on the turbine is the difference between the energy in the steam at the stop valve and the energy in the steam at the exhaust. The energy that has to be supplied by the coal is the difference between the steam energy at the stop valve and the energy of water of the temperature of the exhaust. This assumes that the condensate is used for boiler feed purposes. The operating engineer should endeavour to keep his condensers in such a condition that the available energy is the biggest fraction of the energy to be supplied by the coal.

* These stations were described in the Electrical Review, March, 1913.—Eds.

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Assuming iso-entropic expansion, we can, from the Mollier diagram, obtain the values for the following ratio:—

$$\frac{\text{Energy to be supplied by coal}}{\text{Available energy}} \quad \text{.....Ratio 1.}$$

If we assume the condenser to be of infinite capacity, then the exhaust temperature will be the same as the inlet temperature of the circulating water and the available energy will be consequently greater. The ratio

$$\frac{\text{Energy to be supplied by coal}}{\text{Available energy}} \quad \text{.....Ratio 2.}$$

will therefore be less.

It is found that the difference between these ratios is proportional to the output of the generators, or

$$\text{Ratio 1} - \text{Ratio 2} = d \times \text{output}$$

where d is a constant depending on the design of a condenser and its auxiliaries. We may write this equation

$$\text{Ratio 1} = \text{Ratio 2} + d \times \text{output}$$

and the left-hand side then represents the observed value of the ratio, while the right-hand side is the standard value derived from the circulating water temperature and the machine load.

When a condenser and its auxiliaries are in their best condition, we may write

$$\frac{\text{(Ratio 1)}}{\text{(Ratio 2} + d \times \text{output)}} = 100$$

from which d may be found.

In any future calculation of results obtained in ordinary running or test and using the same constant d, any departure from the best condition will be given as a percentage of such condition. Further, the figure returned reflects the variation as a percentage of actual efficiency, that is, if the figure becomes 101 it means that we are losing 1 per cent. in our coal bill. This is easily seen, for the only variable with condition is ratio 1. It will be remembered that this ratio is

$$\frac{\text{Energy to be supplied by coal}}{\text{Available energy}}$$

and as in this ratio the variable is the available energy, it follows that a 1 per cent. increase in the coefficient can only be a result of a similar decrease in available energy.

We have found that this condenser coefficient is unaffected by circulating water temperature or variations in load. It is not only an absolutely reliable guide as to the condition of a condenser or its auxiliaries, but, as already shown, it gives us directly the influence on the coal bill of any departure from the best condition. This item is one of the most valuable that appears in our returns, and we take this opportunity of publicly acknowledging the indebtedness of the power company to Mr. G. M. Clark who was responsible for its introduction when in charge of the research department of the company.

The circulating water at different stations does not affect the condensers in the same way. At Simmer Pan and Rosherville the inside of the tubes becomes coated with a slimy deposit, which, although not difficult to remove, affects the vacuum very quickly and materially. The water at Vereeniging contains particles of sand which scour the inside of the tubes and keep them clean. At Brakpan the capacity of the dam at the station is small, about 20,000,000 gallons, and in order to keep the temperature down, a spray cooling plant was installed in conjunction with the latest extensions—two 12,000-kw. generators. The evaporation and loss due to drifting, &c., from this cooling plant is estimated to be in the region of 1 per cent. of the total circulating water, equivalent to about 30,000 gallons per hour. As the make-up is by no means pure, the water rapidly concentrates and becomes scale forming. It was thought that if the average mean inlet temperature could be reduced, scale formation might also be reduced or disappear, and steps were taken to increase the spray nozzle plant, which had the result of reducing the temperature by about 4 deg. C., but this had little effect on its scale forming characteristics. Further steps were taken, namely, treating the whole of the 20,000,000 gallons of water contained in the dam, and a water softener of a capacity of 10,000 gallons per hour was provided. About 200,000-240,000 gallons per day were passed through this purifier, the treatment resulting in a simple exchange of the scale forming salts for soluble salts. The effect was extremely satisfactory, but the rate of treatment was relatively slow, especially bearing in mind that 40,000 gallons per hour of make-up was necessary for the dam. It was then decided to accelerate the action by adding sodium bi-sulphate. This is an acid, the action of which is to neutralise the alkalinity of the water, and has been so far successful as to reduce the scaling to a negligible amount.

Curves prepared from the Brakpan returns show the variations of the condenser coefficient during the years 1916 and 1917. Duding the last six or seven months the condenser efficiency has been consistently better than in the earlied period. This improvement is a direct result of treating the dam water. Between October and November, 1917, the condenser coefficient of machines 2, 3, and 4 began to rise. This arose through our endeavour to utilise for cooling purposes the enormous volume of water which had accumulated in the outer pan. The inner pan was allowed to overflow and cold outer pan water pumped back to reduce the temperature of the inlet circulating water. This practice rendered it almost impossible to effectively treat the water by the purifier or by adding bi-sulphate, and as a result, scale began to form and the condenser coefficient rose as stated. The saving due to reduction in circulating water temperature was more than neutralised by the rapid scaling up of the condensers.

With regard to condenser circulating water, in our returns an item which we call W/Tr. is inserted. This is the weight of the condensate divided by the rise in temperature of the circulating water across the condenser. If the state point of the steam at exhaust were constant, this figure would be proportional to the quantity of circulating water passing through the condenser. As this is not the case, however, the figure is not an absolute guide, but when the steam conditions and load are retained approximately constant, it gives a very good idea of the quantity of circulating water being pumped through the condenser.

Condenser cleaning is much the most important controllable factor in condenser efficiency. The usual method is to take off one of the end covers and push a wire brush through the tubes, following this up with a jet of water to wash out any loose mud that may still adhere. This method, while fairly effective, is both inconvenient and relatively expensive. It has been superseded by the compressed air and the rubber disk method recently described before the sister institution, which has so far proved very successful.

(To be concluded.)

THE BRITISH SCIENTIFIC PRODUCTS EXHIBITION.

(Continued from page 178.)

Igranic Electric Co., Ltd., London.—The exhibit of this company was briefly mentioned in our last issue; we are now able to give some further particulars regarding it. The "Igranic" patent ironclad motor starting panel, fig. 1, presents some entirely new developments in this class of apparatus. A self-acting motor starter of the multiple finger pattern, and two single-pole main-contactor switches are mounted together (and interlocked) inside a very strong iron housing having a junction box at the base, and an ammeter at the top. A large

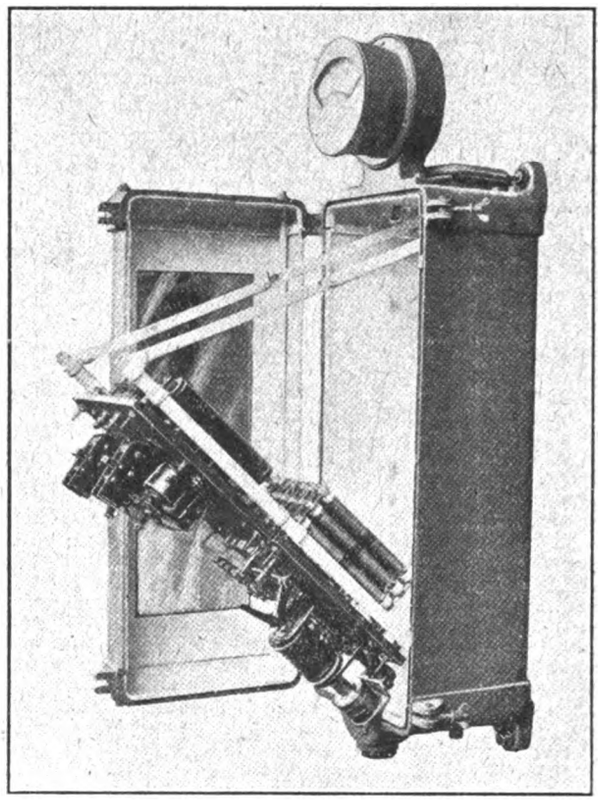

Fig. 1.—"Igranic" Ironclad Motor Starting Panel, swung forward for inspection.

window in the front of the housing gives a clear view of the switch parts, but when a closer inspection is required, the whole front of the box can be swung open on hinges, thus enabling an attendant easily to clean or adjust the switchgear. A specially valuable and quite novel feature is that access can be gained to the resistances and all internal parts of the apparatus by simply loosening two winged nuts on the top of the housing and pulling the panel forward, without the necessity of breaking any electrical connections. When pulled

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forward in this way the whole panel comes out of the box, exposing the resistances and everything else that is mounted behind the slate. This makes inspection and repair exceedingly easy, and it is equally easy to replace the panel by simply pushing it back into the box and securing it by the two winged nuts formerly mentioned. Any type or combination of switchgear may be housed in this patented manner, and all parts can be readily inspected as already described.

On the back of the exhibition panel a number of control devices are fitted to demonstrate the operation of the self starter when employed for various purposes. These devices include automatic control by thermostat, float switch, pressure regulator, vacuum regulator, and by push buttons.

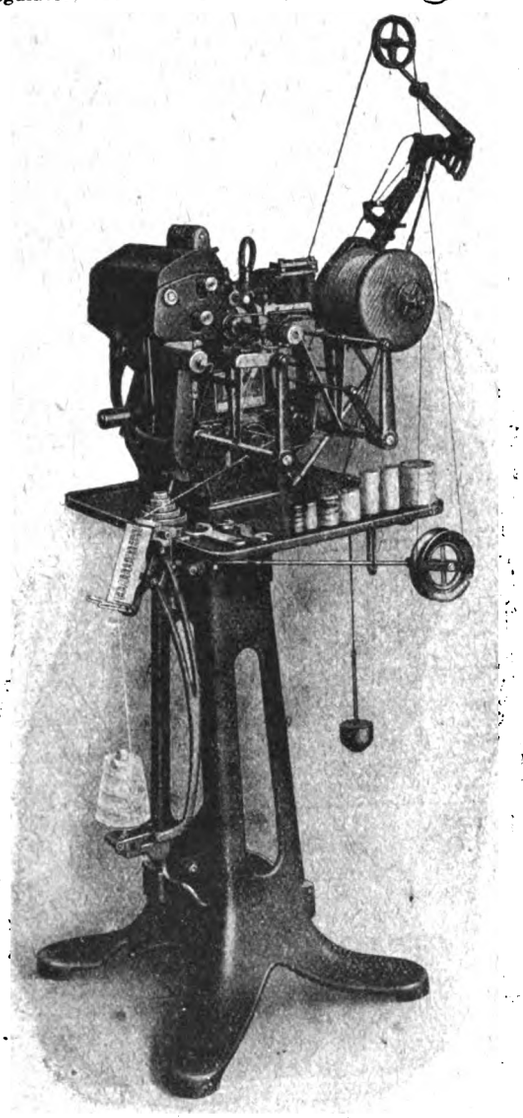
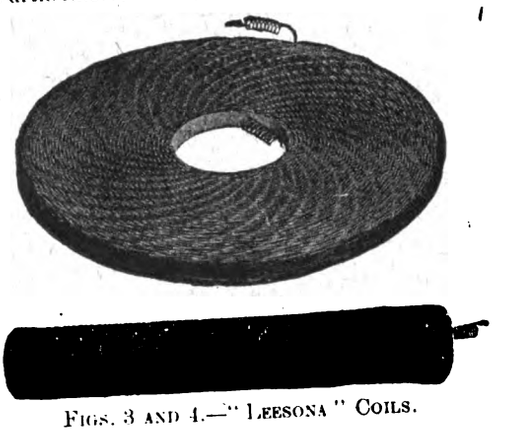


Fig. 2.—"Leesona" Coil-winding Machine.

Included in the exhibit are a number of electromagnet coils wound on the "Leesona" universal coil winding machines, which are capable of producing a wide range of extremely reliable coils, having high space factor and being uniform in all respects. The coils are produced quickly and at low cost, and their construction is such as to render efficient impregnation a simple process. No. 84 machine (fig. 2) winds cross-wound coils for magnets, &c. Cotton or silk-covered wire is wound in layers; each turn is laid at an angle to the axis of the coil, so that each layer is at an angle to the layer below. The advantages of this method of winding are, first, practically zero capacity between the layers and a little less inductance, making an ideal coil for high voltages; secondly, this form of winding is entirely self-supporting, requiring no flanges or heads to support the coil either during winding or in use. Coils as narrow as 3/16 in. and several inches in diameter can be wound without the use of side support; when finished the windings admit of easy impregnation. This machine is practically automatic; a device automatically controls the delivery of the finest wire from the supply spool to the coil, and prevents kinking, entangling, or stretching of the wire. A brake mechanism stops the winding spindle instantly if the wire breaks, also the spindle is stopped by an automatic counter when the desired number of turns have been wound. These automatic devices make it possible for one operator to control several machines.

No. 96 machine is adapted for winding coils for meters, transformers, and relays, as well as field coils, &c. The turns are parallel to each other and in a plane at right angles to the axis. A fine cotton yarn is wound simultaneously with the wire. The yarn is interwoven with the wire, which may be either enamelled or insulated with silk or cotton, also the form and flanges are automatically built up of cotton during the winding process. The plane of the wire convolutions is at right angles to the axis of the coil, while the plane of the cotton strands lies at a different angle to the axis, the entire mass being bound or woven together so that the finished coil is practically indestructible either from internal or external stress. Furthermore, during the winding the yarn is being



Figs. 3 and 4.—"Leesona" Coils.

distributed over the area of the coil at a faster rate than the wire, thus when a layer of wire is completed there is also a layer of cotton over it so that the next layer of wire is separated from the previous layer. This machine is equipped with the automatic device previously referred to, and consequently the coils may be duplicated with great facility.

The Micanite & Insulators Co., Ltd., Walthamstow. This firm is exhibiting specimens of British produced insulating cloths, &c., manufactured in its new factory at Walthamstow. Although in the past large quantities of these materials have been imported from the firm's American factory, manufacture has now been going on for several months at Walthamstow, and the output of this material will shortly be increased threefold. The firm's exhibits include "Paxolin" insulating materials, which materials are built up of paper impregnated with varnish made from the condensation product of phenol and formaldehyde. Samples of standard and Admiralty quality "Paxolin" plates, sheets, cylinders, and tubes are shown. Also insulating accessories are on view showing how this material can be drilled, tapped, threaded, sawn, turned, and planed. Included are also samples of "Empire" oiled insulating cloth and paper, and various micanite manufactures.

Automatic and Electric Furnaces, Ltd., London.—This firm is exhibiting the Wild-Barfield electric furnace which takes work 7½ in. in diameter, 12 in. in length, and a maximum weight for each article of 10 lb. The furnace is designed for the automatic hardening of carbon steel, the output of work per hour being approximately 30 lb. Its principal features are: The critical point is accurately and automatically determined, so that the desired degree of hardness is obtained and the human error is entirely eliminated. The work can be left in inexperienced hands, uniform heating is attained, and the grain obtained is of the finest, no matter what the carbon content of the steel may be. The current consumption and cost are exceedingly small, the maximum power consumption being 4,200 watts. The amount of distortion is reduced to a minimum, amounting generally to not more than 0.0001 in., there are no products of combustion and no oxidisation of the work, and the heat losses are small, involving no special ventilation arrangements.

In addition to the furnace, a Wild-Barfield electrically-heated salt quenching or tempering bath for use in connection with the furnace is shown, as is also a Wild-Barfield patent electric muffle, with pyroscopic detector, galvanometer, compensator, condenser and scale, and resistance for regulating the temperature. (See Elec. Rev., March 1st and June 28th, 1918.)

Messrs. Sims Motor Units, Ltd., London.—This exhibit consists of magnetos of the high-tension type in which the current is generated directly in the winding of the rotated armature without the use of a separate induction coil. The machine is of small dimensions, and it will give an effective spark at the plug at the lowest possible speed of the motor with the timing lever in any position. Other exhibits are magneto spare parts, sparking plugs, and several forms of magnetic petrol gauges for motor car tanks. This is claimed to be the only magnetic gauge that can be attached to either the side or the end of a rectangular or cylindrical tank. It may be screwed, fluid tight, into a flange bushing set into the tank, and it is proof against the effects of air, damp or dust. The gauge is made for both pressure and gravity tanks, the amount of pressure makes no difference, and taking the form of a hollow metal float which is tested to a pressure of 100 lb.; this is threaded on a gun-metal bronze ribbon, which is suspended from the gauge, and to which is attached a permanent magnet. The bronze ribbon passes through a

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tube in the centre of the float, and as the latter passes up and down with the rise and fall of the liquid, it is turned by a spiral cut in the tube. This causes the metal ribbon to make a turn, which turns the magnet also. The magnet exercises its power through the solid head of the gauge, and turns the magnet hand on the dial to correspond with the level of the petrol.

(To be continued.)

THE AYLESBURY ELECTRICITY UNDERTAKING.*

By W. A. TURNBULL, A.M.Inst.C.E., A.M.I.E.E., WH. EX., Borough Electrical Engineer.

(Abstract of paper read before the Institution of Municipal Engineers, *August 24th*, 1918.)

The electricity works are situated near the centre of the town, by the side of the canal, where there is the necessary ample supply of cheap cooling water. The plant consists of two 100-kw. vertical three-line Diesel oil engines and one 200-kw. four-line horizontal suction gas engine. In conjunction with this generating plant is a storage battery, capable of supplying 40 kw. for a period of ten hours.

After an amount of experimenting with the use of tar oil (creosote) as fuel, we were able under certain conditions to start constant running, in August, 1916, on tar oil, Aylesbury being the first Diesel-engine station to start this use of tar oil. Up to February of this year, £996 had been saved on the fuel bill, due to the use of this fuel. The chairman of the Electricity Committee (who is an engineer) must take the great amount of the credit for this remarkable result.

In connection with the gas engine, the gas obtained gives the following analysis :—

CO_2.	O.	CO.	CH_4.	H.	N.
7 %	1·5 %	23 %	1 %	24 %	44·5 %

and has a calorific value of 145 B.Th.U. per cb. ft. An eight-hour full-load test on the engine with anthracite peas gave a consumption of 1·2 lb. per kw.-hour.

The average fuel consumption for the past few months has been 1·5 lb. per unit, including all losses. The present fuel costs for the gas and Diesel engines are as follows :—

Gas engine, coal 1·5 lb. per unit, 40s. ton	...	·32d.
Diesel engine, tar oil ·65 lb. per unit, 100s. ton ·38d.	...	·51d.
American oil ·08 lb. per unit, 300s. ton ·13d.		

This saving of ·2d. per unit at the present time represents a saving on our fuel bill of about £500 per annum, and the saving would be greater if a large amount of the output had not to be made up by the use of the Diesel engines.

There are 16 miles of cable laid in the town, the supply being laid on to all the street lamps. From the works, five-feeder cables run to five different areas of the town, terminating in cast-iron feeder pillars. The whole of the cables are paper-insulated, lead-covered, and armoured with steel tape, and are laid direct in the ground. The distributor cables are four-core, three of the cores being used for the general supply and the fourth core for the street lighting.

The street lighting is controlled from the works by means of remote-control switches, placed at the ends of the feeders and operated by means of pilot wires which run in the same core as the feeder cables. The immediate control of the street lighting from the electricity works effects a great saving in labour, and has been a great convenience in enabling us to switch the street lamps on and off. A special street-lighting wire is advisable, considerably reducing maintenance of the mains, and the labour of lighting and extinguishing. Special all-night lamps or other lamps can efficiently be dealt with by means of time switches.

There are 219 consumers, who at the present time are consuming electricity at the rate of 800,000 units a year. The excessive strain on the plant will be noticed, when a list of 16 comparable undertakings shows an average output of 790 units per kw. of plant as compared with Aylesbury's 2,000 units per kw. of plant.

The capital cost of the undertaking is about £29,000, involving an interest and loan repayment charge of about £3,200 per annum. The financial results of the undertaking for the year ending March 31st last are as follows :—

Units generated, 508,229. Units sold, 415,204. Total cost, 1·43d. per unit sold.

Revenue, £4,293 ; gross profit, £1,837 ; capital charges, £2,559 ; net loss, £722.

Due to the restricted lighting and the Daylight Saving Act, the comparative cost of producing electricity for lighting has been very much increased. A large amount of dead capital is involved, due to the war conditions keeping off the street lighting and private consumers.

* See also Electrical Review, April 19th, 1918.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

13,038, 13,405. "Electrical heating apparatus." J. H. Farthing, M. J. Railing & F. Winstanley. August 12th.

13,049. "Means for controlling alternating currents." British Thomson-Houston Co. (General Electric Co.). August 12th.

13,050. "Electrical signalling apparatus." Sir W. G. Armstrong, Whitworth & Co., C. B. Chicken & J. H. Thain. August 12th.

13,080. "Distribution of electrical energy." C. Grover & W. T. Henley's Telegraph Works Co. August 12th.

13,090. "Electric installations." Soc. Anon. des Etablissements L. Blériot. August 12th. (France, November 23rd, 1917.)

13,104. "Means for making temporary connections with electric supply cables." J. H. Collie. August 13th.

13,105. "Current-collectors for electrically-propelled vehicles." R. H. Wilkinson & A. R. Fearnley. August 13th.

13,125. "Vents for electric accumulators." A. P. Welch & Fuller Accumulator Co. August 13th.

13,151. "Bath for electrolytic tinning." H. Sarrasin. August 13th. (Switzerland, September 27th, 1917.)

13,156. "Electrically operating mechanisms from a distance." A. G. Bloxam (Russische Akt.-Ges. L. M. Ericsson & Co.). August 13th.

13,167. "Variable electric resistances, and apparatus employing same." S. G. Brown. August 13th.

13,187. "Electric batteries." H. F. Joel. August 14th.

13,203. "Apparatus for rectifying alternating current." M. Latour. August 14th. (France, August 14th, 1917.)

13,207 13,208. "Starting devices for alternating current dynamo electric machines." British Thomson-Houston Co., H. C. Hastings & J. Martin. August 14th.

13,231. "Process of electrolytically separating nickel from copper." G. A. Guess. August 14th. (United States, August 14th, 1917.)

13,235. "High frequency alternators." S. Eisenstein. August 14th.

13,282. "Electric controlling-device operable at a distance for laying artillery, projectors, range-finding apparatus, &c." Benard-Barbier et Turenne & E. Granat. August 15th.

13,314. "Apparatus for measuring average maximum demand in kilovolt amperes from an alternating-current supply." A. E. Jepson & A. Howarth. August 16th.

13,321. "High-frequency signalling." Western Electric Co. (Western Electric Co.). August 16th.

13,340. "Electrically-operated fuel valves." British Thomson-Houston Co. (General Electric Co.). August 16th.

13,368/13,369. "Treatment of zinc solutions preparatory to recovery of zinc by electro-deposition." Electrolytic Zinc Co. August 16th. (Australia, August 17th, 1917.)

13,371. "Portable electric batteries." Accumulators, Ltd., & A. Hunter. August 16th.

13,389. "Vents for electric accumulators." Fuller Accumulator Co. & A. P. Welch. August 17th.

13,390. "Electric safety lamps." A. P. Welch & Fuller Accumulator Co. August 17th.

13,411. "Electrically-ignited lighting-device." P. Elphick. August 17th.

13,417. "Telephone apparatus." M. Latour. August 17th. (France, August 18th, 1917.)

PUBLISHED SPECIFICATIONS.

The numbers in parenthesis are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

5,632. Process for the electrolytic deposition of metals. N. H. M. Dekker. April 21st, 1917. (Patent of addition not granted.) (117,638.)

5,663. Dynamo-electric machines. H. Lucas & C. L. Breeden. April 23rd, 1917. (117,639.)

8,713. Locking or securing devices for electric fittings. St. Helens Cable & Rubber Co. & J. C. White. June 18th, 1917. (117,644.)

9,061. Braking systems for electrically driven vehicles. British Thomson-Houston Co. (General Electric Co.). June 23rd, 1917. (117,647.)

10,535. Apparatus for use in electro-plating articles or pieces having holes. Platt Bros. & Co. & G. L. A. R. B. Colin. July 23rd, 1917. (117,658.)

10,739. Devices for securing hawsers, ropes, and the like. W. H. Sandford. July 26th, 1917. (Patent of addition not granted. Cognate application 17,588/17.) (117,677.)

10,785. Methods for forming and treating electrical coils. J. W. Hobley. July 27th, 1917. (117,682.)

10,822. Electrical induction apparatus. British Thomson-Houston Co. (General Electric Co.). July 27th, 1917. (117,685.)

10,830. Utilisation of high frequency oscillations in wireless installations. D. W. Brown. July 27th, 1917. (117,686.)

11,607. Indicating devices for electrical measuring instruments. R. D. Gifford & Nalder Bros. & Thompson. August 13th, 1917. (117,705.)

12,104. Electrical point detectors for railways. A. E. Hudd & G. H. Wion. August 23rd, 1917. (117,712.)

15,741. Electric pocket lamps. E. G. Comp. Phœbus. October 28th, 1916. (110,912.)

16,532. Electric vehicle and other like lamps. H. Lucas & W. H. Eggington. November 10th, 1917. (117,758.)

1918.

2,908. Electric relays, particularly for railway-traffic controlling apparatus. McKenzie, Holland & Westinghouse Power Signal Co. February 20th, 1917. (113,616.)

3,496. Dynamo-electric machines. G. Plaisant. June 22nd, 1917. (Divided application on 18,387/16.) (117,784.)

3,951. Electro-magnetic lockout switches for use in motor control systems. Igranic Electric Co. (Cutler-Hammer Manufacturing Co.) March 6th, 1918. (117,786.)

4,609. Manufacture of commutators. McKenzie, Holland & Westinghouse Power Signal Co. March 16th, 1917. (114,834.)

5,010. Automatic telephone systems. Automatic Telephone Manufacturing Co. July 9th, 1917. (117,411.)

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REMOVE THE MASK!

READERS of the ELECTRICAL REVIEW are quite familiar with our warnings concerning the intentions of Teutonic traders to make every possible use of facilities, both ordinary and extraordinary, that may present themselves in neutral countries for re-establishing their foreign trade connections with peoples with whom they are now at war. Quite early after the outbreak of hostilities, both to the official and to the commercial mind, there arose the difficulty of discovering whether goods imported from neutral countries were actually made there or were of enemy origin. There was the genuine desire to cut off transactions absolutely, but often there was the suspicion that, though complete evidence was lacking, the apparently Dutch, Swiss, or Swedish manufactures were in reality German. In certain cases experts familiar with special lines of goods were able to detect distinctive characteristics, and sometimes in this way even marks of origin were discovered after camouflage had been removed. Since then much has happened to render enemy scheming of such a kind inoperative, and we need have little fear that during the war he will be more successful. But there is undoubtedly serious need for the post-war dangers in the same connection to be provided against. We have no desire to increase the trading difficulties of friendly neutral nations, but it is useless to conceal from even the most legitimate and the least suspected neutral firms that they must remain to some extent under a cloud, unless in the most definite and convincing way they are able to show to impartial, yet representative, parties that they are all that they should be in respect of freedom from enemy connection or taint. Nobody knows better than they do themselves that, however full may be the financial, statistical, personal, and other information that they furnish to prove the cleanness of their hands, there will always be somebody who will remember something about the past. Perhaps he has seen their frank advertisements in the German or international, or even the British, Press in the days of pre-war "innocence," which have enabled investigators to prove the character of their connections. Or, perhaps, a reader of the ELECTRICAL REVIEW may remember, and may turn up in his bound volumes, some reference or other to statements in German company reports, German chairmen's remarks regarding international operations and transactions, of which we made a special feature for our readers' information for many years before the war.

Parenthetically, we may remark that our record has been of particular usefulness in some interesting directions, and no doubt such information will be turned to again and again both during and after the war. In addition to the published material, there is a good deal of knowledge of foreign traders' doings here which never found its way into print, but is in the minds of men to-day, and it plays no less important a part in encouraging their antipathies, their prejudices, and their suspicions. Neutral firms—genuinely neutral as well as nominally neutral—will find it difficult to live down suspicions and prejudices, and purchasers of their goods, too, will lay themselves open to the charge of anti-national trading susceptibilities, unless the air can be absolutely cleared. The neutral firms know

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it quite as well as we do, and we suppose recognise it as one of the penalties of neutrality during a war in which German propaganda, influence, and money have been very freely employed in neutral countries.

The situation is one of some delicacy and of extreme difficulty, and while we are ardent in our desire to raise every reasonable barrier to prevent enemy manufactures from finding their way into England, either on a small scale or on a scale to swamp our own interests, we desire that we shall do nothing more than is absolutely unavoidable in the way of imposing injustice from British sources upon those who in sympathy are really interested in the securing of the principles for which the Allies bleed and die, but who have not seen fit to enter the conflict. What we feel is that something is necessary, something more than exists at the moment, which shall enable British buyers and British manufacturing organisations to have open to them "the whole truth and nothing but the truth" concerning the capital, personnel, organisation, international connections, and so forth, of those who call themselves "neutral manufacturers." It is sometimes said: "The Government Departments are satisfied concerning so and so; that ought to be good enough for me!" Well, we are not sure that it has always been good enough for us, for efficient as some Government Departments have been, it has not happened in every case that they have had access to *all* the information that ought to be studied before giving a decision. We believe that the Departments responsible for such matters have a very much better grip of the whole subject than they had some time ago, and their black lists are extremely useful and entertaining, though the full meaning of the connections that they reveal is not always written on the surface for easy comprehension by the uninitiated. We are now getting on with the war, and while the end may be far off, still we shall do well to consider whether the possibility of a good deal of wasteful discussion and bickering and after-war investigation concerning *existing* alleged neutral undertakings cannot in some way be avoided by setting up some sort of impartial International Traders' Tribunal, which shall both clear the air for those who are legitimately entitled to be classed as non-enemy, and shall enable industries to keep a very close watch for developments which may bring German and Austrian influence into the bodies of those concerns which may to-day be beyond reproach.

In the foregoing we have not been discussing the question of economic policy, or of boycott. These are large matters of themselves. What we are discussing is purely and simply the difficulty of ascertaining whether an article is actually of German or of neutral origin, and of being absolutely certain whether an alleged neutral manufacturer or exporter is in fact such. Let there be no doubt about it, whatever trade policy may evolve from the new relationships that ensue from our companionship in arms with the States, the sentiment of civilisation is going to be against the Hun and against his product for many a long day. And until that period is past the average buyer and user will in consequence want to be assured that what he buys is untainted, and that the manufacturer or factor of it is either entirely free from enemy interest or is connected in such infinitesimal proportions as to render him unobjectionable. We really seem to need a thoroughly organised commercial detective agency with some veritable Sherlock Holmes to render service in special cases.

The Wrenbury Committee, which has recently reported upon the amendments in the Companies Acts that are rendered expedient by the circumstances of, and arising out of, the war, has made certain recommendations respecting means by which disclosure will be obtained of alien interest in companies occupied with "key" industries, and by which alien holding, when discovered, shall be compulsorily reduced. It is recognised that a company formed to carry on one class of business may later manufacture "key" products, and so close scrutiny of developments will be essential. Though we are not directly dealing with this report now, the matter is immediately related to the question of neutral concerns abroad, for these may find it policy to establish and register themselves here in some form or other. The Wrenbury Committee advocates certain legislation and we hope that whatever may be necessary in that connection will be carried just as soon as the Government finds the war position sufficiently established to enable the broad lines of international trading relationships to be laid down.

Wanted, a Book.

One of the commonest of the many queries that are constantly being addressed to us is the request to name the best book, or books, on certain subjects; during the war, contrary to what we should have expected, the number of inquiries of this nature has markedly increased, and we do our best to comply with such requests, though it is not always possible to spare time for the research which would be necessary in some cases. But only too often there is no book available to meet the specified conditions; *e.g.*, if we are asked for a book on electric welding, on present-day methods of electro-culture, or on the latest types of magneto, we are at a loss to name one. If any reader knows of such, published within the last three or four years, we shall be glad to hear from him.

The foregoing examples are quite legitimate inquiries: there should be, and no doubt very soon will be, specialised treatises on all these subjects, as well as on other recent developments. On the other hand, not a few inquiries are received which plainly indicate that the querist has been put in charge of work which he is not competent to perform, and that he seeks to make good the defects of his technical training by reading up the subject—a forlorn hope in matters which call for personal experience or manual dexterity.

One question in particular, however, which we regard as perfectly reasonable, relates to the installation and wiring of alternating-current apparatus. We are acquainted with several useful works which deal more or less fully with A.C. work, and which are admirably adapted for certain classes of readers, but we have not yet met with a book of which the contents fill the requirements which we have in mind. The use of polyphase currents is rapidly extending in this country, and is destined to experience an immense expansion; many electrical fitters and wiremen who are thoroughly at home with D.C. apparatus are being called upon to tackle A.C. motors and switchgear, but are past the age at which they can usefully study A.C. theory, or lack the mental equipment which would enable them to profit by it. What we have in mind for this class of electrician is a simply worded, lucidly phrased little handbook, designed to tell them just as much as they need to know in order to set about such work intelligently and with confidence. There should not be a sine curve in the book, unless it be in an appendix provided for the use of those who care, and are able, to pursue the subject into its more abstruse aspects. Special emphasis should be laid on all the points in which A.C. practice differs from the methods suitable for D.C. work, such as the effect of laying a single cable in an iron pipe, running circuits near unspiralled telephone wires, &c.; and the difference between three-wire D.C. and three-phase three-wire supply, the starting arrangements of A.C. motors of all usual types, the necessity of connecting transformers in parallel with due regard to polarity and phase rotation, should be explained—but all without excursions into technicalities beyond the capacity of the class of reader that we have in view. It may be a difficult problem to produce such a work, but we believe it can be done effectually, and we know there is a need for it.

We may be told that this proposal is heretical—that in order to handle alternating currents rightly, it is essential to be instructed in the theory. We don't believe it. Anyone can use a watch, without knowing anything about moments of inertia, the resilience of springs, methods of temperature compensation, &c. There is too much mystery about alternating currents, due to the over-zealous efforts of its exponents to impart too much information to the tyro. Electrical engineers, certainly, must be fully conversant with the whole theory of alternating currents, but the electrical artisan no more requires such knowledge than the engine fitter requires to know Carnot's theorem, or the nature and significance of entropy. We want a book with no mystery about it.

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GRAPHICAL METHODS FOR RESISTANCES IN PARALLEL.

By W. T. MACCALL, M.Sc., A.M.I.E.E.

The best-known method for determining the combined or joint resistance of two resistors connected in parallel is that shown in fig. 1. In this A B is a straight line of any convenient length, A C and B D are drawn at right angles to A B, and represent to the same scale the values of the two

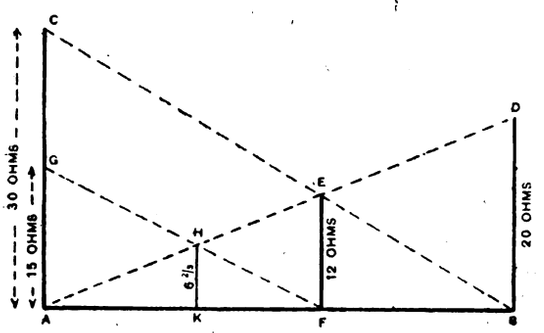

Fig. 1,—Scale: 1 in. = 20 ohms.

separate resistances (30 ohms and 20 ohms in the figure). A D and B C are joined, cutting at the point E, and E F is drawn perpendicular to A B. Then E F gives the value of the joint resistance to the same scale as that used for the separate resistances. Moreover, A F represents the percentage of the current carried by resistance B D, and B F that carried by A C if A B represents 100 per cent.

In this and the other constructions given below, the case of three or more resistances in parallel can be dealt with by successive applications of the method; the joint resistance of two is obtained, and this is then combined with the third resistance in the same manner, and so on for any number.

With the above method it is convenient to mark off the value of the third resistance along the line used for the first resistance (as A G = 15 ohms in fig. 1). Then join G F cutting A E (which is already drawn) at H, and draw H K perpendicular to A B. Then the joint resistance of the three resistors is given by H K; in the example taken, 6⅔ ohms is obtained as the joint resistance of 30 ohms, 20 ohms, and 15 ohms in parallel.

It is preferable, but not necessary, to take the resistances in order of magnitude, starting with the largest. The construction is simplified by using squared paper.

A joint resistance scale which is, or, at any rate, was until recently in use by the G.P.O., is shown in outline in fig. 2.

The complete scale is given in Preece and Stubbs's "Telephony," 1st edition, p. 485, and its principle is partly explained on p. 164 of the same book. It is double the size of that shown, and is marked in 1-ohm divisions.

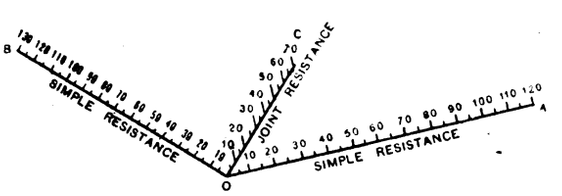

Fig. 2.

It is used by placing a straight edge on the value of one resistance on the right-hand arm (O A) of the scale and on the value of the other resistance on the left-hand arm (O B). Then the point at which the straight edge cuts the third scale (O C) gives on that scale the value of the joint resistance. The scales of ohms along O B and O C are equal, while that along O A is $\sqrt{2}$ (= 1·414) times as big as the other two.

This second method is a particular case of the following general method: Let O A, O B, O C (see fig 3) be any three straight lines radiating from a common point O. Then, if a point D is taken on O A, and a point E on O B, so that O D, O E represent any two resistances, R_1, R_2, to the proper scales, and a straight line D E is drawn cutting O C at F, then it can be proved that O F represents on the corresponding scale the combined resistance of R_1 and R_2 in parallel. The scales used must be such that if a, b, c are the number of ohms per unit of length along O A, O B, and O C respectively, then—

$$a \sin B O C = b \sin C O A = c \sin A O B.$$

It follows that if F G be drawn parallel to O B, and meeting O A at G, then O G represents the combined resistance to the same scale as O D represents R_1. For O G/O F = sin O F G/sin O G F = sin F O B/sin (180° − G O B) = sin B O C/sin A O B = c/a. Therefore, a . O G = c . O F. *i.e.*, O G and O F represent the same number of ohms on their respective scales.

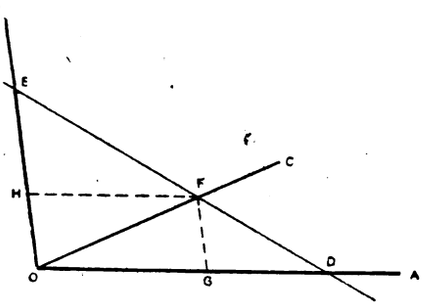

Fig. 3.

Similarly, if F H be drawn parallel to O A, and meeting O B at H, then O H will represent the combined resistance to the scale used along O B. Thus by the use of one or other of these further constructions, the need for a scale of

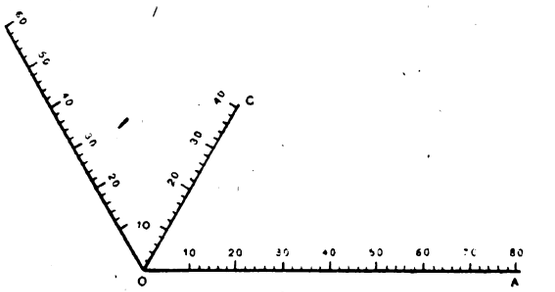

Fig. 4.

ohms along O C is avoided, but the method of using the set of scales is made less simple, except in some special cases (see below for example). An alternative application of this

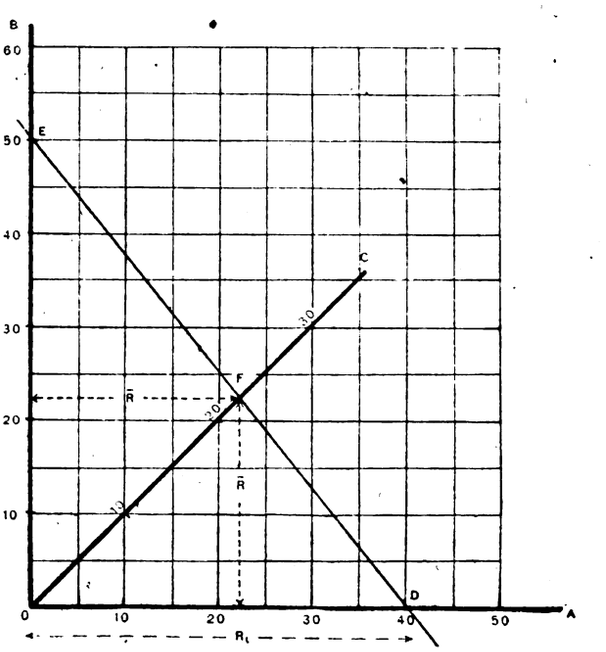

Fig. 5.

relation is to determine the scales graphically instead of by calculation from the above equation. For, since O F, O G, and O H all three represent the same number of ohms to the

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corresponding scales, one scale may be taken of any convenient size, and the others can then be found by drawing lines like F G and F H in fig. 3.

Three special cases of this general method may be noted in addition to that already given in fig. 2. Firstly, if each of the angles A O C, C O B be made equal to 60°, which can easily be done with a compass, then the scales of ohms along O A, O B, and O C are all equal, see fig. 4.

Secondly, if each of the angles A O C, C O B be made equal to 45°, so that A O B is a right angle, see fig. 5, then the

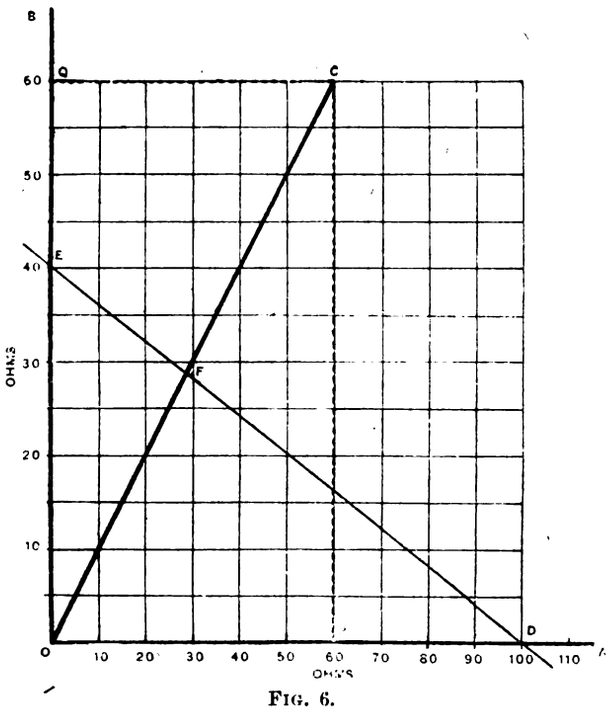

Fig. 6.

scales along O A and O B are equal, while that along O C is $\sqrt{2}$ (= 1·414) times as big; compare this with the second method, fig. 2. But if the lines are drawn on squared paper there is no need to have a separate scale for O C, since the combined resistance, R, can be read off parallel to either of the scales O A, O B used for the separate resistances R_1 and R_2.* In fig. 5 the straight edge D F E is shown adjusted to

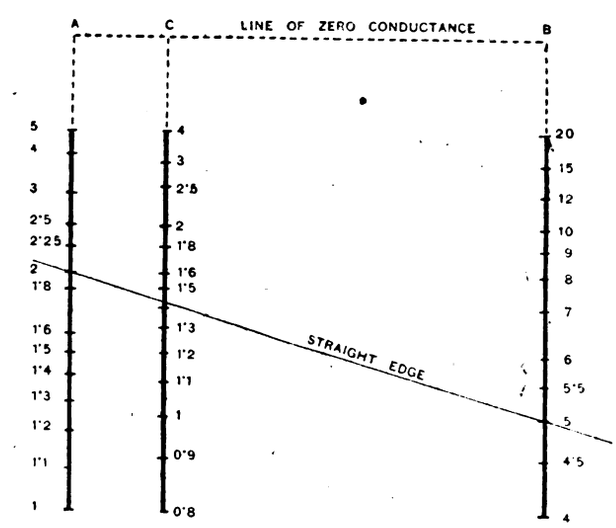

Fig. 7.

find the joint resistance of 40 ohms and 50 ohms in parallel and giving 22·2 ohms as the result. This is an example of the general method mentioned above for reading off the joint resistance.

Thirdly, if the angle A O B is a right angle, and squared paper is used, any two different scales may be taken along O A and O B respectively, the sizes of these scales being chosen so as to be most convenient for the resistances under consideration. The position of O C is settled by taking the points representing the same resistance on the two scales (P and Q in fig. 6) and finding the intersection, C, of the vertical and horizontal lines through these points. O is then joined to C.

In using such a diagram the result can be read off on either the scale along O A or that along O B. Obviously greater accuracy is likely to result if the larger scale is used. In fig. 6, D F E represents the straight edge, and the joint resistance of 100 ohms and 40 ohms is obtained as equal to 28·6 ohms from the point F. The scale of ohms along O B is twice as large as that along O A.

Another way of dealing with the problem is to utilise the fact that the joint conductance (reciprocal of resistance) is the sum of the separate conductances. An "adding nomograph" or "alignment chart" or "abac" may then be employed, with the scales marked in resistance values instead of conductances (see fig. 7). A number of interesting points arise with regard to the methods of obtaining convenient scales; but for the present it may suffice to note the following in connection with the example given. It is suitable for cases in which one resistance lies between 1 ohm and 5 ohms and the other between 4 ohms and 20 ohms, and, therefore, the combined resistance is between 0·8 ohm and 4 ohms. On each of the vertical lines the distance below the line A C B is proportional to the corresponding *conductance*—*e.g.*, A—2 is double A—4; B—5 is four times B—20; C—1 is three times C—3. But the scales eventually are not equal—that under A being four times and that under C five times as big as the one under B, in terms of conductance. Correspondingly, B C is made four times the length of A C.

The dotted portion of the figure is required only for constructional purposes, and so need not appear in the finished nomograph; neither is the use of squared paper advantageous except for construction.

To use the nomograph a straight edge is placed across the scales, and adjusted to the values of the two resistances on the outer scales; the middle scale then gives the value of the combined resistance. For instance, the line drawn in fig. 7 shows that 2 ohms and 5 ohms in parallel have a combined resistance of 1·43 ohms. For accurate work the scales would be more finely divided than as shown, but the method has the disadvantage that the scales of resistance are necessarily not uniform, whereas in the previous methods each scale is uniform throughout.

THE PERCENTAGE ERROR.

By A. T. BULLEN.

Most electrical undertakings nowadays boast a more or less adequately equipped test-room, but no matter how well equipped that department may be, there is a grave danger of its being most inefficient, unless the results obtained by it are applied in a correct manner.

It is necessary, if the result of a test on any particular meter is to have a definite meaning, that it should be expressed as a percentage error, but unless that percentage error obtained, too, has a definite meaning, it is likely in its application to create still further inaccuracies, and, as we shall see later, this always affects the undertaking adversely; that is, it means a loss to the undertaking which would not occur if the figures were applied in their proper manner.

There are three ways of working and writing the results of a test. The first way is by comparison of the time the meter should take to register a certain amount with the time it actually does take; the second is by a comparison of the constants, and the third is by comparing the watts being registered by the meter with the actual load.

Each method is as correct as any other, and each has some special feature to recommend it, but, curiously enough, if we want to express a percentage error that means the same thing in each case we must approach them in different ways.

It has been discussed and argued frequently among testers as to whether it is correct to calculate the percentage error from the correct time or using the observed time as a

* This method was given without proof by Mr. L. O. Meyer in the Electrical Review of November 9th, 1917, subsequent to the writing of this portion of the present article.

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basis, but it is fairly clear that the observed time is the proper figure to divide by.

Take the case of a meter which should complete 40 revolutions in 60 seconds. For some reason it is now doing its 40 revolutions in 30 seconds. Its percentage error is, obviously, 100 per cent. fast, since it is recording at twice its proper speed. This is—

$$100 \times \left(\frac{60 - 30}{30}\right),$$

$$\text{or } 100 \times \frac{\text{Correct time} - \text{observed time}}{\text{observed time}}.$$

The same applies to a meter tested by a comparison of the constants; the percentage error must be calculated from the observed or calculated constant and not from the true constant; but if the third method of testing be adopted—*i.e.*, a comparison of the watts measured—then the percentage error must be calculated from the correct watts and not from the meter watts, if the same result is expected.

Thus, if 1,000 watts be the correct load under the same conditions as before, the meter will measure 2,000 and the percentage error will be —

$$100 \times \left(\frac{2{,}000 - 1{,}000}{1{,}000}\right)$$

$$= 100 \times \frac{\text{meter watts} - \text{true watts}}{\text{true watts}}.$$

This is all fairly obvious, and the real danger does not come in until we start to apply these figures to the meter under consideration.

Let us take a specific case. A meter having registered 400 units in a quarter, is suspected by the consumer of over-registering, and is accordingly tested. The results prove that the consumer was quite justified in his complaint, and the mean error of the meter is found to be 40 per cent.

An allowance is clearly necessary, and the chances are that 40 per cent. of the account is immediately deducted and an amended account made out for 240 units. But this is wrong. The true meaning of the percentage error has not been grasped.

On test the meter measured 140 watts, where 100 was correct; clearly, then, it is 40 per cent. fast according to our previous argument.

It is; but the error creeps in because the 400 units registered by the meter is comparative to the 140 watts measured when the meter was on test.

The true allowance, therefore, is not 40 per cent. of 400 units, but is $400 - \frac{100}{140} \times 400 = 114$ units, the amended account being for 286 units instead of 240 units.

Thus, unless care is taken, the undertaking will lose 46 units.

Similarly, had the meter been slow, the undertaking would still have lost, for had the meter been again 40 per cent. slow, it would have registered 240 units instead of 400, and the amount added to the account would have been $\frac{40}{100} \times 240 = 96$ units, which would have meant a loss to the undertaking of 64 units.

What, then, is the remedy? It is either a perfect understanding of what is really meant, which is not always easy, because while one person tests the meter another calculates the allowance to be made, or the deficiency, or it is to base the percentage error not on the meter in its ideal state, but on its actual performance; that is, to state that so much per cent. of the units registered are excess units, and *vice versâ*, if the meter be slow.

Applying it to our case. 114 units out of 400 were excess units, that is—

$$114 \times 100/400 = 28{\cdot}5 \text{ per cent.}$$

How, then, can we get that figure in the test room? Simply by basing our calculations on the meter watts instead of the true watts, thus :—

$$\frac{100 \times \text{meter watts} - \text{true watts}}{\text{meter watts}} = 100 \times \left(\frac{140 - 100}{140}\right)$$

$$= 28{\cdot}57 \text{ per cent.}$$

If, on the other hand, we are working on the constant or by the time, we must base our percentage calculation on the correct constant or time.

This is necessary, because if a meter is wrong, it is the wrong figure that is accessible to us; all we know is the actual consumption, and not the true.

These few lines have been written, not because there is any real difficulty in the problem, but because it is one of those obvious things that are so often missed.

In his own experience the writer has proved that such mistakes, if they can be so termed, do occur, but it is hoped that through these notes many, particularly those who are rather inexperienced, but who, through the war or for other causes, have had to assume responsibilities they would otherwise have been spared for a year or two, will benefit, who otherwise would have wandered on in semi-darkness.

THE BRITISH SCIENTIFIC PRODUCTS EXHIBITION.

(*Continued from page* 216.)

Messrs. Hadfield's, Ltd., Sheffield.—One of the features of the exhibition is the great increase, not only in the production of ferro-alloys, but of electric steel. The feature of this firm's exhibits is an armour-piercing projectile of 15 in. calibre after perforating a hard-faced armour plate 15 in. in thickness, of which a model is also exhibited, which plate is undrillable for several inches below the surface. "Hadura" hardened steel rolls, for cold-rolling steel and other hard metals, are illustrated by pairs of 8-in. and 16-in. rolls. Before the war such rolls were obtained from abroad, but now all requirements are met with home-made products. A pair of sprocket-wheels as used for tanks and tank plate, which has been subjected to firing trial, illustrate "Era" manganese steel, while "Hecla" steel for aircraft is represented by tensile and impact test-bars, covering a range of tenacity from 50 to 100 tons per sq. in. Helmets and body shields of "Resista" steel, which have been subjected to firing trial, and specimens of the Hadfield-Jack system of producing sound ingots, are on view. Thread milling cutters of "Heclon Superior" high-speed steel, "Galahad" rustless steel, and special magnet steel for replacing the expensive high tungsten steel are also exhibited.

The Watford Electric and Manufacturing Co., Ltd., Watford, Herts.—After manufacturing the "Thury" regulator for some considerable time, this company has now produced a patented type of control pillar embodying in addition to the advantages pertaining to a "Thury" regulator equipment, numerous additional advantages pertaining to the more efficient control of electric furnaces.

The equipment, as will be seen from the illustration (fig. 5 (p. 222), is a self-contained unit for each electrode motor, and the gear is enclosed in a massive cast- and sheet-iron pillar with glazed, hinged, front doors to enable the operation to be under inspection whenever desired. The equipment has been designed to ensure the minimum of knowledge being required to operate the control, and a practically fool-proof equipment seems to have been obtained suited to the rough usage and dirty conditions of a steel works.

To use the control pillar a start push button is pressed by the operator which closes a double pole clapper switch at the bottom of the unit, making the equipment alive and ready for the control of the electrode motors. After such use as is desired of it a stop button is pressed, and the pillar is again made dead with the minimum of control operations. After energising the pillar ready for use by pushing the start button, the melter uses the hand wheel on the left-hand side of this button, which is clearly indicated as being placed in the "auto" position or the direction to raise or lower the electrodes to or from the metal in the furnace. Assuming that he is starting up the furnace, after closing the power switch he brings the electrode down to the metal, and immediately contact is made therewith a superimposed control cuts off the supply from the drum controller operated by the above-mentioned hand wheel, and withdraws the electrode from contact with the metal, on which the operator puts the pointer on the hand wheel to the "auto" position, and the pillar is then in operation for automatic control. It will thus be seen that there is no necessity for hand control of the electrodes as has been the practice thus far. On the right-hand side of the operating push buttons is another hand wheel with a pointer moving over a scale marked "Decrease" and "Increase" respectively, and by means of the operation of this hand wheel the load on the electrode can be varied from full load down to approximately one-sixth of full load.

The above operations constitute the only demand of the melter in controlling his electric furnace, and with this type of control the actual melter responsible for the correct heat being maintained at all times in the furnace is easily able single-handed to maintain all the desired control.

Above the main clapper switch at the bottom of the pillar, and in the lower half of the panel, are situated two other double-pole clapper switches; these are so connected in the armature circuit that when the one closes, a downward move-

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ment of the electrodes is obtained, and when the other closes an upward movement is secured; the shunt field of the motor being permanently energised immediately the main clapper switch in the pillar is operated. The rotation of the electrode control hand wheel in the one direction therefore, produces, by energising the downward movement clapper switch, a rotation of the motor moving the electrode to the charge, and *vice versa* for the other direction of rotation of this hand wheel. In the upper part of the pillar there are two regulating devices, one responding to the variations in the current strength of the arc as reproduced in the secondary of a current transformer, and the other responding to the variations of the voltage of the arc. When the controller hand wheel is in the automatic position the energy for operating the motor-reversing clapper switches is supplied through a moving arm in the centre of the pillar which responds to the variations in the current strength-regulating device, and moves between two contacts which give a supply to the alternative clapper switches.

By means of an additional solenoid-operated switch the contact supply through these clapper switches to the motor is made intermittent, so that a step-by-step movement is given to the electrodes during normal current strength-regulating control which permits of the current adjusting itself to the new conditions in the furnace following the movement of the electrodes. The superimposed voltage control provides for the

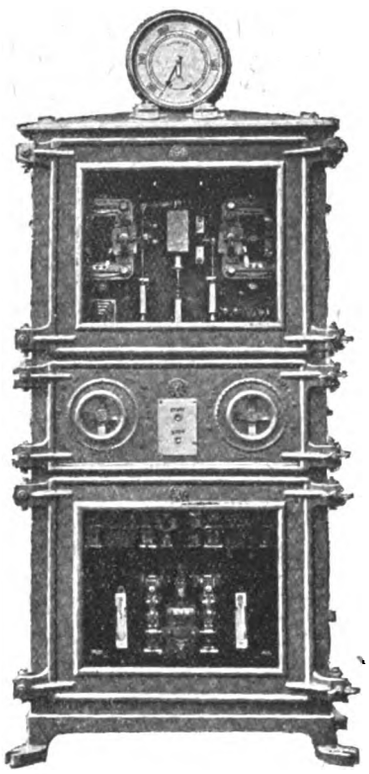

Fig. 5.—Electric Furnace Control Pillar.

normal control of the electrode to be vested in the current strength-regulating device, but immediately there is a fall of pressure across the arc due either to dipping or a heavy overload the voltage control device entirely isolates the current strength-regulation and itself applies current to the solenoid of the raise clapper switch, which withdraws the electrodes from the bath in a rapid and continuous upward movement until the voltage is re-established, when it again automatically reintroduces the current strength-regulating device to the control of the heat in the furnace without the intervention of any external operation.

The making and breaking of the motor armature circuit is provided for by means of the aforementioned clapper switches which are provided with a rolling contact, a magnetic blow out and interlocking contacts to ensure that the two switches cannot be simultaneously closed. They are further provided with dynamic braking contacts so that when both are returned to the "off" position the armature is dynamically braked through a resistance introduced in the armature circuit, thus pulling up the motor quickly.

The pillar is supplied connected up complete in every way with the exception of the actual leads from the mains and to the motor. In addition provision is made in the pillar to permit of the insertion of upward limit switches to come into operation when the electrode carrier approaches the top of the mast.

An additional special device is embodied in the automatic controlling features to ensure that once contact is made on either side of the regulating contact arm the complete sequence of operations must follow to ensure that this slow-moving contactor device is not called upon to draw an arc by breaking the circuit of the clapper switch solenoid, and thus burn itself away quickly, the actual interruption of this circuit being made on a quick-moving rolling contact over a carbon disk. The pillar can if desired be fitted with an ammeter as shown in the illustration, and a voltmeter can also be attached.

Fleming, Birkby & Goodall, Ltd., Liversedge, Yorkshire.—The manufacture of moulded electrical insulation is quite a specialised art, and one which unfortunately has been somewhat neglected in this country; it is pleasing to note, therefore, that this firm has realised the necessity of giving special attention to this industry. The firm is already well known, but present development is connected more particularly with moulded insulation for general electrical work. Keen and constant research work has been put in on Birkby's moulded insulation during the last four years with very gratifying results. Many difficulties have been successfully overcome and an insulation produced having quite remarkable properties, of which the following are claimed to be some:—

Specific gravity 1.33 to 2.0; dielectric strength of base material 500 volts per mil or 20,000 volts per millimetre; tensile strength 4,000 lb. to 6,500 lb. per sq. in.; unaffected by temperatures from 100 deg. F. to 2,000 deg. F.; has no softening point; unaffected by water, weather, oils, acid-fumes, alkalis, ordinary solvents, live steam, &c.; does not support combustion; not affected by surface condensation; chemically inert; not brittle; extreme accuracy in moulding; made in various colours; contains nothing harmful or anything that will damage metal parts; and it is something entirely different and superior to shellac and similar gum compounds, hard rubber, ebonite, fibre, &c.

It will be readily seen what a wide field of use there is for an insulation of this character. Insulation problems which have caused trouble can now, it is stated, be solved, and a

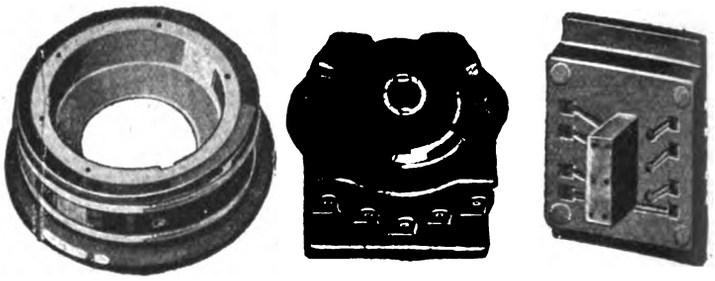

Fig. 6.—Birkby's Moulded Insulators.

large number of extra requirements fulfilled. One or other of the different grades will be found suitable for practically all electrical requirements.

In addition to moulded insulation the firm also specialises in the manufacture and supply of all other electrical insulating materials, fibre, leatheroid, presspahn, mica, micanite, yellow and black insulating cloth, silk, tape and paper, cotton tapes and webbing, insulating varnish, &c., and is sole maker of Birkby's "Oilless" trolley bush, which has a wide use and reputation. We are asked to state that at present, due to large quantities of Government work, very little, if any, new business can be taken on for moulded insulation, but inquiries from interested firms will be welcomed, and they will be supplied with further information.

(To be continued.)

SOME NOTES ON GAS-FIRING BOILERS.*

By T. M. HUNTER, A.M.Inst.C.E.

Gas is an ideal boiler fuel. The capital cost of an installation of gas burners is small, and gas is simple to use when the principles of its use have been mastered. It is possible to maintain the boiler efficiency at a high level when the fuel supply is regular and uniform; so that gas firing ought to show in every case a higher efficiency than coal-firing. Using softened water and cleaned gas, the boiler should always work in its most efficient state. The economiser can be enclosed in an airtight case, and thus all the cold air leakages are avoided. Gas makes the separately fired superheater a most convenient arrangement. This is an important matter in connection with one modern development of the steam turbine, which calls for reheating the steam after it has passed through one or more of the elements.

The defects of industrial gas, as a fuel, are that its pressure and composition are liable to variations, and that, in the case of most blast-furnace gas in this country, it is heavily laden with dust. Using gas varying in pressure and calorific value, it is difficult to set the combustion arrangements so as always to burn the gas at the highest efficiency. Even on the most

* *Proceedings* South Wales Institute of Engineers. Vol. 34, No. 2. Abstract.

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modern installations it is in practice found necessary to burn the gas, in its average state, with 20 per cent. excess of air, not because perfect combustion cannot take place with less air, but simply to avoid the serious loss caused by unburned CO, in the waste gases, when the gas pressure or calorific value increases. Dust in gas fuel is a serious evil; it gets on the boiler tubes and flue walls, and very quickly reduces the efficiency if allowed to accumulate. There are many cases in which it would not pay to clean the dust out of gas. Cleaning involves the loss of the sensible heat in the gas, which amounts often to from 10 per cent. to 15 per cent. of the total calorific value of the gas. The saving in the boiler, by the use of cleaned gas, must be more than this, and must also pay for the power used in the cleaning plant, and for the maintenance and capital charges on that plant. In water-tube boilers, in which the tubes can be cleaned while the boiler is running, it is quite a question whether cleaning will pay, but with Lancashire boilers, which can only be cleaned periodically, cleaning the gas will surely pay. In most boilers at present the burning gases are allowed to impinge directly on the tubes, and thus the dust is burned on to the tubes, and must be removed like scale. So long as this method of combustion is used, gas cleaning is an attractive proposition. In water-tube boilers it is possible to arrange gas burners in such a way that a great amount of the dust can be fused by the flame and left on the floor, and, in this way, only a small amount of the dust in the gas has to be blown off the tubes by the steam lance.

In 1915 one of the officials of the United States Steel Trust stated that they had made tests, and found that, over all their plants, the average boiler efficiency of their water-tube boilers, fired with uncleaned blast-furnace gas, was 55 per cent. Their experiments made with various forms of burners showed them that they could easily improve this average to 65 per cent., but that it was doubtful whether they could maintain 70 per cent. efficiency for very long at any of their plants, under ordinary working conditions. These figures are for boilers alone, and do not include efficiency of superheaters, economisers, or air pre-heaters.

Water vapour in the gas, in any quantity, has a very serious effect on the efficiency of combustion. It lowers the flame temperature and increases the amount of heat carried away to the chimney by the waste gases. Such moisture should, wherever possible, be eliminated by cooling the gas to 30 deg. C. or lower. The discovery of potash in blast-furnace gas, as a by-product in the manufacture of iron, has brought the subject of gas cleaning into very great prominence. The dry processes of cleaning give the dust in a condition ready for immediate sale, so that they have great attractions from the point of view of the recovery of potash. The wet cleaning process has the additional disadvantage, from the gas-firing point of view, that all the sensible heat in the gas is lost, and that the gas is generally loaded with a fine spray of moisture, which must be evaporated and raised to the flame temperature.

In the Halberg Beth process the temperature of the gas as it leaves the cleaning plant is about 70 deg. C. In very many cases the moisture supplied in the ore and the coke is sufficient to saturate the gas at this temperature. Any moisture over this amount, which has found its way into the furnace, is condensed as the gas is being cooled before the cleaning plant. The gas at 70 deg. C. carries only some 2 B.TH.U. per cubic foot of sensible heat, which is almost a negligible amount. If this gas is burned and the products of combustion pass to the chimney at 250 deg. C., the moisture present in the gas is responsible for a loss in efficiency of 5½ per cent. compared with the result to be attained by burning the same gas supplied at atmospheric temperature and saturation. This loss in efficiency rises very rapidly as the temperature of the gas rises, if it is still saturated. At 100 deg. C. the gas carries 3 B.TH.U. of sensible heat per cubic foot, whereas the moisture carried at just under that temperature is three times as much as at 70 deg. C. It is evident from these figures that it will not pay to retain these small amounts of sensible heat, when the gas is loaded with moisture, but that further cooling of the gas must be done.

Take now the case of gas cleaned at a high temperature by the Lodge electric method. We find in the gas all the moisture put into the furnace, and at times this may be a very large amount. On the other hand, the sensible heat carried by the gas is much larger. At 200 deg. C. it is 7 B.TH.U. per cubic foot, at 250 deg. C. it is 9 B.TH.U., at 300 deg C. it is 11 B.TH.U. Further, the temperature of the waste gases leaving the boiler is little if any greater than the entering temperature of the gas. The loss due to moisture in the gas, in this case, is that due to the poorer transfer of heat caused by the lower flame temperature, which is the result of the dilution of the products of combustion by the water vapour. This loss is one of boiler output, not of efficiency, so long as the amount of water vapour present is not sufficient to prevent complete combustion of the gas. Provided we have ample boiler-heating surface, the loss may be neglected. Cleaned gas should never be sent to the chimney at a higher temperature than 250 deg. C.; economisers of one kind or another should always be fitted to reduce the temperature below this figure. If there is a large quantity of moisture in the cleaned gas, it may be necessary to sacrifice the sensible heat of the gas and to throw away even as much as 10 per cent. of the calorific value in this way, for the sake of getting combustion at a reasonable temperature and to get an adequate boiler output.

The losses due to the admission to the boiler of any air in excess of the minimum amount required for the combustion of the gas, are the most serious losses in the firing of boilers with gas. Whether the air is admitted through the burners or finds its way in through the boiler setting, is of little consequence. The author need not labour this point, but it should be noticed that, in practice, the theoretical flame temperatures are never reached: that the ignition temperature of the gases with which we are dealing is about 600 deg. C.: and consequently, if we use a large excess of air for combustion, we soon approach near enough to this temperature with our flame temperature to make complete combustion in the vicinity of the boiler tubes almost an impossibility. For these reasons we are led to conclude that the scientific method to follow in burning gas is to use an arrangement or burner which gives us complete control over the conditions of combustion, for then only shall we be able to reproduce the conditions of maximum efficiency.

The huge losses involved in boiler firing by gas are not realised. The ordinary efficiency of gas-fired boilers, under present conditions, is from 50 per cent. to 60 per cent., and many boilers fired with blast-furnace gas work at an efficiency as low as 30 per cent. Figures have been obtained by careful testing, using gas meter or gasometer, which show the following results: 83 per cent. efficiency for a water-tube boiler with superheater, but without economiser, fired with coke oven gas; 80 per cent. for a Lancashire type boiler, with both superheater and economiser, fired with cleaned blast furnace gas; 79 per cent. for Lancashire boiler, with both superheater and economiser, fired by producer gas; 65 per cent. to 67 per cent. for many tests on water-tube boilers, without superheaters or economisers, fired with uncleaned blast-furnace gas. The difference between these figures, in the case of one boiler, is sufficiently startling. In the case of a small ironworks, where 100,000 lb. of steam are raised per hour by gas, the cost of the steam, if it were raised by coal, would be about £40,000 per annum. A saving of 25 per cent. in efficiency means a saving of £10,000 per annum.

The essentials for the economical combustion of gas are that the gas should burn immediately and completely, at the highest flame temperature and with the smallest excess of air. America and the Continental countries are far ahead of us in gas-firing matters. They have long ago proved that the best combustion takes place when gas and air are intimately mixed before combustion begins. For this reason, one or other variation of the Bunsen burner is almost universally fitted in modern foreign works. There is not one such installation in this country so far, and indeed, the pre-heating of air for the combustion of gas has hardly been considered here. The usual method of burning gas in this country is to admit the air and gas by ports in the boiler front, with or without external combustion chambers, and to let them mix while combustion is taking place. Under these circumstances the flame temperature never rises to anywhere near the possible figure, the flame is long, combustion is slow, and in many cases is still going on in the chimney. This has been recognised in certain Babcock boilers, fired with uncleaned blast-furnace gas. These are made with tubes spaced farther apart than usual, and improved results are obtained simply by the additional space left for combustion. It is evident that the results must be far better when the gases are completely burned in the combustion space below the tubes. Using modern burners with gas or air under pressure, far more gas can be burned in the boiler than is possible by the older method, while at the same time the efficiency is raised. If high boiler outputs are required, a high pressure of air or gas will give a short intense flame, and the boiler output will only be limited by the volume of waste gases with which the boiler flues can deal.

To attain an intimate mixture either the gas or the air must be under a pressure, which should not be less than 2 in. w.g., or induced draught may be used. It is preferable, unless the boiler brickwork is enclosed in sheet steel, to use gas or air under pressure, or both, at the burners. By doing this, the serious leakage of air into the boiler through the brickwork, often through invisible cracks, is avoided, as the whole of the boiler can be kept under a very slight pressure and the products of combustion simply drawn away from the damper by the chimney draught. The cost of the power required to supply this pressure is very small. About 1 per cent. of the power generated is all that is needed. The flames formed by the combustion of the industrial gases when burned with a correct amount of air, can generally be described as blue and colourless. They would take a place towards the blue end of the spectrum; and, consequently, they do not give out much heat by radiation, as is done by flames which give a line near the red end of the spectrum. The problem of taking the heat out of gas flames is very like that of best utilising the waste heat from coke ovens or steel furnaces.

The author made a number of experiments upon a Lancashire boiler, fired with cleaned gas, in order to discover whether a brickwork arrangement in the flues could be designed, which, while not seriously diminishing the chimney draught, would cause much of this heat to be transferred as radiant heat. Many arrangements were tried, but the conclusion come to was that is was not possible, with natural draught, to heat the brickwork to such a degree that the transmission of heat was measurably improved. The result was practically the same in the case of brick baffles built in the flues. Such baffles are very useful where it is necessary

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to mix air and gas during combustion, but this seems to be their sole function, when working on chimney draught alone, and this action is not required when firing the boiler with suitable burners.

The subject of the transfer of heat from hot gases to the water in the boiler is of great interest to anyone who tries to design a boiler specially for gas-firing. Most of the heat must be transferred from the gas by actual contact between the gas and the tubes. It is found that by far the greatest part of the resistance to this transfer of heat occurs at the surface where the gases touch the tubes; the resistance to transfer through the metal, and from metal to water, is almost negligible in comparison. The reason seems to be that a very thin film of cooled gas sticks to the boiler tubes and prevents the contact of hot gases with the tubes. There are two ways of getting over this. Either the surface of the tubes in contact with the gases may be greatly increased in relation to the wetted surface of the tubes, as is done by the use of corrugated flues or ribbed tubes, or by using small-tube water-tube boilers like the Yarrow boiler; or the gases may be caused mechanically to scour the surface of the tubes, sweeping away this layer of cooled gas, and making close contact all the time between the hot gases and the tubes. This can be done by applying considerable power to the gases in the way of forced draught or suction, as in the Bonecourt boiler, where, in addition to the gas pressure available, suctions of as much as 16 in. w.g. are employed, and the transfer of heat through the fire tubes is enormously increased. It is claimed that evaporations of 30 lb. per square foot of heating surface per hour can be got continuously, and that the whole of the combustion takes place in the first 2 ft. of a 15-ft. boiler tube. The transfer of heat through this part of the fire must therefore be enormous. The author would not like to be near one of these boilers should any trace of oil get into the feed water.

Similar results, with a much more reasonable temperature gradient through the length of the fire tubes, could be attained by the use of suitably designed boilers, with much smaller suctions than 16 in. w.g. The Lancashire boilers made thirty years ago, with a tube plate about 20 ft. from the front and small fire tubes running from it to the back of the boiler, would make excellent boilers for gas-firing, provided we were prepared to use induced draught, and to treat them as internally fired only, giving up the outside heating surface. Only the smallest suctions can be applied to boilers with brick settings, owing to air leaking in through the walls. If, however, we caused the gas to burn completely in the wide flues, and then drew the products rapidly through the small fire tubes, we should get an adequate duty from the boiler, at a high efficiency; and we should cut out all the loss by air leakage and much of the loss by radiation, which are so serious in the Lancashire boiler as usually fired. The marine type of Scottish boiler, with two or more flues, would be even more suitable for this treatment, and the author expects soon to see boilers of this type used for gas-firing. He believes that this boiler would beat the best water-tube boiler in efficiency.

The cost of the power used to produce the forced or induced draught, must be debited against the boiler before the net efficiency of the boiler is brought out. To give a suction of 16 in. w.g. on the boiler, at plants where 30 lb. of steam are required per H.P.-hr. in the engine driving the fan, costs 10 per cent. of the steam raised in the boiler: it costs 4 per cent. of the steam where 12 lb. of steam per H.P.-hr. are required, as at modern power stations. A 4-in. w.g. pressure or suction should be enough for the boilers just described, and this would only cost a fraction of these amounts, while the added efficiency of the boilers would far more than pay for the steam used. It must, however, be considered in each case whether it would not be cheaper to install additional boilers, and to run them at natural draught, than to run the boilers with mechanical draught, at higher outputs. The improvement in efficiency attainable by the latter method is the factor which will decide the question.

The provision of pre-heated air for combustion is even more important when using gas than when using coal fuel. At many works no economisers are fitted on the boilers because the feed water is already heated by the exhaust steam from the engines. It is quite usual to find a temperature of 350 deg. C., and often more, in the waste gases from gas-fired boilers, if they are working at a fair output. This could easily be reduced to about 200 deg. C. by the use of a good air heater. The gain to the boiler is not merely the number of B.TH.U. added in the hot air, though that would amount to a considerable addition to the calorific value of the gas. Pre-heated air promotes much better combustion and a higher flame temperature, and thus improves the heat exchange. It is of no use to pre-heat the air or gas by extracting heat from the flame, or from the waste gases before they leave the boiler. This merely returns with one hand what is taken away with the other; yet we see patents seriously taken out which claim to make great savings by these means. Modern air pre-heaters can be used even with uncleaned blast-furnace gas, as the plates can be brushed or blown clean at frequent intervals while the heaters are at work, with a very small amount of labour.

The author has twice come across cases where it was stated that gas-firing was responsible for damage to the boiler tubes. He has had experience of boilers, fired for many years with Mond gas, which show absolutely no damage at all. If gas is burned with a small excess of air, so that there is a minimum of oxygen in the burned gases, and if combustion takes place quickly, so that it is practically complete before these gases touch the boiler tubes, no damage whatever can happen to the tubes. In firing water-tube boilers he always likes to arrange the gas burner, pointing towards the floor, at an angle of, say, 20 deg. below the horizontal, so that the gases may be completely burned before rising to the tubes. This has the further advantage that the brickwork of the boiler, upon which the flames play, is kept very hot, and assists in the rapid combustion of the gas. In the case of uncleaned blast-furnace gas, the flame temperature is so high, by this method, when burning the gas with a small excess of air, that much of the dust can be melted, and thus thrown out of the products of combustion, instead of being burned on to the tubes.

He has records of a large number of readings made in America of the flame temperatures in water-tube boilers fired in this way. The temperature was measured in the combustion space, about two feet in front of the burner nozzles. The temperatures range from 1,040 deg. C. to 1,260 deg. C., the average being fully 1,160 deg. C. The CO_2 reading in the gas averaged 23 per cent. He does not know what the possible flame temperature would be with the gas used and this small excess of air, but judging from the calorific value, which was about 102 B.TH.U. per cubic foot, he would say that it was about 1,300 deg. C. Similar tests were made on other boilers into which the gas and air were admitted by ports in the front of a combustion chamber. This chamber was large enough for complete combustion of the gas, so that here also the CO_2 readings averaged about 23 per cent. The temperatures in the combustion chamber varied from 760 deg. C. to 960 deg. C., with average about 900 deg. C., while the possible temperature to be attained was the same as before, viz., 1,300 deg. C.

These tests show clearly the great advantage of gas-firing in a scientific way. The old combustion chambers, at small boiler loads, were able to give about the same results as regards composition of the chimney gases. By using gas burners, no combustion chambers, with their high radiation losses, were required, and a better transfer of heat could be made, resulting in a higher boiler load and better efficiency.

While in the case of large boilers we may adjust the variations of pressure, air supply, and chimney draught automatically, we must recognise that at most plants this is not likely to be done, and we shall have to rely on the control of the boilers by more or less skilled men. Boilers fitted with the best combustion arrangements will give results 5 per cent. better, if intelligently controlled, than they will give if run by the usual boiler men uncontrolled. If the boiler men could earn a small premium for maintaining good results, they would quickly see that it was to their interest to study the results they were getting, and would reduce economy in boiler firing to a fine art.

WAR ITEMS.

Letters from Soldiers.—A corporal with the Forces at home, in acknowledging receipt of the ELECTRICAL REVIEW, says: "It is most highly appreciated, and keeps one in connection with the old world, which sometimes seems to be a shadow of the past, but which is constantly being illuminated by the REVIEW."

A reader who has been in France a long time writes:—"Please accept my apologies for not having written you ere this to thank you for your continued kindness in forwarding the REVIEW to me so regularly. . . . I appreciate it very much indeed, and you would be amused at the crowd of men who hover around my tent on Tuesday evenings (REVIEW usually arrives Mondays) inquiring 'if I have finished with it yet.' We find much pleasure, and I hope profit, in discussing the various articles, and it is exceedingly gratifying to know that even if we are far away from our old lives, and, in many cases, occupations, we are still able to keep posted as to all the happenings at home. I am afraid some of the works at home must be carrying on under great difficulties. Shortage of staff, heavy cost of coal and oil, daylight saving, rationing of consumption, and early closing of shops all help to do them a little bit of 'no good.' Still, it is something to be able to carry on at all, I suppose, and I certainly think that the men at home are to be congratulated on the good work they are doing. I know, from personal experience, that it is very hard to keep on with one's daily duties; everyone seems to look at you with contempt, and give you that 'why are *you* not in khaki?' stare. Many of those at home are having a harder time of it, mentally, at all events, than those out here, and although I long to get back again, I do not envy them."

To be Wound Up.—Winter & Almenraeder, 48, and 49, Great Sutton Street, E.C.1, importers of vulcanite, &c., successors of H. Traun & Sons, 25, Goswell Road, E.C.1, manufacturers of ebonite. Controller, Mr. J. D. Pattuth, 65, London Wall, E.C.2.

Labour Supply.—To co-ordinate the functions of the several Government departments concerned in the regulation

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and supply of labour, the Ministry of National Service, the Ministry of Labour, and the Ministry of Munitions have agreed to adopt a uniform grouping of counties into nine administrative districts.

Westinghouse War Relief Fund.—We have received a copy of the statement of receipts and payments of the British Westinghouse Employés' War Relief Fund from August 22nd, 1914, to June 30th, 1918. Of the total amount contributed (£57,253), £38,061 came from the employés and £19,191 from the company. There has been paid out to dependents £38,147. £12,392 is set aside for a disablement and dependents' fund, and £2,479 has been spent in donations to local and national funds and in Christmas gifts. The number of families in receipt of weekly relief is now 822, and the number of employés who have joined His Majesty's Forces is 3,461, among whom, unfortunately, the casualties have been exceedingly high.

Reconstruction.—From time to time we have summarised generally the important investigation operations of the Ministry of Reconstruction. We have never underestimated the value of the work of this department, for we recognise that it is only by an expert understanding of the various problems bearing upon the national life that we shall be enabled to prepare for the new state of affairs that will exist when war activities, military, naval, and industrial, come to an end. Occasionally we have been privileged to put before our readers certain special aspects of reconstruction relating to industry and trade, demobilisation, raw materials, and so forth. There will be many readers, however, who will be anxious to have before them a connected general summary of the problems and proposals of the Reconstruction Ministry, and this is now made available for them by the Ministry itself in the form of a 20-page pamphlet (No. 1 of a series), entitled "The Aims of Reconstruction." The questions briefly reviewed are: Shipping, raw materials, allocation of raw materials, transport, demobilisation, industrial organisation, joint industrial councils, interim reconstruction committees, working conditions, social development, health, housing, education, and problems of finance. Copies of this pamphlet, and of the second of the series which deals exclusively with "Housing in England and Wales," can be obtained at twopence each from the Ministry of Reconstruction Offices, 2, Queen Anne's Gate Buildings, Westminster, S.W.1.

Exports to China.—The "London Gazette" for September 3rd contains a supplementary list of persons and bodies in China to whom exports may be consigned.

Exemption Applications.—At the Yarmouth Tribunal, the case of an electrician (38), in Grade 2, was reviewed on the ground that he was of the old military age, and it was not in the national interest that he should remain in civil life. His father said he was the only man left of five, and was engaged on the X-ray apparatus at the hospital. Originally he was placed in Grade 3, then put into Grade 1, and on appeal placed in Grade 2. It was impossible to obtain skilled men now. Lieut. Hadley pressed for the man subject to a substitute being found. Temporary exemption for two months with a view to substitution.

An electrical engineer and contractor (32, Grade 1), who appealed at Oldham, was given until the end of September with a view to securing a trade protection card.

At Salisbury, the National Service representative appealed for withdrawal of conditional exemption held by an electrical installation attendant (44, Grade 1) at Alderbury. The employer said that the man was responsible for the supply of electricity to an estate and for private purposes, and it was not possible to substitute him. Exemption until January 1st was granted.

At Windermere, J. K. Thornborough (37, Grade 2), electrical engineer, who appealed, was granted a month in which to obtain a certificate of full-time national service.

Before the Somerset Appeal Court, the National Service representative appealed for the withdrawal of conditional exemption held by W. R. Hewlett (37, Grade 2), electric light fitter, of Taunton. Respondent stated that he worked at least 75 hours per week, his business was one of the oldest in the town, and his occupation was a certified one. The appeal was disallowed.

Hambledon (Surrey) Tribunal has granted three months' exemption to A. Ashdown (48), electrician, of Wormley.

At Weston-super-Mare, exemption was asked for H. Brewer (40, Grade 2), wireman with the Electrical Supply Co., Ltd. It was stated that he was one of the two wiremen left, whereas before the war there were from eight to twelve. It was urged that the man was needed as he was experienced. Six months were granted, with leave to apply again.

At Dover, the Corporation appealed for further exemption for W. J. Revell (28, B2) and W. C. Peddrick (41, B1), drivers of electric scavenging vehicles. It was suggested that women could act as drivers, but it was stated that a woman should not be asked to drive up the steep track used. Each was given three months, and six months were conceded to F. Quinnell (46, Grade 3), engine driver at the electricity works; and three months to A. Robertson, electrical engineer to the tramways.

At Reigate, the East Surrey Traction Co. appealed for W. P. McAlpine (38, Grade 2), electrician and magneto repairer, and with the consent of the National Service representative, he was granted six months' temporary exemption.

SCIENTIFIC AND INDUSTRIAL RESEARCH.

The report of the Committee of the Privy Council for Scientific and Industrial Research for the year ending July 31st, 1918, has just been issued (Cd. 9,144; 4d. net). It states that the past year has seen a great extension of the work of the Department. The National Fuel Research Station at East Greenwich will, it is hoped, begin work this year; the buildings and equipment are estimated to cost about £120,000. The National Physical Laboratory has been taken over, and the very inadequate salaries of the staff have been increased. A Research Board has been established, with Sir Lionel Phillips as chairman, to develop researches into the production of tin and tungsten in Cornwall, and other important investigations have been undertaken.

Satisfactory progress has been made during the year with the negotiations between the Department and the industries of the country for the establishment of industrial research associations, for which purpose Parliament voted a sum of 1 million sterling; model articles have been drawn up, and, with an amended memorandum, are appended to the report. An industry can establish an approved association without seeking assistance from Parliamentary funds, and such association will have exactly the same privileges, and receive the same assistance in the way of advice and information as associations in receipt of grants. The Department has found sometimes a certain hesitation on the part of manufacturers to establish relationship with the Government for the purpose of research, fearing that the Department will interfere with the work, and prevent the results of research from reaching the firms which have subscribed to its cost, or give the results to competing firms which have not joined, or have left the association. The intention of the Department is that the associations shall manage their own affairs and benefit by their own discoveries. If the firms in an industry will undertake research on any plan which they think suited to their needs, they will receive the sympathetic consideration and assistance of the Department.

The Department has guaranteed to the British Scientific Instrument Research Association an expenditure of £36,000 on approved research during the next five years.

The amount standing to the credit of the Research Fund on July 31st was £1,016,391; a sum of £11,181 had been transferred to the current account for the payment of impending grants. Various funds in connection with the National Physical Laboratory have been taken over by the Imperial Trust. During the year three patents have been taken out by the Trust in conjunction with the inventors. Fifteen recommendations in respect of individual researches have been approved, and five other researches have been continued, under the control of the department. Recommendations have been considered in respect of, and to, 21 scientific investigations of industrial importance conducted by other bodies, of which 15 had received aid in 1916-17. Grants were made to 25 students under training in methods of research, and to 36 workers engaged in research. The expenditure under this head was £7,500, comparing with £3,550. The number of students and workers during the session 1918-19 is likely to be further increased. The expenditure during the year was £30,825 out of the sum of £38,050 taken in the estimates—more than twice the expenditure in the previous year. The value of the work done was beyond all comparison greater than its cost. For the current year a sum of £163,350 has been taken, including a sum of £89,750 for the services of the National Physical Laboratory, which will also receive from the various War Departments payments amounting to £74,100.

The Report of the Advisory Council states that throughout the year attention has been given to the organisation of those fields of research which cannot be covered by means of research associations—researches of a national character. Attention is drawn to the danger that after the war there will not be an adequate supply of trained research workers, and the Department throws the responsibility for recruiting the army of men and women that is needed upon the education authorities of the country. In this connection the findings of the Committee appointed to inquire into the Position of Natural Science in the Educational System of Great Britain are cited, and the Advisory Council emphasises the necessity of prompt action.

Referring to the progress made in the establishment of research associations and the organisation of national research, the report deals with questions relating to the Standing Industrial Councils of the Whitley Report, the conditions prevailing in different trades, &c. The foundation of the British Scientific Instrument Research Association on May 16th last is regarded as a very important event; this Association "has every prospect of becoming the representative industrial body dealing with the application of science to the manufacture of instruments of precision." It was not found possible to bring the makers of internal-combustion engines into one association, owing to the absence of sufficient common ground for common action; the makers and users of refractories similarly did not see eye to eye, and the Council has decided to act independently by promoting research at the Pottery School at Stoke, and assisting the Institution of Gas Engineers to carry on research. The proceedings of the National Physical Laboratory, the Fuel Research Board, and other important organisations are outlined, and particulars are given as to the progress made on similar lines in the Dominions and the United States.

Touching the regulations under which the Council makes grants in aid of researches to students and other workers, and which specify that the Committee of Council must be the first recipient of the results of investigations, and will decide "in the national interest" to what extent the results shall be made available, also reserving to the Council the right to determine whether, and to what extent, the bodies and persons who have taken part in a

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research shall secure patent rights, &c., and the profits arising therefrom, the Committee says that in practice no worker has found these conditions unfair. The action of the Department is limited to cases in which the national interest is affected, and where results of commercial value are concerned. It is not in the national interest that results of commercial value obtained by the expenditure of national funds should be made available for other countries, to the detriment of our own; nor that such results should go to a single firm to the detriment of other firms in the same industry who are equally willing and able to take up a new idea; nor that successful research workers should be unfairly exploited by manufacturers or company promoters, and where the means for research has been found by the Government, the Department intends to secure a generous reward to the inventor.

As a rule, the results of investigations are made available for publication at once.

The following is a summary of the grants made and considered during the year 1917-18:—

Grants made to students, pure science	21
" " " applied science... ...	5
" " research assistants, pure science	5
" " " " applied science	5
" " research workers, pure science ...	8
" " " " applied science	14
" " for apparatus	9
Grants refused—students	1
" " research workers...	8
Applications referred to other departments ...	6
" withdrawn—students	9
" " workers and assistants	11
	102

Again emphasising the deficiency of scientific students, the Committee quotes the report of Sir J. J. Thomson's Committee, and states that it is prepared to recommend allowances for students under training or salaries for additional research assistants, but cannot supplement the salaries of the permanent staffs of the Universities.

Applications for assistance have been received from 11 inventors, but in no case has a grant been made.

BUSINESS NOTES.

Australian Government Contracts.—The Australian Commonwealth Government recently decided to constitute a Stores Supply and Tender Board for the Commonwealth, and the following appointments have been made:—Mr. J. R. Collins, Secretary to the Treasury (chairman); Messrs. M. L. Shepherd (Secretary to the Prime Minister's Department), G. L. Macandle (Naval Secretary), W. D. Bingle (Secretary to the Works and Railways Department), Atlee Hunt (Secretary to the Home and Territories Department), and J. Oxenham (Secretary to the Postmaster-General's Department). The acting secretary is Mr. O. D. Daly, and the Board's functions are to arrange the supplies of all goods for the several Commonwealth Departments.—*Tenders.*

Book Notices.—*Handbook of National Kitchens and Restaurants.* Pp. 64, figs. 37. London: Ministry of Food.—In view of the coal shortage and the difficulties that will be experienced during the winter months, both the Coal Controller and the Food Controller feel that the wide extension of national kitchens throughout the country would be of material assistance in meeting any situation that may arise. The Ministry of Food will lend the necessary capital, free of interest, the same to be repaid in 10 equal annual instalments, to any local authority that desires to set up national kitchens or restaurants. The booklet under notice is the official handbook of national kitchens issued through the N.K. Department of the Ministry of Food. It deals in a comprehensive manner with the setting up of kitchens and restaurants by local authorities, giving expert advice on all matters appertaining to this national movement. A foreword is contributed by the late Lord Rhondda and an introduction by Alderman Chas. F. Spencer, Director of National Kitchens. The first half of the handbook deals in a clear and concise manner with such subjects as the size of kitchen, adaptation of existing buildings, choice of equipment, staff, finance, &c. Rural kitchens and village canteens are also dealt with, while six appendices are added in which lists of equipment and goods required, together with a number of varied and useful recipes, are given. The handbook should be found most useful and helpful to all who are interested in the movement; copies free of charge may be obtained from the Ministry of Food, N.K. Division, 4, St. Paul's Churchyard, E.C. 4.

"Reconstruction Problems." Parts I and II. London: Ministry of Reconstruction. Price 2d. each.

"Power Plant." By T. R. Wollaston. 1918. Manchester: Sherratt & Hughes. Pp. 116, 17 figs. Price 5s. net.

"Alternating-Current Electrical Engineering." By Philip Kemp. Pp. viii + 494; figs. 399. London: Macmillan & Co., Ltd. Price 17s. net.

"Volumetric Tests in Scientific Glassware." National Physical Laboratory, Teddington.—This is a pamphlet prepared by the Metrology Department, describing the conditions which must be complied with when scientific glassware is sent for test, the nature of the tests, fees, &c.

Advertising and Trade.—Messrs. Greenly's, Ltd., advertising specialists, of 37 and 38, Strand, W.C. 2, are issuing a monthly circular, entitled "Business" (Methods, Plans, Opportunities). The August issue discusses advertising as a means for the exploitation of markets.

Liquidation.—British Telegraph Instrument Co., Ltd.—Creditors must send particulars to the liquidator, Mr. J. H. Webb, 179, Clapham Road, S.W. 9, by October 7th.

Bankruptcy Proceedings.—A. M. Ferguson, electrician, 424, Chester New Road, Warrington.—Receiving order made August 26th, on debtor's own petition.

Fire.—Messrs. W. Canning & Co., electro-platers' engineers and manufacturing chemists, whose Snow Hill Engineering Works, Birmingham, were totally destroyed by fire on August 23rd, having found it impossible to rebuild the engineering works without delay, have purchased extensive premises and machinery, as a going concern, at Salop Street, Highgate, Birmingham, formerly in the occupation of Piston Rings, Ltd. (Telephone Nos. 638 and 2424 Midland), and work has already been resumed. The damage was said to amount to more than £20,000.

Organisation of Electric Furnace Makers in America.—A meeting was held recently in New York of certain electric furnace manufacturers of the United States, at the request of the General War Service Committee of the electrical manufacturing industry, the result of which was the formation of a permanent Committee, to be known as the Electric Furnace Industries War Service Committee, for the duration of the war, or for such a length of time as it is apparent that there is a necessity for it, by the Government, to compile and detail information pertaining to the electric furnace industries in connection with steel, non-ferrous alloys and metals in general where the melting problem is concerned.

"Anchor" Works Hospital and Distress Fund.—The annual report of this Fund connected with the Leigh Works of Callender's Cable and Construction Co., Ltd., was submitted to the recent annual meeting. The scheme, which is systematically subscribed to by all the "Anchor" employés of 17 years of age and upwards, embraces "The Hospital and Distress Fund" and "The Special War Fund." To the former the employés have contributed during the year £227 16s., and have made substantial grants to local and Manchester hospitals, and the balance has been paid to necessitous members, whose cases are carefully investigated by the Committee. The contributions to the "Special War Fund" amount to £1,000 all but a few shillings; £232 has been dispensed amongst hospitals and war charities, and £373 expended on comforts in the shape of parcels and postal orders for the numerous "Anchor" employés serving with H.M. Forces. At the annual meeting (presided over by Mr. A. Crooke, in the unavoidable absence of Mr. J. Bowyer, "Anchor" Works manager), contributions were voted to hospital and war charities for the coming year. The administrative work is undertaken by a Committee with Mr. W. Mort as hon. treasurer, and Mr. R. Hocken, hon. secretary.

LIGHTING AND POWER NOTES.

Aberdeen.—Extensions.—The T.C. Electricity Committee has agreed to purchase new converting plant, at a cost of £6,755.

Argentina.—The electric lighting and tramway undertakings of the City of Asuncion have been acquired by the "Cia. Americana de Luz y Traccion," which intends to develop the electricity works and to electrify the steam section of the tramways. The company is controlled by the same group of Italian, Swiss, and Argentine capitalists who own the "Cia. Italo-Argentina de Electricidad"; the president is Ingeniero Juan Cardsio.

Senor Enrique Moranz has been granted a concession by the Senate of the Province of Cordoba to install electricity at Capilla del Monte for 20 years.—*Review of the River Plate.*

Australia.—Sydney.—Owing to the scarcity of electric motors, the Council has suspended its arrangements for the sale of hired motors.

Barnstaple.—Price Increase.—The charges for electricity supplied by the T.C. for lighting and power purposes are to be increased by 20 per cent. from October 1st next.

The T.C. has increased the maintenance premium payable to the D.P. Battery Co. by £25 per annum.

Calder Valley.—Wages.—All classes of municipal employés in the district between Todmorden and Brighouse are demanding an increase of wages of 30s. per week above pre-war rates. In view of an award by the Committee on Production, about a month ago, of a 2s. advance on the existing 16s. above pre-war rates, the Calder Valley Wages Board has declined to accede to the demand, and the men have decided to tender their notices.

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Continental.—Sweden.—According to the *Board of Trade Journal*, an electric power company, with a minimum capital of 1,000,000 kroner, has been formed at Stockholm.

Darwen.—Price Increase.—The Electricity Committee has recommended that the charge for electricity be increased to 8d. per unit.

Wages.—The employés at the electricity works have applied for an increase of 3s. 6d. per week, in accordance with the last award of the Committee on Production.

Dublin.—E.L. Restrictions.—The Electricity Committee has now enforced the new regulation reducing the supply for lighting to two-thirds of that consumed in the quarter from September, 1917, with a proviso that if the amount is exceeded the supply will be cut off altogether.

Elland.—Price Increase.—The U.D.C. has increased the charges for energy, from the September meter readings, as follows:—Lighting, 6½d. per unit; heating, 2d., plus 60 per cent.; power, 2d., subject to existing sliding scale for consumption per H.P. of maximum demand, plus 60 per cent. on net invoice.

Epsom.—Price Increase.—The U.D.C. has advanced the charges for electricity as follows:—For lighting, flat rate, 8d. per unit; sliding scale, up to 1,800 units per annum, £45; 1,800 to 3,000, 6d. per unit; 3,000 to 6,000, 5½d.; 6,000 to 9,000, 4½d.; beyond 9,000, a flat rate of 5½d. Houses not exceeding £25 rateable value will be charged £1 19s. per annum for two 25-C.P. lamps, £2 11s. for three, £3 for four, £3s. 6s. for five, and 6s. for each lamp over five. Power and lighting, flat rate, 4d. per unit; sliding scale, up to 400 per quarter, 4d.; 400 to 1,000, 2¾d.; 1,000 to 1,500, 1¾d.; 1,500 to 2,100, 1d.; beyond, 2,100, a flat rate of 2½d. Power for flat irons, 15s. per annum each iron.

Greenock.—Year's Working.—The past year's income of the Corporation electricity department amounted to £117,588, and the expenditure to £110,000, compared with £96,843 and £86,000 respectively in the preceding year. The output increased by 3,810,282 units. The reserve fund now stands at £46,497.

Leeds.—Wages.—An application from the employés of the electricity department for payment of double time for Sunday work has been refused by the General Purposes Committee.

Liverpool.—Price Increase.—From the end of the present quarter the Corporation is increasing the price of electricity for lighting and power by a further 10 per cent., making 40 per cent. over pre-war charges.

London.—Proposed Price Increase.—The Charing Cross, West End, and City E.S. Co. has applied to the B. of T. for permission to increase the maximum price of electricity from 5d. to 6d. per unit.

Malaya.—Electricity in Tin Mining.—In 1917 in the Federated Malay States 55,576 H.P. was used in the tin mining industry, of which 2,420 H.P. was steam-electric and 4,395 hydro-electric. The Tin Bentong Co.'s hydro-electric power plant and an electrically-operated dredge were the only new plant of any magnitude installed during the year.

Nottingham.—Proposed Extensions.—With regard to the scheme of the E.L. Committee for the installation of new plant at the Trent Side power station, the Chairman of the Committee states that Government permission to proceed with the scheme cannot be obtained until after the war.

Ormskirk.—Price Increase.—The Ormskirk Electric Supply Co. has increased the charges for electricity for all purposes by a further 10 per cent., from August 31st last.

Oxford.—Explosion.—Three persons were injured by explosions, one of which occurred in the street and the other in a cellar, in the Carfax district last week. The city engineer informed a local newspaper that the electric light cables fused at a point where two gas mains crossed over them, with the result that the gas-pipes were burnt through, and the gas immediately took fire. At the time the three covers of the chambers of the electric cables were off, and there was no smell of gas perceptible at them. Gas, however, found its way into a chamber on the line of the telegraph cable, and by some means was ignited and exploded. With regard to the explosion in the cellar, it was evident that some of the gas had accumulated there, and appearances pointed to the probability of someone having taken a naked light into the cellar. In relaying the electric cable it is being placed in a wooden trough filled with bitumen, so as to keep it from contact with pipes, and it is hoped that this will prevent any such occurrence in future.

Salford.—Wages.—In accordance with the award of the Committee on Production, the Electricity Committee has increased the war bonus of its employés from 20s. per week to 23s. 6d.

Sheffield.—Generating Plant.—At a recent meeting of the Council, when the Electric Supply Committee's minutes came up for consideration, the chairman, with Mr. Warlow, a director of one of the large steel works, moved an addition, which he asked the Council to confirm, authorising the purchase of turbo-alternators, boilers, &c., a request which raised a protest by a member of the Council, who has previously attempted to retard the progress of electricity supply. This member pointed out that as the addition involved the expenditure of something like £700,000, further opportunities should have been afforded the full Council to discuss the matter. Moreover, he considered the expenditure unnecessary, seeing that the present demand for energy was being met with existing plant. "There is," he added, "no reason or excuse for putting out these orders at a price so extravagant and outrageous as to make it absolutely impossible for the Committee to supply the manufacturers of Sheffield with cheap electricity. The cost of the proposed order is nearly three times the pre-war figure, and the cost of producing electricity with a plant of that kind is bound to be prohibitive." He did not agree with people who had visions of unlimited prosperity after the war. It was pointed out in discussion that any further delay in the matter would probably mean paying still higher prices for the same requirements, and ultimately it was decided to sanction the expenditure, subject to the approval of the Finance Consultative Committee.

South Africa.—Johannesburg.—Plant Extension.—The Municipal Council has provided £10,000 for the purchase of a temporary steam generating plant, and is to invite tenders for the same.

South Shields.—Price Increase.—The E.C. has increased the charges for electricity for all purposes, except for public lighting and traction, by 20 per cent. from the end of the present quarter.

Willesden.—Year's Working.—The total income of the U.D.C. electricity department for the year ended March 31st last amounted to £51,644, and the expenditure to £37,516, including £26,769 for the purchase of energy in bulk and £10,747 for distribution costs, &c. Of the gross profit, instalments on loans absorbed £9,113 and interest £4,117, the net profit being £1,201. The capital expenditure during the year was £8,763, including £6,428 for mains and services and £1,920 for transformers, &c. Units sold increased from 5,990,685 to 7,603,956 (lighting, 1,607,648; power and heating, 5,887,103; public lighting, 109,205). The cost of the bulk supply was 0·845d. per unit, compared with 0·866d. in the previous year, and distribution costs were 0·128d., against 0·121d., while the total cost, including management expenses and capital charges, was 1·605d., against 1·719d. The maximum demand was 3,255·5 KW., against 2,826 KW. in the preceding year.

TRAMWAY AND RAILWAY NOTES.

Birkenhead.—Year's Working.—The annual report of the Corporation tramway department for the year ending March 31st last states that the income was £97,838, or £17,093 higher than the record made during the preceding 12 months. Traffic receipts were £96,386, an increase of £16,714; working expenses, £53,815, an increase of £11,708; the profit was £44,023, an increase of £5,382; interest on capital was £26,651, an increase of £1,662. Of the balance (£17,372, or an increase of £3,720) £8,550 went in aid of rates, £3,822 to reserve fund, and £5,000 to renewals funds, the former of which now stands at £12,013 and the latter at £39,338. Due to the increased price charged for electricity, the cost of electrical energy was £11,326, compared with £7,244 last year. War bonus being paid to employés is at the rate of £12,800, and war allowances to employés on active service amounted to £998 per annum. The passengers carried numbered 20,538,476, an increase of 2,588,043, excluding soldiers and sailors carried free of charge. The car-miles were 1,219,250, and number of units used per car-mile was 2·221. Net profit was £17,372, against £13,653.

Darwen.—Increased Fares.—The Corporation is applying to the B. of T. for power to raise the tramway fares beyond the limit allowed by the Corporation's 1899 Act.

Leeds.—Reconstruction.—The Tramways Committee proposes to reconstruct the tramway track in certain thoroughfares, and to attach the overhead wires to supports fixed on buildings, instead of to the poles in the middle of the streets, as at present in use.

Fares.—The Committee has refused an application from the Otley U.D.C. for a reduction of fares on the railless system between Otley and Guinsley.

London.—Women Tramway Workers.—The award of the Committee on Production in connection with the claims of the women tramway and omnibus workers for equal pay for equal work, was issued last week. It lays down that the wages of women aged 18 and over are to be increased by 5s. per week, subject to a maximum of 25s. per week over pre-war rates; payment to be on the basis of a week of six days or six shifts; the award to take effect from July 9th last; and the Committee recommends that the whole question of women's wages and advances should be the subject of a special inquiry.

The Government has appointed a Committee to investigate and report as to the relations which should exist between the wages of men and women, having regard to the interests of both, as well as

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to the value of their work, and also having in view the necessity of output during the war, and the progress and well-being of industry in the future.

In view of the shortage of paper, the L.U.T. tramcars now have canvas bags fixed near the exits, in which passengers are requested to deposit their used tickets on leaving the cars.

New South Wales.—Fare Reduction.—Replying to a deputation asking for a reduction in fares, the Chief Commissioner for Railways stated that a reduction in fares would mean a serious loss in revenue, and the Department was not in a position to lose revenue. Passengers were carried at half the price charged in other countries. If the war continued, and the Commissioners were not able to get the material required for the construction of railway and tramway rolling stock, they might have to seriously restrict travelling. In New Zealand the authorities had cancelled all pleasure travel, and after 6 p.m. at night no trains were run at all. Something of the same kind might have to be done in New South Wales. It was also stated that electrical material could practically not be obtained. Wheels and tires had been all imported, and there was the greatest difficulty in replacing them when they wore out. Tires, particularly, were used up at a very rapid rate. The practice in condemning tires had been altered, otherwise the service would necessarily have been reduced by half. Strenuous efforts had been made to manufacture equipment locally. Pinions for motors, and also tires, were now being made in the railway workshops. They had also experimented with a chilled cast-iron wheel, but the result had been disastrous, as the wheels would not stand the traffic. Nearly half the tramway rolling stock was fitted with obsolete motors, the replacement of which would cost £250,000. The electrical plant was overstrained, and, naturally, breakdowns of appliances frequently took place. In the March quarter there was a decrease of 6·76 per cent. in passengers carried in comparison with the same quarter of 1917, and the reduction in car mileage amounted to 5·5 per cent. Relatively more car miles were run in comparison to passengers carried in the last quarter than in the 1917 quarter.

TELEGRAPH AND TELEPHONE NOTES.

American Marconi Decision.—The Marconi Wireless Telegraph Co. of America has appealed against the judgment in favour of the International Radio Telegraph Co., mentioned in our issue of August 23rd, and it is hoped that the decision will be reversed. We are informed that the amount involved is about £60,000, *i.e.*, about one-tenth of the amount which has been reported.

Canada.—At the request of the Labour Department, the Canadian Pacific telegraph operators have consented to submit their differences to the Board of Arbitration.

China.—It is reported that the Marconi Co. has signed a contract for a loan of £600,000, at 8 per cent. interest, on the security of Chinese Treasury bonds, repayment beginning in 1924 and ending in 1929. It is said that the company undertakes to provide China with 200 wireless telephones, transmitting 40 miles, but no official confirmation of this statement has been issued. China will employ an English expert.

According to *The Times* the company signed a contract on August 24th with the Chinese Ministry of War to supply 20 wireless telephones for military purposes, and the loan is half for the purchase of the telephones, half for unspecified expenditures.

Telephony in Sweden.—The A.B. Stockholmstelefon (formerly Allmanna Telefon) is to be taken over by the Swedish Telegraph Administration, and is thus to be amalgamated with the Rikstelefon (the State Telephone System). The sum to be paid by the Telegraph Administration for the acquisition of the entire telephone lines, plant, apparatus and materials of the A.B. Stockholmstelefon is about 47,000,000 kronor. A preliminary agreement on the above lines has been sanctioned by the Government, but its definitive conclusion depends on the Riksdag. The Stockholm Telephone Co., which has a capital of 18,000,000 kronor, serves Stockholm and the surrounding district. The local competition between this company and the State Telephone has been very severe, and the amalgamation of the two telephone systems has long been under consideration.—*Board of Trade Journal.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Atherton.—September 16th. U.D.C. Two 110-kw. single-phase transformers. See "Official Notices" August 30th.

Bristol.—September 26th. Electricity Committee. Six months' supply unwashed small coal. Chief Engineer & Manager, The Exchange, Corn Street.

London.—Office of Works.—September 12th. Electrical accessories. See "Official Notices" to-day.

September 16th. Supply of electric bell fittings. See "Official Notices" to-day.

Manchester.—September 13th. Corporation Electricity Committee. 3½-ton electric tipping wagon. See "Official Notices" August 23rd.

South Africa.—October 23rd. Union of South Africa. Department of Posts and Telegraphs. Copper wire, &c., telephone apparatus (bells, blocks, boxes, coils, protectors, rosettes, switches, switchboards, &c). Tenders to Union Tender Board, Union Buildings, Pretoria. Specifications, &c., may be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence), London.

Johannesburg.—September 16th. South African Railways and Harbours Administration. Supply, during 1919, of electrical cables and wires and bare copper wire (tender No. 163). A copy of the specification, &c., may be consulted by British manufacturers at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence).

CLOSED.

Australia.—P.M.G.'s Department, N.S.W. :—

2,500 condensers, £422.—British General Electric Co., Ltd.
2,500 circular dry cells, £194.—Western Electric Co. (Aust.), Ltd.

P.M.G.'s Department, Queensland :—

Telephone switchboard material, schedules 437 and 439, £505.—Western Electric Co. (Aust.), Ltd.
One ammeter and four meggers, schedule 439, £202.—H. Rowe & Co.

P.M.G.'s Department, Victoria :—

1,000 meter coils, £275.—Auto-Telephones (Aust.), Ltd.; 8,000 diaphrams and 1,100 jacks, £235.—J. Paton & Co.; automatic private branch telephone exchange equipment, £467.—Automatic Telephones (Aust.), Limited.

Victorian Railways Department :—

Supply of porcelain bus-bar insulators, £1 2s. 6d. each.—Australian Porcelain Co., Pty., Ltd.

Victorian State Coal Mine :—

Enamelled copper wire, No. 21 s.w.g., 5s. 6d. lb.; 31, 9s. 7d. lb.; 32, 10s. 6d. lb.; 33, 11s. lb.; 34, 12s. 6d. lb.; 36, 21s. 7d. lb.—British General Electric Co., Ltd.; ditto No. 18, 3s. 8d. lb.; 30, 5s. 8d. lb.; 37, 7s. 6d. lb.—Lawrence & Hanson, Pty., Ltd.

—*Tenders.*

Salford.—Lighting and Cleansing Committee. Charging switchboard and automatic cut-off, £58. Drake & Gorham, Ltd.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, September 6th. At 3.45 p.m. Visit to the British Scientific Products Exhibition, at King's College, Strand, W.C. 1.

(Midland Section).—Saturday, September 7th. At 3 p.m. Visit to the Boulton & Watt Collection of Engineering Exhibits, at the Reference Library, Birmingham.

(North-Eastern Section).—Tuesday, September 10th. At 7.15 p.m. At the Mining Institute, Newcastle-on-Tyne. Paper on "Electric Furnaces," by Mr. C. Bleakinsop.

Iron and Steel Institute.—Thursday, September 12th. At 10.30 a.m.; and Friday, September 13th. At 10 a.m. At the Institution of Civil Engineers, Great George Street, S.W. 1. Autumn meeting.

Institution of Mining Engineers.—Friday, September 13th. At 11.15 a.m. At University College, Nottingham. Annual general meeting. Presidential address.

Salford Technical and Engineering Association.—Saturday, September 14th. At 7 p.m. At the Royal Technical Institute. Paper on "Steam Turbines," by Mr. E. Lee.

NOTES.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Corps Orders No. 37, by Lieut.-Colonel C. B. Clay, V.D.:—
Captain of the Week.—Capt. E. G. Fleming.
Next for Duty.—Capt. W. Hynam.
Monday, September 9th, to Saturday, September 14th.—Drills as usual.
Sunday, September 15th.—Commandant's Parade, at Waterloo Station, 8.45 a.m., for work at Esher. Dress: Drill Order, without rifles. Mid-day and tea rations to be carried.

C. Higgins, *Capt.* R.E., *Adjutant.*

Fatality.—At an inquest at Birmingham, on Monday, a verdict of "Accidental death" was returned in the case of W. H. Hearl, who was killed at the Wolseley Co.'s works, Adderley Park. While painting the ironwork of the roof on August 29th he put out his hand to replace a square wooden block that carried two of the electric wires, which was hanging loose. In doing so he received a shock and fell, breaking his neck.

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The Industrial Reconstruction Council.—A Conference on Works Committees will be held, under the auspices of this Council, on Tuesday, September 10th, at 6 p.m., in the hall of the Institute of Journalists, 2 and 4, Tudor Street, E.C. 4. The subject will be introduced by Mr. Robert Wilson, of the Ministry of Labour, after which the discussion will be open. No tickets are necessary.

Purification of Coal Gas by Electricity.—The deposition of tar and other impurities from coal gas has recently been undertaken by electric means, and according to the *Elektrotechnische Rundschau* satisfactory results have been attained. High-tension direct current is discharged between a cage made of thin wires and a tube, the system of wires being mounted in the middle of the tube. The gas is cleaned in its passage through the tube. The tendency towards the production of harmful discharges is least if the wire electrode is negative. The shape of the electrode is very important, and the sustaining insulators are specially formed and cemented into the tube. A ½-in. gas tube is passed through a series of cast-iron disks, between which the thin steel wires are fixed. The whole arrangement is then placed in a felt-covered tube, which constitutes the earthed electrode.

The apparatus was tested with a flow of 7,500 cb. m. of gas per hour, two precipitation chambers of 1½ m. height and 0·2 m. diameter being used. The disks of the active electrode were of 100 mm. diameter, and were fitted with 16 thin piano-steel wires. The passage traversed by the gas was about 4 m. long. The gas was exposed to the discharge for about 0·4 second. After five hours' operation the tar deposited on the insulators was found to interfere with the action. For complete cleansing of the gas, 0·2 KW.-hour was required for 7,500 cb. m. of gas. The total cost of the apparatus was about 2,000 marks. The test was made with 20,000 volts and a current of about 3 milliamperes. The temperature of the coal gas has little influence on the operation. Tar deposited at 175° F. is free from water and suitable for asphalting. It can be cleansed in a washing apparatus, and the residue of naphthaline can be won by a second electric precipitation. The illuminating and heating capacity of the gas is improved if the tar is removed hot.

A Flying Hospital.—According to the daily Press, a squadron of surgical aeroplanes is in course of formation in France. Each machine, in addition to the pilot, will carry a surgeon, an X-ray operator, and a complete set of surgical and X-ray apparatus, including a folding aluminium table. Electricity for X-ray and sterilising purposes, &c., will be supplied by a generator on the machine. The intention is to carry succour, quickly and at short notice, to badly wounded men on any part of the battlefield.

The Electrification of Fibres.—In the July issue of the *Journal* of the Leeds University Textile Association is published a detailed account of research work by S. A. Shorter, D.Sc., on "The Electrification of Fibres." The subject is divided into six parts: introduction, textile machines and the electrical series, electricity in carding, electricity in drawing and spinning, electricity in finishing, humidity and electrification. The author points out that the development of electricity by friction seems to be of a very complicated nature, dependent on circumstances difficult to control. The view generally held at the present day is that the so-called frictional electricity is merely a special case of contact electricity, the part played by rubbing being merely the production of effective contact. Lists quoted from different authorities show that the textile substances are in general positive to the substances with which they come into contact. Wool is a worse conductor than cotton, hence it is more liable to electrification than cotton. All the substances which ordinarily come into contact with wool in textile processes electrify it in one way—positively. If in any process some substances electrified it positively and some negatively, the total effect would be much smaller. It is obviously desirable to investigate whether there are any substances which electrify wool negatively. An investigation of this point resulted in the discovery of the following substances which have this property:—Asbestos, vitreous silica, glass (certain kinds), porcelain (certain kinds), buff leather, wash leather, raw hide, gelatine, and parchment. Glass and porcelain were found to be very variable in their nature, and very variable effects were found in different specimens of wood. The discovery of the peculiar property of buff leather (distinguishing it from ordinary tanned leathers) resulted from an investigation of the French drawing machinery. It was found that the wool issuing from the front rollers of a French drawing frame was strongly electrified positively, and that after passing through the rubbing leathers the positive electrification was only slight, in spite of the extra friction. In continuing the account of the research according to the divisions named, Dr. Shorter concludes by observing, with regard to humidification, that it may be pointed out that there is no reason why, with an efficient and efficiently-controlled humidifying plant, the conditions naturally occurring on a "good spinning day" should not be reproduced artificially all the year round.—*Textile Recorder.*

Temporary Increase of Charges for Electric Supply.—Mr. T. W. Cole, secretary of the Provincial Electric Supply Committee of the United Kingdom, writes to draw the attention of the provincial electric supply companies to the new Act (Statutory Undertakings (Temporary Increase of Charges) Act, 1918) referring to the above. Under this Act the Board of Trade is empowered to grant relief to electric supply companies whose financial position has been adversely affected by the war. The relief would be given by authorising an increase in the statutory charges, the relief being limited to sufficient to enable three-quarters of the pre-war rate of dividend to be paid. Applications can now, therefore, be sent to the Board of Trade accordingly.

Flash Suppressors for Railway Generators.—A new device is used in the 3,000-volt sub-stations of the Chicago, Milwaukee and St. Paul Railway, to suppress the cause of flash-over and thus protect the machine when the current output exceeds a pre-determined value.

The device consists of small contactors that short-circuit the armature winding of the continuous-current generator through three collector rings connected in 3-phase relation. The alternating-current short-circuit is applied a few thousandths of a second after the continuous-current short-circuit, and its effect is not only to stop the increase in the continuous current, but actually to reduce its value to practically zero for an instant. The short-circuit on the slip rings reduces the voltage between commutator bars to practically zero, and at the same time a large wattless current is made to flow through the armature, with the result that the net field strength is greatly reduced. The continuous current rises to a sufficient value to flash, but it is damped down by the alternating-current short-circuit before a bar can pass from one brush-arm to the next. The flash which is actually started is suppressed immediately.

The suppressor is actuated and tripped in the same way as a circuit-breaker, except that the suppressor *closes* a circuit instead of having to open one and quench an arc. The contacts have only a short distance to travel and are very small and light. They can be made to close in from 0·006 to 0·008 second.

The continuous-current circuit-breakers benefit from the use of the flash suppressor, because the voltage is reduced to nearly zero before the breaker opens. The flash on the commutator is reduced to a harmless instantaneous "puff."—*Electric Railway Journal*, May 4th, 1918.

Automatic Apparatus to Limit Peak Loads.—The contract under which the Chicago, Milwaukee and St. Paul Railway is supplied with power for the operation of its electrified division is based on a 60 per cent. load factor, with the provision that the load is not to exceed an average value of 12,000 KW. in any five-minute period. Under these conditions it is very desirable to maintain a high load factor, and to this end a scheme has been devised, and special instruments have been developed, which have increased the load factor from 40 to 60 per cent.

The power indicating and limiting system for securing this result consists of a 1,200-volt circuit running from the first to the last sub-station, and fed from a very small motor-generator in the load dispatcher's office. In each sub-station where there is a power-company feed tap there is installed a contact-making wattmeter, which introduces into the power indicating and limiting circuit an additional ohmic resistance whose amount varies with the load supplied at the feeder tap. In each sub-station there is also automatic apparatus which, when the total kilowatts used in the system reach the amount contracted for, and, consequently, when the current in the power indicating and limiting circuit reaches a certain value, causes resistance to be inserted in the fields of the sub-station generators of the motor-generator sets.

This reduces the voltage on the trolley system, causing the speed of all trains to be decreased. The maximum reduction in load thus obtained is about 30 per cent. of that which would be used in case the power indicating and limiting system were not provided. The apparatus is so arranged as to reduce the voltage of the most heavily loaded sub-stations first, and also to reduce the voltage of any individual sub-station, so as to throw the load on the other sub-stations when the load on such sub-station reaches the particular amount for which the apparatus may have been adjusted.

In the dispatcher's office there is a switchboard, on which is mounted apparatus for controlling the small motor-generator set supplying the system, and also indicating and curve-drawing wattmeters, which show for any instant the total kilowatts supplied by the power company.—*Electrical World*, July 20th, 1918.

A New Electric Truck.—With reference to our notice under the above heading on page 199 of our issue of August 30th, we are asked to state that the Chloride Electrical Storage Co., Ltd., do not manufacture electric trucks. Their "Ironclad-Exide" accumulator is, however, used extensively on various makes of trucks.

The King's Fund for the Disabled.—The King has given the magnificent sum of £78,000 to the fund which was recently inaugurated to assist disabled officers and men of the Navy, Army, and Air Force to become useful members of the community again. The trustees of the fund, of whom Mr. John Hodge, Minister of Pensions, is chairman, appeal to the humanity and gratitude of our readers for subscriptions which will help to find a new place in civil life for officers and men of his Majesty's Forces disabled in the war, and for the widows and children of officers and men who have given their lives for us.

The State pension scale must be hard and fast. Outside that scale there is a great human field which the King's Fund can cover, in which the officer, the man, or the dependent can be put on his or her feet, and given a sound re-establishment in civil life.

At present the trustees are receiving 600 applications a week; 2,500 cases have been dealt with thus far. Where the officer or man has been trained by the Ministry of Pensions, or where there is a business given up for war service, which he can restart, an adequate grant can be made.

The fund is a monument of gratitude. It will cheer our gallant fighters to see that monument rising to £3,000,000—the amount aimed at.

Let us, therefore, provide the money—and quickly. Urgent cases are waiting. Contributions should be sent to the King's Fund for the Disabled, Westminster House, Millbank, S.W. 1. All cheques and postal orders should be crossed.

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Swiss Railway Electrification.—In the June session of the Swiss Parliament, the urgent necessity for railway electrification and for simplification of the management of the Federal railways was again brought up. This time, however, it would seem as if something really were about to be done both in the matter of Federal railway administrative reform and in that of electrification.

The committee which inquired into the electrification question spent ten whole years over preparing its report. A few years ago, electrification would have cost 500,000,000 fr., but now it must cost several hundred millions of francs more—very large sums for Switzerland, especially now. Another estimate of the expense of electrification was between 250,000,000 and 350,000,000 fr. The Swiss Federal Council now proposes to devote 30,000,000 fr. (£1,200,000 on the basis of a normal exchange) annually to the electrification of the State railways. But the prices have quadrupled since the question was first mooted.

Undoubtedly much of the opposition and perhaps even the delay in electrifying the Swiss State railways are to be attributed to the powerful, if invisible, German influences ever at work in Switzerland. Moreover, in normal times German engineers and electricians, their Government always behind them, would have outbid the Swiss. Hence patriotic Swiss, especially French-Swiss, are urging the necessity for proceeding with the electrification of the State railways now, even at the risk of the work being carried out less cheaply than it would be were it done by State-backed German firms. They would rather pay more and have the work done by their own engineers, their own electricians, and their own workmen.

Meanwhile the Scherzligen-Berne line is being already electrified, but it has just been announced that work on the second Simplon Tunnel will probably have to be suspended, as it is no longer possible to procure the necessary materials and labour (chiefly Italian). On the south side 9,314 yards have been completely excavated, and on the north side 9,600 yards. Orders have been given for the building of 20 electric locomotives for the Federal railways. Half are to be built by Brown, Boveri, Ltd., Baden (Switzerland), and half by the Oerlikon machinery works. An electric locomotive at present prices will cost 840,000 fr. (£33,600).—*Railway Gazette.*

Novel Electric Heating System.—A novel electric heating system has been installed at a school in Baden, the arrangements being such as to enable the heat to be stored up during the night, when the generating station is lightly loaded, and to be used for heating purposes in the daytime. The installation utilises the existing hot-water system and radiators. A water-container of about 15,000 litres capacity surrounded with an effective heat insulation is used for heating the water. Inside this container electric resistances are built that raise the temperature of the water to 110 deg. C. during the night. The hot water can be circulated through the system of pipes, its speed being regulated by a valve. The quantity of water in the reservoir is sufficient to keep up the circulation of hot water all day long without switching on the current. Provision against over-heating is afforded by a thermostat. The supply is taken from a 2,000-volt network, and the voltage is transformed down to 220 volts. The total power taken is 100 to 120 KW. The advantage of the system consists in storing heat at a time when the energy is cheap, and thus using a portion of the water-power that is usually run to waste at night time. The system is rather cheaper under the present conditions than one using coal. It is expected that the town will shortly install similar heating arrangements in various other public buildings.—*Elektroindustrie.*

A Submersible Electric Pump.—A valuable adjunct to the Admiralty salvage work is the submersible electric-pump, which is now in use on every vessel of the salvage fleet, and it has helped to save many a good ship to which pumps of the ordinary type could have given no assistance, owing to their limited lifting power. The submersible pump is simplicity itself. The special feature of the motor is that it only needs enclosing to keep floating débris from the working parts, while permitting water to circulate through it internally. The motor is of the induction type, with short-circuited squirrel cage rotor, on roller bearings, mounted in gun-metal housings at either end of the set. The only connection required is a three-core electric cable. There are three types of this motor pump in general use by the salvage section—4 in., 6 in., and 8 in. The 8-in. model requires 50 H.P., and will deliver 350 tons per hour at a total head of 75 ft. At a 20 ft. to 30 ft. head the delivery increases to 550 tons. Cooling is effected by a continuous supply of filtered water taken from the delivery. There are no glands to be taken up, or any other details likely to give trouble. The motor, which has its windings insulated by a new process to endure continuous immersion in water, is supplied with current from the salvage ship, or from a special enclosed waterproof portable generator, driven by paraffin engines, which can be placed on board a wreck when cable connection is inconvenient or impossible. These generators, being of the enclosed ventilated type, can be closed up if the weather becomes too bad to continue working the plant, and can then be left on deck until the weather moderates. In most cases the pumps may be suspended from the steamer's derricks and lowered into the water without coupling up any suction pipes. Pumping can begin immediately one length of delivery hose is attached, the whole operation occupying only a few minutes. The advantage claimed for this pump is the fact that it can be brought into action in places that would be inaccessible to the ordinary type. In the case of a large steamer stranded on a rock-bound coast, exposed to the sea and completely waterlogged, the application of ordinary pumping methods would involve the provision of duplicate sets, which would be liable to sustain damage in the event of bad weather approaching. On the other hand, the submersible motor pump could be lowered down to any submerged deck, placed in position by the diver, and driven from the generators of the salvage tug, either alongside or some distance away from the wreck. Should bad weather intervene, it would only be necessary to disconnect the wires, and the pumps, being under water, deep down in the hold, would be practically immune from damage, and could be started up again whenever the weather improved, simply by making a fresh connection. The merits of the new system were seen at their best in the case of a torpedoed vessel which had failed to make shallow water before sinking. Her shelter deck, 57 ft. from the keel, was barely awash at low water, so that the conventional pump would have been useless. Recourse was, therefore, had to the submersible electric motor pump, which was lowered into the stokehold, and, after holes had been blasted in the top of the tunnel to allow the water to drain through into the stokehold and engine-room, the pump got to work, and so lightened the ship that she could be dragged further inshore, and subsequently refloated.—*The Engineer.*

Leads for Electric Furnaces.*—Mr. A. A. Meyer, in a paper read before the American Electro-Chemical Society in May last year; called attention to the serious drop in the voltage between the transformer and the electrodes of electrical furnaces. It was found by oscillograms taken that about 24 per cent. of the available voltage at the transformer was lost as drop in the short copper bars between the transformer and electrodes. According to him, this drop was unquestionably due not to resistance, but to reactance which was introduced in the circuit by the neighbouring steel structure of the furnace. Tests along various sections on these bars showed that the drop per c.m.-ft.† in the bars going through the steel structure, and with a current density of about 1.3 amp. per 1,000 c.m., was over three times that in the flexible leads more remote from the steel work and where the current density was about 1.7 amp. per 1,000 c.m. The desirability of such large reactance is a question somewhat in dispute. Acting upon these hints, Mr. R. F. Flinterman, of the Michigan Steel Castings Co., Detroit, in a paper recently submitted to the same American society, described the alterations made to a 6-ton Héroult furnace which, in accordance with the old method of construction, had eight solid copper bars ¼ in. by 6 in., 7 ft. long, for each phase, placed triangularly, with 20 in. between phase centres. These bars led from transformers to flexible cables. The latter were about 20 ft. long, consisting of nine 1,000,000 circular mil stranded copper cables for each phase. The cables in turn connected to bars on the furnace itself, the bars being made up of six copper bars ¼ in. by 6 in. in each phase, running first vertically and then horizontally to the electrode clamps. In the case both of the bars between the transformers and the flexible cables, and also the bars on the furnace itself, the ¼-in. by 6-in. copper bars were held apart by 6-in. by 3-in. by ¼-in. copper spacers. These have all been replaced now by vulc.-asbestos spacers. In addition, mica insulation was placed between the various leads in such a way that the different parts were isolated and made to act as nearly as possible independently from one another. It has been found that these small changes have made a great change in the operation of the furnace. From all indications it appears that the drop in voltage found by Mr. Meyer has been much reduced. It was expected that this point would be more clearly established by a series of tests to be undertaken in the near future. Mr. Flinterman thinks it is safe to assume that part of the drop was due after all to skin effect, and that it was not entirely due to induction set up in the steel construction at the rear and top of the furnace. Under the circumstances, he thinks, it would be much better to do away with the solid bar construction entirely. The later Héroult furnaces are now constructed as is the 3-ton furnace of Mr. Flinterman's firm, where the flexible cables are carried direct to the upper part of the steel structure at the back of the furnace. It would seem even better to carry the flexible cables direct through to the electrode clamps. There would be, of course, some induction set up in the steel structure, but there would not be so much voltage drop as there is now. At any rate, as now constructed, the firm's furnaces are running much faster than formerly, and their energy consumption is regularly lower than it was before. On one run of 24 hours 11 heats were taken from the 3-ton furnace. The average energy consumption for the week, including all delays and stops, is running under 625 KW.-hours per ton. Since the work is light, and the metal must be brought to a very high temperature, this is considered a very low consumption.—*Iron and Coal Trades Review.*

* See also ELEC. REV., July 20th, 1917.

† Circular-mil-foot.—A circular mil is a unit used in America and is equal to the area of a circle with a diameter of one-thousandth of an inch.

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Electrical Power Engineers' Association.—We are asked to state that the secretary for the Glasgow area is Mr. Arthur H. Kelly, 5, Battlefield Avenue, Langside, Glasgow. The interim secretary for the remaining areas of Scotland is Mr. J. H. Wright, 8, Garland Place, Dundee. All communications on E.P.E.A. business for Scotland should be addressed to the respective gentlemen named above.

Electrical Ship Propulsion.—It is announced that for the propulsion of some of the new U.S.A. steamers recently ordered, the plans contemplate using electrical propelling sets of the type found satisfactory in naval vessels. The men to act as electrical engineers on the vessels will be recruited from big power plants throughout the country.

Appointments Vacant.—Mains assistant, for Croydon Electricity Works, £3 + 20s. + 12½ per cent. bonus; boiler-house superintendent, for Salford Electricity Department. See our advertisement pages to-day.

Electricity as a Soporific.—In a letter to the *British Medical Journal*, Lieut.-Colonel W. F. Somerville, R.A.M.C. (T.), makes the following interesting statement :—

Dr. Guthrie Rankin, in his paper on this subject (broken sleep), says, *inter alia*, "Electricity is said to be sometimes useful as a sedative agent, but its effects are uncertain, and may prove to be exciting rather than soothing." From considerable personal experience I have no hesitation in saying that the reverse is the case. Before mobilisation, nearly four years ago, I treated in Glasgow during the previous 14 years numerous cases of insomnia *per se* by means of high-frequency currents with scarcely a failure, and, when sleeplessness formed one of a group of symptoms in cases of neurasthenia, the good influence of these currents was most marked in restoring sleep. The sleep produced differs materially from that obtained by the use of drugs. It is a refreshing sleep; digestion is not upset, nor is an evil habit acquired. I have never seen any "exciting effects" from the application of high-frequency current, and these should never occur if the treatment is in skilled and qualified hands.

Electrical Installation at a Summer Camp.—A camp 4,000 ft. above sea level where the guests sleep in tents and live out of doors is not the place where one would ordinarily look for extensive applications of electricity. But the proximity of large water-power pointed the way to the wide use of electric appliances at Camp Curry, Yosemite Valley, California, as described in the *Journal of Electricity* of August 1st. Electricity was supplied by the Government power house situated at the head of the valley. This year further provision had to be made to meet the increased load demanded by electric cooking. The cooking load of this camp alone amounts to about 125 KW., plus several motors, a small heating requirement, and the entire lighting load. The peak load occurs at the unusual hour of from 4 to 5 A.M.—the time when the largest amount of baking is being done.

Even in former years, electricity was used throughout the camp, as in the valley itself, for general illumination. The camp is designed for a capacity of one thousand or more, and has been known to register a far larger number. There are some six hundred tents which are arranged in irregular streets. These avenues and the numerous administrative buildings were all electrically lighted. Recently electric heaters have been added as special features for some of the tents for use in the early spring and late autumn. The new cottages which have this year been added to the camp are further provided with electric water heaters, and are electrically lighted throughout.

The important innovations, however, are those of the kitchen department. Here the large oil range has been supplemented by two Hughes electric hotel type ranges of 22 KW. each, making a total of 44 KW. The great advantage in the use of electricity is found in the doing away with the fuel difficulty (neither coal nor gas is available, and the valley is some fifteen miles from a railway), and in the great convenience of heat regulation. The range is started in the morning at full heat to warm it up, and switched later to the medium unit, establishing an even temperature. During the serving period, the low temperature is sufficient and permits the range to be used in part as an auxiliary to the steam serving table. In the same division of the kitchen, an hotel type electric toaster of 3 KW. has been installed. This type has three racks, allowing a large quantity of toast to be made at one time, and has proved one of the great conveniences of the new installation. A 25-KW. Hughes electric bake oven is housed in another division of the kitchen buildings. This takes the place of an old-fashioned brick oven in which wood was used for fuel. The new oven has three compartments into which the large pans fit. These are to be electrically lighted on the interior, permitting inspection of the food while baking. An accurate record of the temperature is shown on the registering thermometers and the heat may be regulated at will. In connection with this department an electric mixer greatly lessens the labour of baking for a thousand or more guests.

Three electric dishwashers of the Peerless type, and a recently installed 9-KW. Hughes hotel type griddle complete the kitchen equipment. With a dining-room which seats over 500, the electric washers have materially decreased the time required for the task, as well as the number of washers needed for dish-washing. The laundry, which is an extensive installation housed in a building of its own, is very completely outfitted, but leaves room for further application of electricity in the future. A great deal of carpentry work is carried on in the construction of new buildings, rustic fencing, and repair work which is continually needed about the camp. This is handled by a small electrically-driven saw mill. These installations and the further additions contemplated were made possible by the construction of the new Government power plant situated some two or three miles below the valley proper.

The new plant has a capacity of 2,000 KW. with a present output of 1,000 KW. A 42-in steel pipe 800 ft. in length carries the water down to the level of the power house, where it is delivered under a 336-ft. head. The pipe is good for 93 sec. ft., but under the present conditions for the generation of only 1,000 KW., only half that amount is utilised. Two 1,250-K.V.A., G.E., 2,300-volt, 30-cycle, 3-phase, A.C. generators of 720 R.P.M. direct connected to a 1,500-H.P. Pelton-Francis turbine, furnish the power. The exciters are 10 KW., 125-volt direct connected. Three transformers, oil cooled, of the outdoor type, 60-cycle, 400 K.V.A., located at the plant, step the pressure up to 11,000 volts, at which it is transmitted over some eight miles to the valley. There it is stepped down to 2,300 volts, which is the ordinary voltage for use. The cost of the entire installation was upwards of $220,000. The installation has given entire satisfaction, and, owing to the reasonable rates for power, which compare very favourably with the cost of wood and fuel oil delivered at the valley, even further extensions are planned for the future.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Aberdeen T.C. Electricity Committee has increased the salary of the electrical engineer, Mr. BELL, by £100 to £850.

Mr. T. WILSON, mains assistant at the Dover Corporation electricity works, has resigned.

The Manchester Electricity Committee has appointed Mr. S. A. RUSSELL as shift engineer at Stuart Street power station at a salary of £250 per annum, rising to £275 per annum at the end of twelve months; and Mr. C. B. TUTT as shift engineer at the city power stations at £220 per annum, rising to £250 per annum on January 1st, 1919.

Mr. D. B. BREARLEY, works superintendent at the Barrow-in-Furness borough electricity works, has been granted an honorarium of £10 for an improvement effected in the boiler house, through a patent recently granted to the Stirling Boiler Co. and himself.

Mr. A. J. GRIFFIN, engineer-in-charge at the West Ham Corporation power station, has resigned to take up an appointment with the Western Electric Co.

Mr. H. E. MORTIMER, of the Croydon Electricity Department, has been appointed assistant mains engineer in the St. Marylebone electric supply department.

At Burnley electricity works, on Tuesday, Mr. TOM TAYLOR, assistant electrical engineer, was the recipient of a mahogany timepiece as a wedding present.

General.—We understand that Mr. J. C. WHITE has severed his connection with the St. Helens Cable & Rubber Co., Ltd. Mr. White is the designer and patentee of the corrosion-proof system of wiring and fittings, of which particulars have appeared in our pages from time to time.

Mr. A. MANIGHETTI has resigned his position as works manager with the Westinghouse Cooper-Hewitt Co., Ltd., which he has held for nearly five years, to take up an important post with Messrs. J. E. Thompson & Co., Ltd., of Rosebery Avenue, E.C.

Mr. D. G. ROBERTSON, who has been sales manager of Messrs. George Ellison for the past nine and three-quarter years, has now vacated the position, on his appointment as assistant general manager.

Roll of Honour.—The remains of the late Colonel BERTRAM HOPKINSON, C.M.G., F.R.S., who was killed in a flying accident, were interred at Cambridge on August 30th. The funeral took place with military honours. A distinguished company of scientists and others attended the service at King's College Chapel. Among them were: Sir Alfred Hopkinson (uncle), Mr. Charles Hopkinson (uncle), Sir G. Beilby, and Sir Dugald Clerk. The Air Ministry was well represented, and the relatives present included Mrs. Hopkinson (widow), Mrs. John Hopkinson (mother), Mr. and Mrs. Alexander Siemens. The King and Queen sent a letter of sympathy to the widow.

Second Air Mechanic A. J. WINROW, R.A.F., who has been accidentally killed whilst flying in England, was employed

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at the works of the British Westinghouse Co., Ltd., Trafford Park.

Lieutenant J. S. Plummer, 5th Leicesters, who has been missing for a long time, is now officially presumed killed on August 16th-17th, 1917. He was last seen well up to the enemy's trenches, badly wounded in the arm, and his C.O. wrote his mother saying that he actually ordered a man who was attempting to carry him back to leave him. The man was very loth to do this, but Lieut. Plummer insisted, saying, "You will take my orders as an officer and leave me." He joined the Surrey Yeomanry in 1914, later transferring to the Leicesters. He will be remembered in electrical circles as a bright and keen business man, and will be missed at the Electro-Harmonic evenings.

It is with great regret that we observe the following notice in the *Times* of August 30th:—

DIED OF WOUNDS.

Byng.—On the 24th August, of wounds, Lieut. Leonard G. Byng, M.C., Grenadier Guards, the second beloved son of the late G. Byng and Mrs. Byng, of 32, Bryanston Square, W., aged 30.

Lieut. Byng was a director of the General Electric Co., Ltd., and many of its subsidiary companies. One of his brothers, Mr. Harry Byng, fell in action in Flanders early in the war, while leading his platoon to attack.

Company-Sergeant-Major R. Edwards, York and Lancaster Regiment, who was in civil life on the Rotherham Corporation tramway staff, has been awarded the Meritorious Service Medal.

Cadet W. G. A. Bird, who was in the electrical department of the North Staffs. Railway Co., has been gazetted Second-Lieutenant in the Royal Air Force, which he entered last February.

Mr. A. R. Green, only son of Mr. W. J. Green, manager of the Weston-super-Mare branch of the Bristol Tramway Co., Ltd., has been gazetted Lieutenant in the Royal Air Force, and attached to the Senior Naval Officers' Base at a station in Eastern waters. Prior to the war he was in the electrical department of the Bristol Tramway Co., and he has served in Egypt for two and a-half years with the Army Service Corps (Motor Transport).

Second-Lieutenant W. G. M'Intyre, Border Regiment, who has died of wounds, was on the staff of Messrs. Babcock and Wilcox, Ltd., of Renfrew.

Lance-Corporal W. Geddes, Scottish Rifles, who has been seriously wounded, was employed at the electricity works, Lossiemouth.

Private D. J. Fry, Machine Gun Corps, and Pioneer W. Daynes, R.E., both formerly in the general office of the India-Rubber Co., Silvertown, have been wounded in France.

Obituary.—Mr. S. A. Mahood.—We regret to record the death, which occurred suddenly of heart disease on August 26th, in London, of Mr. S. A. Mahood, A.M.I.E.E. Mr. Mahood was for many years with the Brush Electrical Engineering Co., Ltd., and later with the Birmingham and Midland Tramways Joint Committee and resident engineer of Smethwick power house. He was 60 years of age, and leaves a widow and one son, who is a lieutenant in the R.E. serving with the British Army in Mesopotamia.

ENEMY PENETRATION AND PROPAGANDA.

In our leading columns to-day we refer to some aspects of the vexed question of German trading influence exercised through neutral countries. In continuation of these comments, it may be remarked that the American Government is "going the whole hog" in its investigation of Teutonic connections in the industrial organisations of other countries. Its presence in the military sense with "both feet" gives it also a very lively interest in the commercial aspects of Teutonic plans for world domination. It possesses a store-house of information which greatly increases the possibilities of successful economic counteraction of enemy influence during the war at any rate, and after the war, too, unless the political developments for future peaceable co-operative activities between a democratised Germany and all the peoples of the earth lead to universal freedom of trade. That is a great ideal, but in the absence of certainty that it is within fair distance of attainment, we can count at the moment upon American investigation of enemy economic interests as of vast assistance to the allies, who are determined that, unless there is a complete change inside Germany, and a change which will last, the economic penetration efforts of Germany shall be fought tooth and nail. American participation in the war makes the task of dealing with Teutonic world-trade connections easier than it would otherwise have been, because Germany had great designs for reviving her industries *viâ* the States. "Negotiated peace" with an undefeated Germany would leave us as a certain legacy incessant warfare in the economic sphere. Absolute military defeat should prevent even that, but whether it does or not we cannot afford in our present plans to omit the making of suitable safeguards. We have referred in our leader to-day to some of the neutral country possibilities against which such safeguards are needed, but, of course, there are many others. What of the elaborate schemes of the Teutonic industrial magnates and financiers who, before America was definitely in the war, were making most insidious preparations for securing a hold on the American Press? What of their plans to secure possession of British papers or neutral ones? What safeguards have the public, other than the Company Acts and the Business Names Registration Acts, for knowing who has an interest in a particular organ? We are not sure that even the Company Acts or the Business Names Registration Acts, with public files at Somerset House and with names printed at office entrances and on notepaper, will suffice to secure our Press against the affectionate approaches of German capitalists who desire gradually and unobtrusively to "work their way in," and so transform opinion and convert the reader to ways of greater sympathy toward Teutonic wares. And those Acts alone may not be sufficient to enable manufacturers to tell whether they are advertising in British-owned and British-hearted publications.

In June the *Times* referred to a new "League for the Promotion of German Economic Interests Abroad." The candid Secretary-General, Herr Peter, of Cologne, admitted that one of its objects was to "obtain a powerful influence over the foreign Press." "He said that all arrangements had been made to begin work immediately after the war, that 11,000,000 marks had already been guaranteed, and that, if the sum can be increased to 100,000,000 marks, 'it will at any rate be possible to secure the publication of German replies in the same quarters in which attacks on German trade interests are published in the enemy Press.'"

Truly, the Press, and especially the Trade Press, while it aims at occupying a position of complete independence from Government and private manufacturing interests, will find it very necessary also to be on the alert against German propaganda enticements and nondescript entanglements from now onwards. Only really strong journals, entirely frank and entirely free from undesirable connections, will be the safeguard of British industry.

In its investigation of German propaganda methods the United States unearthed facts showing that millions of dollars were held at the disposal of advertising firms in New York for promoting German commercial enterprise at the end of the war. One advertising contract was under discussion last year involving an expenditure of £300,000 annually for five years! This was in the belief that unrestricted warfare was going to bring an end to hostilities by June, 1917, but when the United States entered the war the plans and printed matter advertising German products were withdrawn (*Times*, July 30th). Another Prussian miscalculation! America is written off so far as after-war German trade war propaganda is concerned—at any rate, no such plants will find a congenial soil or atmosphere there while American blood is flowing in France. German plans to "nobble" the Press of America were prepared by Dernburg, and by one Viereck, a pro-German editor in the States. Controlling interest in thirty leading papers was to be secured so as to keep America out of the war. Because these schemes failed, it does not follow that they will not be tried again when Germany, in desperate straits, with the mark of Cain upon her forehead, seeks to trade with those she sought to dominate. Already plans to work through the Press of certain neutral countries have been alluded to in these pages, and last week we stated that Swedish electrical manufacturers recognised that the A.E.G. proposals to manufacture in Sweden for the Russian and South American markets were not hopeful auguries for the future. Holland, Denmark, Switzerland, and Spain will all be employed by the German to give a sort of camouflage of respectability to the ill-fame which Prussianism has brought upon Teutonic industry. A writer in a financial magazine has lately drawn attention to the

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activity of German industrialists in Spain. They are appointing Spanish agents whose post-war duties will consist in receiving German-made goods, relabelling them "Made in Spain," and so forcing them in markets where otherwise they would hardly be welcome. Such a prospect will not be surprising to our readers, for we have many times referred to German commercial propaganda in Spain during the war. Activity along the same lines is undoubtedly proceeding in other neutral countries, and these circumstances all point to the need for us to see whether there is not something more that we can do to set up a really efficient organisation for ensuring that, even assuming the most utter military defeat of Germany, the way shall not be open for German traders to worm their way into former trade circles under false pretences. The German people will always manufacture for export, but let us do our utmost to prevent them doing business in Allied territories under either an allied or a neutral mask.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Where are we Going To?

Your leader of August 30th concludes:—"When the *Times* urges that Labour should be given anything it pleases to ask for, does it not recognise that it is putting an axe at the very root of the industrial tree?"

Industry pictures itself to my imagination, at the moment, not as a tree but as a runaway coach, with Bolshies on the box, politicians at the pole, and Labour leaders. The employer, from whose hands the Government has taken the reins, still clutches at the brake in the hope of preventing a smash. Why should he not adopt the suggestion of the *Times*, and, in deference to the general wish, let go, to see what happens? So long as Treasury Notes are cheaply reproducible, why should he not join with the majority in demanding a fresh inflation of the currency every few months? Then matters may be more quickly brought to the necessary climax, the resultant wreckage cleared up, and the machine repaired in time for the economic war we are told to expect.

In the same issue, Mr. J. W. Woolley, of the Electrical Trades Union, writes:—"When the E.T.U. has reached the desired goal of solely controlling the industry . . . what is, and what is not, fair output will be decided by the E.T.U."

Reasonable control, with continuity of employment, is essential to successful manufacturing, and Mr. Woolley's remarks are therefore full of promise for our complex and difficult industry. A one-time member of this Union, who for several years watched the progress of our electrical pioneers towards, or through, the bankruptcy courts, may well feel proud of its present capacity, and its aspirations to take entire charge of our future.

No need for us to worry further about restoring our war-wrecked export trade, the training of our future workmen and scientific staff, or the invention of machines or methods to flabbergast the Hun. Mr. Woolley's plan will relieve the dejected employer, whom the Government still holds strictly responsible for the output, of this one remaining burden. Already the employer scarcely counts for strike purposes, as it pays so much better to declare a strike against the State.

Under Mr. Woolley's scheme, good jobs will be found in the great factories of the trusts, or Government departments, for those men whose present goal it is to earn one-half of what they receive. Several men recently left work urgently needed for national defence, on which they were receiving three times the "recognised district rate," and obtained new and better-paid jobs elsewhere; one of them recently wrote home: "We're not expected to work *here*, we just swank around." The trusts can apply their own remedy, by simply doubling prices when it seems necessary to double their output.

When virility returns to Britain, several things may happen. Multitudes of men will be determined to resume their interrupted careers. They will not allow themselves to be handicapped by petty bureaucrats, but will sweep them aside or render them harmless, solacing them, when necessary, by appointing them directors of the British Empire. They will frustrate the knavish attempt by a small faction to introduce the Eastern caste system here under the name of "class consciousness." They will throw down the comparatively recent political division of our free nation into employers and employés, together with its accompanying evil of Government by bribery.

They will start, or restart, hundreds of businesses, and utilise war savings to provide the tools or other forms of capital. To such, and to other existing honest enterprises, the best of our loyal workers will be attracted, and in such they will seek, and find scope, for mental progress and material prosperity. New, and far juster, methods of rewarding human effort will be devised, and will not, as now, depend on the truculence of the individual, or of the combination to which he belongs.

To-day's *Times* reports Miss Simons, at the National Federation of Women Workers, thus:—"The women omnibus workers had brought to the notice of the Government the fact that it was virtually on the edge of a precipice, and that its own making."

The 'bus girls' solemn warning to the heads of the State will remain, even apart from its charming metaphor, one of the precious memories of the Great War. So now to work, and no more for the duration from

Robt. W. Paul.

London, *September 2nd*, 1918.

REVIEWS.

General Lectures on Electrical Engineering. By C. P. Steinmetz, A.M., Ph.D. Pp. 242; 50 figs. London: Hill Publishing Co. Price $2.50.

This work, now in the fifth edition, by the well-known American electrical expert, Dr. C. P. Steinmetz, must not be regarded as a text-book of the ordinary type, but rather as an amplification of a series of lectures.

Thus we find that each subject coming under discussion is not expounded with any considerable attention to detail, but great care has been taken in every case to bring out and lay stress on the fundamental features of the problem.

It is perhaps not necessary to detail precisely the subject matter of each lecture, but, broadly speaking, the book includes considerations of the generation and transmission of electrical energy, the regulation and control of circuits (including an account of such matters as high frequency oscillations and surge and lightning protection), electric traction, and the application of electric power for lighting and chemical purposes.

The conclusions reached by the author are, of course, in accord with American practice, and occasionally interesting differences from the practice in vogue on this side of the water are brought out. One matter of this nature is in connection with the pressures used for low tension lighting distribution, the lamp pressure recommended by the author being 110 volts, as against twice that value commonly used here. The explanation given is that American supply companies are more concerned with the actual light output of the lamp than English companies (whose interest in many cases ceases at the service mains), and that the loss in lamp efficiency at the high voltage is not compensated for by the higher efficiency of distribution.

The section on load factor and the cost of energy is not perhaps so clear as other portions of the book since the writer occasionally speaks of power when the term energy would be of greater service. The chapter on high tension transmission includes particularly useful accounts of corona loss and of the possibility of troubles due to pressure resonance, the relative safety of different types of transformer connections being considered from this point of view.

A very interesting lecture deals with the effect of harmonics in waves, together with a consideration of the methods of avoiding difficulties due to this cause. Troubles due to high-frequency and high-pressure disturbances, whether their origin be internal or external, are well explained, the merits of various forms of lightning arresters being discussed.

Station engineers will find many useful hints in the section dealing with the hunting of synchronous machines, methods of localising the trouble and effecting a cure being considered in more detail than is usual in the book. The regulation and control of circuits is dealt with, but not at great length. We feel that a discussion of the several forms of automatic protection available for generators and feeders would, if made on the lines of the rest of the book, be of great value to engineers.

Electric railway characteristics and motors are dealt with in three very instructive chapters, stress being laid on the value of a consideration of speed-time curves when studying railway problems.

The chapter dealing with the incandescent electric lamp is also of great interest, the fundamental principles being well brought out. In places in this chapter the author refers to the lamp with a tungsten filament as the Mazda lamp; surely it is far better to use the former name, the latter indicating the trade name of the wares of a particular firm.

Taking the book as a whole, we can give it nothing but praise. In a brief review it is only possible to mention a few of the points which are most striking, but in each chapter of the book important truths are brought out in a way seldom seen in works of a more orthodox type. The book may be well commended to all electrical engineers, whatever their standing in the profession, and no one engaged in the transmission or distribution of electrical energy can afford to neglect the perusal of the work. Students taking senior courses in technical schools or universities will also find the book of immense service.

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The Lighting Art. By M. Luckiesh. London: Hill Publishing Co. Pp. viii+229; 43 figs. Price 10s. 6d. net.

Amongst so-called illuminating engineers there is a tendency to reduce the consideration of lighting problems to mere formulæ; this viewpoint is fostered very largely by those manufacturers who thrust upon the market devices, some of which are no doubt superior in efficiency and effect to many of the older types of lighting equipment. In the initial stages, while the education of the general public is taking place, this outlook may be laudable, but if pushed to an extreme, the knowledge of the illuminating engineer trained under such conditions is likely to become narrow, and the installations for which he is responsible are merely uninteresting repetitions of previous work, lacking thoroughness, variety, quality, and artistic merit. It may be argued by some that so far as industrial work is concerned, certain of these attributes are not essential, efficiency only being desired, but the author of this book emphasises the important effect the quality of light has upon the worker. It may also be said by some that the illuminating engineer who is a member of the staff of a firm of manufacturers of lighting specialities, will carry out his duties with full regard to the requirements and possibilities of the work in hand. After all, the commercial standpoint will be the main consideration, and one cannot but believe that the result will not be of the best, for the manufacturer is interested in the sale of his own wares, and limitations will be imposed upon the expert. It therefore follows that the specialist who is independent, and who is able to draw from the open market for his apparatus, will in the end produce the installation which is correct from an illuminating engineer's point of view taken in the broadest sense. We are of opinion that this book will assist those whose knowledge, through force of circumstances, may be described as narrow, to obtain a much wider understanding of the subject. The work, which is dedicated to "The relatively small group of men whose unselfish efforts in lighting are directed toward the conservation of vision—that most valuable human resource—and toward the increase in the safety, the efficiency, and the pleasure of mankind through the applications of light—that most potent natural agency," opens with a chapter entitled "The Broad Aspect of Lighting," which in a general way indicates the lines upon which the efforts of the illuminating engineer should run, and closer co-operation with the architect and others intimately interested in the effects to be obtained is advocated. The suggestion is made that as artificial light is more easily controlled, and in many cases cheaper than daylight, as for example, in large cities where space is valuable, a time will arrive when the worker will demand artificial light, and buildings will be constructed in which there is no consideration as to the access of daylight. It may be that the physical health of the worker calls for a certain amount of sunlight; but as there is a tendency towards a much shorter working day, it would appear as if this feature can be obtained to the full during leisure hours. Recent reports by the Welfare Section of the Ministry of Munitions would indicate that from the point of view of prevention of accidents, good artificial lighting is strikingly superior to the average daylight conditions which occur in a factory.

It cannot be denied that the scientific and artistic application of light may be utilised in enhancing the beauties of an object. Existing installations are singularly lacking in this respect, and in the second chapter, it is pointed out that gradation in shading and coloured light have immense possibilities, particularly if the illuminating engineer is trained to foretell the result to be obtained from the equipments utilised, and this "visualisation" is next dealt with. It is pointed out that variety is essential if perpetual interest is desired so that the term "painting with light" expresses the author's aim in a complete manner; this is far from being attained in this country as yet owing to the control which is placed upon most illuminating engineers. The author proceeds to discuss the distribution of light, and many important points, as for instance shadow effects, the influence of the surface illuminated and other allied circumstances which are often neglected, are emphasised. A plea is made for directional similarity between artificial light and daylight, it being pointed out that this procedure obviates the necessity for positional changes in work at the time of change over from one system to the other. Fixture design and salesmanship are next considered, and it is well to note that the commercial standpoint has not been lost sight of in these pages; indeed the shortcomings of the average salesman and salesroom are strikingly dealt with.

The following chapter treats of light and colour in a more technical manner, and contains much that might be memorised by the illuminating engineer with advantage. The colour of various illuminants forms the subject of the next few pages, and practical means are suggested for obtaining tinted illuminants. The pages devoted to "psycho-physiology of colour" form most interesting reading, and those particularly concerned with decorative lighting would do well to bear in mind the remarks regarding colour preference, and the attributes which have been applied to the principal colours. In view of the importance of co-operation between the illuminating engineer and those responsible for the interior decoration and use of a building, it would appear that the simulation of artificial daylight has received a far wider treatment in the United States than in this country, so that students of the following pages will be able to avoid many of the pitfalls, and apply to a particular problem the particular solution required. As is pointed out the spectrum of daylight varies considerably not only during the day, but also from day to day and from season to season, and according to its direction relative to the object illuminated.

Chapter XII deals with special applications of coloured light, and not the least interesting paragraph is that which states that "a battleship which had just been launched was equipped with a lighting circuit of blue lights for use when in an engagement at night or at least when near the enemy. The reason for using blue lights is not clear, but doubtless was for the purpose of obtaining the maximum luminosity with sources of low intensity."

Detailed considerations relating to the design of reflectors are introduced under the heading of simple principles of light control; little that is fresh is here presented, but we do not remember having seen the subject treated in such a clear and concise manner previously. The chapter on lighting and architecture is in our view one of the most important contained in the book, and any attempt to summarise the particulars given would be out of place. Mr. Luckiesh is an authority upon domestic lighting, and the particulars he gives us regarding portable lighting units are unique, as is also his contribution regarding residence lighting. Generally this class of work is carried out in a haphazard way with little regard to the actual necessities, and every person who at any time is concerned with the lighting and decoration of residences should make himself familiar with the arguments put forward. Commercial lighting has formed the subject of separate treatises, but nevertheless the subject is discussed with the freshness which characterises this book throughout. The lighting of public buildings is very carefully dealt with, particular attention being paid to museums and picture galleries. Industrial lighting is treated in a general manner, attention being drawn to the importance of the background, particularly where fine work is to be handled. The public are blamed for their lack of appreciation of the functions of lighting and setting in relation to stage plays, and the possibilities in this connection are briefly touched upon; an especial plea is put forward for the intelligent use of coloured illuminants. When conditions are better there can be but little doubt that spectacular lighting will become of immense importance; the experience gained at the Panama Pacific Exposition will be of considerable assistance to those whose duty it will be to put forward schemes for this type of decoration, and some of the hints advanced by the author suggest the enormous field there is.

Illuminating engineering as generally known in this country is presented in the compass of about a dozen pages. Natural lighting is next discussed, while the book closes with a chapter on the language of colour, which presumably is introductory to a further volume promised from the pen of Mr. Luckiesh.

Seldom have we read a technical work with so much pleasure as the one now before us; it would appear to be one which should be found on the table of all those whose business demands their interest in proper lighting and decoration. It is a book which should become a classical work, and will doubtless be imitated, but it will scarcely be possible for the subject to be presented in a more intelligible and interesting manner.

Interior Wiring. By A. L. Cook. London: Chapman and Hall. Price 9s. 6d. net.

A glance at the table of contents of Mr. Cook's book shows that he has attempted to deal with his subject in a most comprehensive fashion. He might reasonably have confined his work to the actual wiring—quite sufficient in itself for any book—but he has dealt with it from a much wider aspect, covering all the ground that surrounds the subject, including such questions as systems of illumination and types of motors to be used under various conditions. The book is divided into three parts, and only the third really deals with wiring work proper, the other two containing the preliminary data and calculations for power and lighting respectively.

Considering the broad interpretation of his subject that Mr. Cook has adopted, he has covered the ground in very complete fashion, though obviously a book of 400 pages cannot go into great detail in so many matters as are mentioned in the table of contents. The text is clearly and concisely written, and the illustrations, particularly the diagrams of connections, are very good. A series of tables is included which gives a large mass of very valuable data and the book is well indexed.

From the point of view of the English reader, however, there is a very serious defect in that these tables and the various references to wiring regulations are all based on American practice. Tube sizes have a particularly mysterious rating. The sizes are supposed to be inside diameters (instead of outside as over here), but actually a ½-inch tube has an internal diameter of ⅝ inch approximately, and a ¾-inch is nearly ⅞ inch internal diameter, and so on.

Wire sizes, again, are all Brown & Sharpe gauge or in circular mils. Sizes less than No. 14 are not allowed in conduit as compared with our usual minimum of 3/22, and apparently wires up to No. 10 are run solid, *i.e.*, with a single conductor and not stranded—all of which is strange reading

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to one accustomed only to I.E.E. rules and a prohibition against any single conductor larger than No. 18.

Many other discrepancies might be noted which would lead anyone into much trouble who followed here the practice indicated by the various tables. Voltage drops up to 5 per cent. for lighting; street lights run "generally in series," and so on, do not agree with our regulations. One curious regulation is mentioned on p. 196, viz., that it is not permissible to run two 120-volt lamps in series on 240 volts.

In part 3 of the book, which deals with the actual wiring installation systems, there are again many divergencies from English practice. Most space is given to screwed conduit, but after that come flexible conduit; armoured cable; metal moulding; knob and tube wiring and open wiring, with a very slight reference to wood moulding (or casing) and concentric systems. Of these open wiring, casing and concentric wiring are the only ones used here except for occasional special work whilst twin-lead wiring, so largely used here, and also slip tubing, seem non-existent in America. Such wide variations between standard practice here and there are very striking.

In spite of or perhaps because of these defects, from the point of view of the English student, the book will be of considerable interest and value, and if one knows enough to discriminate between what is in accordance with English practice and what is not, much valuable information can be obtained from the book.

NEW COMPANIES REGISTERED.

Bailden Syndicate, Ltd. (151,334).—Private company. Registered August 30th. Capital, £100 in 1s. shares. To acquire, work, develop, and resell any inventions or processes relating to chemical, electrical, or engineering undertakings. Agreement with C. W. Bailey. The subscribers (each with one share) are:—H. S. Denny, 2, Rotherwick Court, Golders Green, N.W., consulting engineer; C. W. Bailey, Evington, Leics., consulting chemist. The first directors are: H. S. Denny and C. W. Bailey. Solicitor: G. Reader, 35, Coleman Street, E.C.

Newcastle Graphite Co., Ltd. (151,285).—Private company. Registered August 28th. Capital, £50,000 in £1 shares. To manufacture and deal in amorphous and graphite electrodes, graphite powder, and other forms of artificial graphite, used in connection with electric furnaces, electrical industries, foundries, the manufacture of blackings, &c. The subscribers (each with one share) are:—H. Peile, Milburn House, Newcastle-on-Tyne, colliery owner; H. Harrison, Elswick Works, Newcastle-on-Tyne, accountant. The first directors are: H. Peile, H. Harrison, F. Priestman, J. E. Davidson, and S. Berton. Solicitor: W. S. Burton, Pilgrim House, Newcastle-on-Tyne.

Coventry Foremen's Association of Engineering & Allied Trades, Ltd. (151,281).—Registered August 26th. Capital, £4,000 in £1 shares. To promote the mutual acquaintanceship of, and exchange of opinions by, foremen, managers, and departmental heads of the engineering and allied trades of Coventry, to organise lectures, demonstrations, and visits to works and other places, to encourage inventions, to acquaint members with legislation and regulations affecting the management of workshops, to assist members in obtaining employment, to take action in combating foreign competition in connection with the said trades, &c. The subscribers, who are also the first directors, are:—J. H. A. Bagley, 60, Melbourne Road, Coventry, foreman, Coundon N.S.A.A. Factory, 50 shares; W. Greenall, 118, Earlsdon Avenue, Coventry, foreman, H. Williamsons, Ltd., 25 shares; F. C. Meadows, 30, Stanley Road, Earlsdon, Coventry, foreman, Maudsley Motor Co., Ltd., 20 shares; E. L. Roberts, Lismore, Stoke Park, engineer, 50 shares; G. W. Donald, 23, Shaftesbury Road, Earlsdon, Coventry, engineer, 10 shares; G. W. Eastwood, 75, Hugh Road, Coventry, engineer, 50 shares; L. W. Williamson, 60, Thornhill Road, Coventry, engineer, 30 shares. Registered office: 7, The Quadrant, Coventry.

A. W. Richardson & Son, Ltd. (151,301).—Private company. Registered August 28th. Capital, £10,000 in £1 shares. To take over the business of mechanical, electrical, and general engineers carried on by C. W. Richardson, at Skew Bridge Works, Patricroft, near Manchester, as A. W. Richardson & Son. The subscribers (each with one share) are:—C. W. Richardson, Fern Bank House, Patricroft, engineer; W. R. Francis, 50, Victoria Crescent, Eccles, engineer. The first directors are: C. W. Richardson, W. R. Francis, A. Williams, W. W. Mills, and W. H. Liggins. Solicitor: C. J. Booth, Duchy Chambers, 4, Clarence Street, Manchester.

Cremer Aircraft & Industrial Works, Ltd. (151,290).—Private company. Registered August 27th. Capital, £10,250 in 10,000 "A" shares of £1 each, and 5,000 "B" shares of 1s. each. To take over the business carried on by A. J. Cremer, at Lorn Road, Brixton, S.W., and to carry on the business of aircraft manufacturers, engineers, electricians, engine, dynamo, and motor manufacturers, &c. The subscribers (each with one share) are:—A. J. Stryckmans, 21, Coleman Street, E.C. 2, member of Brussels Stock Exchange; A. de Barsy, 20, Fortismere Avenue, Muswell Hill, N.10, engineer. Directors: L. Hiard, A. de Barsy, A. J. Stryckmans, and A. J. Cremer (all of Belgian nationality). Registered office: Lorn Road, Brixton, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Ramsden Green, Ltd.—Particulars of £500 debentures created July 24th, 1918, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £100. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Reid Bros. (Engineers), Ltd.—Particulars of £6,000 debentures, created August 22nd, 1918, filed, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Monometer Manufacturing Co. (1918), Ltd.—Particulars of £20,000 first mortgage debentures, created July 2nd, 1918, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

Tyneside Tramways and Tramroads Co. The half-yearly meeting was held in Newcastle-upon-Tyne on August 28th, Dr. J. T. Merz, chairman, presiding. The report for the half-year ended June 30th last stated that the surplus of receipts over expenses was £8,945. After paying debenture interest and preference dividend, 5 per cent., less tax, is paid on the ordinary, £1,000 is put to the credit of reserve for renewals, depreciation, and other contingencies, and £2,600 to the credit of special reserve account, leaving to be carried forward £1,697. The traffic receipts show an increase of £6,154 as compared with the corresponding period of last year. The Chairman said the increase of traffic receipts was a satisfactory feature, although of that increase some £1,400 had been absorbed by higher wages, and the enhanced cost of materials, &c. They had about £2,500 more to deal with this year than last. Last year they paid 2 per cent. for the half-year; now they were proposing to pay 2½ per cent. There were considerable expenses ahead, and, perhaps, there would be a diminished income. There was a claim in respect to excess profits duty which had not been settled yet, and the Government had put forward a proposition for reducing the consumption of electricity with a view to reducing the consumption of coal. This matter was not yet settled; it was not put forward as a definite order, and at present they would take no action. If it were adopted, however, it would mean a considerable reduction of income. Their investments and loans amounted to £34,000, and altogether in reserves they had £38,000. Their traffic was still increasing, but at the same time ther expenses were going up.

Official Announcements re Companies. — The following companies have been struck off the register, and are dissolved:—

Argentine Electrolytic Syndicate.
Armour Plate (Cowper-Coles) Patents.
Bachelet Levitated Railway.
Colonial Rail & Tramway Syndicate.
Crowther & Co.'s Electrical Industries.
Davis Electrical Co.
Elgctromobile Co.
J. G. Childs & Co.
Mechanical Traction Syndicate.
Miners' Lamp Electric Lighting Co.
Salt Lake and Ogden Gas & Electric Light Co.
Spiral Regulating Dynamo Co.

The following will be struck off within three months unless cause is shown to the contrary:—

A. T. Speedometer Co.
Bleichert's Aerial Transporters.
Feld Bros. & Co., Ltd.
Harold Wood Electrical and Engineering Supplies Co.
Mea Magneto Co.

Lancashire Dynamo & Motor Co., Ltd.—The report for 1917 shows a profit, after providing for interest, income-tax, depreciation and special expenditure, of £26,315, against £29,321, to which has to be added £6,791 brought forward. The present distribution on the ordinary shares is to be 2½ per cent., in the shape of a bonus, making 12½ per cent., free of tax, for the year—the same as for the last two years. It is proposed to place to the reserve £10,000 (equal to 10 per cent. on the ordinary shares), (making £60,000) and to carry forward £7,193. Since the close of the last financial year a fresh issue of shares, of which a substantial portion was taken by the staff, has been made.

Richardsons, Westgarth & Co., Ltd.—After providing for estimated liabilities to the Government, the accounts show a profit of £141,403, plus £46,217 net balance of profit for 1916. It is proposed to pay two years' arrears of preference dividend, and to write large sums off for depreciation, &c.

J. Stone & Co., Ltd.—A dividend of 10 per cent. per annum on the ordinary shares is recommended. £50,000 is put to reserve, and £116,702 is to be carried forward.

Browett, Lindley & Co., Ltd.—Further preference dividend of 3 per cent. on account of arrears. Interim dividend of 4 per cent. on ordinary.

Western Telegraph Co., Ltd.—Dividend 3s. per share and bonus of 4s. per share, making total of 8 per cent. for the year.

Madras Electric Tramways, Ltd.—Interim dividend 8 per cent. per annum, free of tax, on the ordinary shares.

Clyde Valley Electrical Power Co.—2 per cent., less tax (interim). Last year, 1¼ per cent.

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Stock Exchange Notices.—Applications have been made to the Committee to appoint special settling days in—

General Electric Co., Ltd.—7,500 additional ordinary shares of £10 each, fully paid (Nos. 50,001 to 57,500).

Oriental Telephone & Electric Co., Ltd.—110,087 additional ordinary shares of £1 each, fully paid (Nos. 179,364 to 289,450).

The undermentioned have been ordered to be quoted in the Official List:—

Callender's Cable & Construction Co., Ltd.—35,000 additional ordinary shares of £5 each, fully-paid (Nos. 30,001 to 40,000 and 45,001 to 70,000).

General Electric Co., Ltd.—7,500 additional ordinary shares of £10 each, fully-paid (Nos. 50,001 to 57,500).

Brazilian Traction, Light & Power Co.—Quarterly dividend of 1½ per cent. on the fully-paid cumulative preference shares.

Northampton Electric Light & Power Co., Ltd.—Interim dividends of 5 per cent. (6d. per share) on the ordinary "A" and "B" and "B" preference shares for the half-year.

Aberdeen Suburban Tramways Co., Ltd.—Net profits for the half-year to July 31st £2,309, plus £1,614 brought forward. Dividend at the rate of 5 per cent. per annum, adding £1,200 to depreciation fund, and carrying forward £1,061.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Interim dividend on the ordinary shares, 2½ per cent.

STOCKS AND SHARES.

Tuesday Evening.

The rapid advance of the Allies and the extremely cheery character of the news from the Western Front go far to keep Stock Exchange markets in good form, and to maintain good prices. The principal feature is the strength of gilt-edged securities. War Loan, Consols, and others of similar character have gone ahead materially, and this has had a natural effect upon other fixed-interest stocks and shares of good calibre. The volume of business is perhaps less than might have been expected. Probably this is something that will be remedied after the holiday season. Meanwhile, prices are buoyant in nearly all departments, with industrials still in the forefront of the activity.

Amongst the latter, considerable animation characterises the Marconi market, and the price of the parent shares has jumped 10s. to 4⅜ under the pressure of strong buying. The subsidiaries are also harder without, however, making much quotable progress, Americans being 30s., Canadians 14s. 6d. The unfavourable effect recently produced by the law-suit in which the American Co. was involved has now completely worn off, and it is stated that the amount of money concerned will turn out to be comparatively small. Marconis have reached a price at which caution counsels profit-taking, although the optimists in the market talk the price higher in the immediate future. Marconi Marines have risen to £3, while the price of Spanish & General Wireless Trust is about 12s. A little business in Oriental Telephone Fractional Certificates has found the price about 13s. Monte Video Telephones are 2s. 6d. better at 25s., and Cuba Telephones have risen to 10¼.

The rise in Districts continues to make uninterrupted progress, and this week the stock has advanced to 25½, which is only a point below the quotation for Metropolitan Consolidated. In this market, the cheerful optimist is also apparent, and, although the possibility of an early dividend is ridiculed, some stick to the opinion that shortly after the war the company will be in a position to make a distribution to its proprietors. Underground Electrics are steady, though the market is less buoyant than it was a fortnight ago. Business has been done in the contingent certificates of the company, these being quoted on the basis of 1s. 3d.–1s. 6d. The Income Bonds of the company are ex £2 net dividend, and at 84 show a rise of 10s. on balance.

There is nothing fresh to report in the list of home electricity companies. Two or three shares are quoted ex dividend, and this accounts for the only movements. More business is afoot in manufacturing shares, although here, as we were noticing a week ago, business has fallen off to a considerable extent compared with what it was in the early part of August. Ediswan shares are now quoted in their new denomination of £1, and the present quotation of 16s. 3d. is roughly equivalent to that which prevailed before. Electric Constructions hold their rise to 27s. 6d. Henley Ordinary are ex 6d. dividend, and the Preference are ex 2s. 3d.; no change has been made in the price of either. Cromptons are changing hands about 16s. 3d., and the Preference around 19s. 6d. Victoria Falls Ordinary are 18s., and the Preference 23s. 3d. British Insulated Ordinary are another ⅛ to the good at 45s., and British Aluminium rose to 40s. 7½d. Buying from the North raised Babcocks to £4, and other shares connected with the iron, steel, and coal industries are prominently good. Telegraph Constructions gained 30s. at 47, and nearly all the shares in the manufacturing list, whether electric or telegraph, remain a very hard market.

Amongst the foreign and colonial issues, British Columbia Electrics have weakened in spite of the cheerful advices received from Vancouver with reference to the conditions of business in the city and the province. Mexicans are mostly higher, and Mexican Light & Power First Bonds at 57 are 2½ points up, the Common shares at 29 gaining 2. Brazil Tractions hold their recovery, and Anglo-Argentine Trams are as a rule more easy to sell than they are to buy.

The rubber share market has got on to rather firmer ground, and the slump has been stayed by the incursion into the market of a good many bargain-hunters. Nevertheless, the immediate prospect is obscure, although for after-the-war dividends the outlook is bright enough. Not a great deal is being done in the market for base-metal shares. Amongst armaments, Vickers stand out with a big rise, induced by reports circulated in the market to the effect that when the companies' accounts do appear, the figures will show wonderful results. Armstrongs have appreciated in sympathy.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1916.	Dividend 1917.	Price Sept. 3, 1918.	Rise or fall.	Yield p.c.
Brompton Ordinary	9	10	6⅜	—	£7 17 0
Charing Cross Ordinary	5	4	8⅛	—	6 8 0
do. do. do. 4½ Pref.	4½	4½	8½	—	6 18 6
Chelsea	8	5	8½	—	7 18 10
City of London	8	8	11¼	—	6 19 2
do. do. 6 per cent. Pref.	6	6	9½	—	6 3 1
County of London	7	7	10¼	—	6 17 7
do. do. 6 per cent. Pref.	6	6	9⅛	—	6 1 6
Kensington Ordinary	6	7	5⅛	—	6 17 7
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3½xd	—	7 18 10
Metropolitan	3	4	8¼	—	6 8 0
do. 4½ per cent. Pref.	4½	4½	8½	—	6 18 6
St. James' and Pall Mall	8	9	6⅜	—	7 1 2
South London	5	5	8	—	6 13 4
South Metropolitan Pref.	7	7	20/6xd	—	6 16 7
Westminster Ordinary	7	9	5⅞	—	7 13 3

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	6	6	97½	—	6 3 0
do. Def.	1½	1½	23⅜	—	6 7 8
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10¼	+ ¼	*6 16 7
Eastern Extension	8	8	15⅜	—	*5 3 3
Eastern Tel. Ord.	8	8	158½	—	*5 1 0
Globe Tel. and T. Ord.	7	7	14⅜	—	*4 17 5
do. do. Pref.	6	6	10⅜	+ ⅛	5 15 8
Great Northern Tel.	24	22	37½	—	5 17 4
Indo-European	13	—	57½	—	5 12 6
Marconi	15	20	4⅜	+ ½	4 11 6
Oriental Telephone Ord.	10	10	8⅛	—	3 4 0
United R. Plate Tel.	8	8	7⅛	+ 1/16	*5 4 1
West India and Panama	6d.	1/3	1⅜	— 1/8	*3 12 0
Western Telegraph	8	8	16⅜	—	*4 17 9

Home Rails.

Central London Ord. Assented	4	4	60½xd	—	6 12 3
Metropolitan	1	1	26½	— ½	3 15 6
do. District	Nil	Nil	25½	+1½	Nil
Underground Electric Ordinary	Nil	Nil	2⅜	—	Nil
do. do. "A"	Nil	Nil	8/-	—	Nil
do. do. Income	6	4	84xd	+ ½	*4 15 3

Foreign Trams, &c.

Adelaide Sup. 6 per cent. Pref.	6	6	48xd	—	6 9 9
Anglo-Arg. Trams. First Pref.	5½	5½	8½	—	—
do. do. 2nd Pref.	5½	—	2½	—	—
do. do. 5 Deb.	5	5	66	—	7 12 2
Brazil Tractions	—	—	46	—	—
Bombay Electric Pref.	6	6	102	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	60½	—	8 5 4
do. do. Preferred	Nil	Nil	43	—1	Nil
do. do. Deferred	Nil	Nil	38	—1½	Nil
do. do. Deb.	4½	4½	60½	—	7 0 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	50	—	Nil
do. 6 per cent. Bonds	Nil	Nil	42	—	Nil
Mexican Light Common	Nil	Nil	29	+2	Nil
do. Pref.	Nil	Nil	41½	—	Nil
do. 1st Bonds	Nil	Nil	57	+2½	—

Manufacturing Companies.

Babcock & Wilcox	15	15	4	+ ⅛	3 15 0
British Aluminium Ord.	10	10	2 1/16	+ 1/32	4 18 6
British Insulated Ord.	20	20	2¼	+ ⅛	4 9 0
British Westinghouse Pref.	7½	7½	2½	—	5 9 1
Callenders	20	25	11½	—	6 4 6
do. 5 Pref.	5	5	4½	—	5 17 8
Castner-Kellner	22	20	38	—	5 10 4
Edison-Swan, "A"	—	—	1/16	—	Nil
do. do. 4 per cent. Deb.	4	4	75⅛	—	5 6 0
Electric Construction	7½	10	1⅛	—	7 5 6
Gen. Elec. Pref.	6	6	10½	—	6 5 4
do. Ord.	10	10	18½	—	*5 8 1
Henley	25	25	2½xd	+6d.	5 15 0
do. 4½ Pref.	4½	4½	4xd	+ ⅛	5 12 6
India-Rubber	10	10	17⅛	—	*5 15 9
Telegraph Con.	20	20	47	+30/-	*6 2 0

*Dividends paid free of Income Tax.

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TURBINE HOUSE PLANT OPERATION.

By T. G. OTLEY, M.I.E.E., and V. PICKLES, A.M.I.E.E.

(*Abstract of paper read before the* SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS, *May*, 1918.)

(*Concluded from page* 214.)

In the operation of condensing auxiliaries care should always be taken to get the best possible service out of the plant, it should at all times be run at as high a speed as practicable. There is another point, however, which has an indirect bearing on the operation of this plant and that is the aeration of feed water. Condensed water is almost ideal for boiler purposes, but the volume of air which it contains has to be carefully considered, especially when rotary air pumps or kinetic ejectors are used. With the exception of the air pumps supplied with the eight 3,000-KW. sets installed at Simmer Pan and Brakpan and the two provided for the 12,000-KW. machines at Brakpan, all our air pumps are of the rotary type. The air pumps for the 12,000-KW. sets at Brakpan are of the kinetic type, supplied by Messrs. Allens, of Bedford. The Rosherville 9,600-KW. turbine auxiliaries consist of a small Curtis turbine, driving twin circulating pumps, condensed water, and "Schleuder" air pump. The condensed water and the Schleuder impellers are in one casing with a diaphragm between, both taking their suction from a common pipe with a weir fixed across. It has been found that the condensed water impeller at normal speed of revolution is capable of handling a much larger volume of water than the normal quantity passing through the condenser, and consequently the water is churned up and a quantity of air is drawn over from the Schleuder side, with the result that the water passing up to the hotwells is almost saturated with dissolved air. This type of air pump was first installed by us at Rosherville, and shortly after the station started up we experienced serious corrosion in the economisers and boilers. The trouble was traced in a large measure to the amount of air contained in the condensed water. The remedy was to place an artificial head on the discharge side of the water pump whereby the impeller was kept flooded. Since that time corrosion arising from air-saturated water has practically ceased. Speed regulation is effected by means of throttle governor, but to compensate for large differences in the exhaust pressure, hand controlled nozzles are provided. Beyond providing a small collar at the side of the air pump end bearing, there was nothing to take any end thrust, and we have had to design and install a ball end thrust bearing fitted to the bend supplying the water to the air pump. The pumps have on the whole proved themselves extremely reliable and cheap to maintain.

At Brakpan with the kinetic type of auxiliary, air is extracted from the condenser by means of an ejector using water as the entraining medium. The ejector water is drawn from a tank into which the condensate is discharged, which arrangement is ideal for aerating the water, resulting in serious corrosion taking place in the economisers. A rearrangement was made whereby the condensate instead of being discharged into the tank was pumped direct to the hotwell, and the tank was used exclusively for the kinetic ejector circulating water. The temperature of this water was kept low by allowing it to overflow into the dam and making up with cold water. This matter of the aeration of boiler feed water is of very great importance, and it has not received the attention or consideration which it merits.

It may be of interest to give a comparison of the performance of these sets with the type in use at the other stations. The comparison is made with one of the 11,000-KW. sets at Simmer Pan, the main turbine and the main condensers being exactly similar and in the same state of cleanliness.

—	Load KW.	T1 deg. C.	T2 deg. C.	Tv deg. C.	Tc deg. C.	Tv-Tc.	Condenser Coefficient.
Simmer Pan No. 7...	9,800	15·8	24·2	36·1	25·6	10·5	98·1
Brakpan No. 4...	10,000	18·7	30·2	34·8	32·8	2·0	96·0

The kinetic pump shows a clear gain in the matter of vacuum, which is all-important, and its air removing capacity is shown by the small difference between Tv and Tc which is a direct gain to the boiler house, and is well worth having in a station running at a high load factor.

Some three or four years ago we went very closely into the performance of our condensers, and a number of experiments were made by the research department under the direction of Mr. G. M. Clark, to find whether the efficiency of the plant supplied could be improved. The first experiment was to ascertain whether the quantity of air leaking into the system and being dealt with by the air pump was excessive. Known quantities of air were admitted to the condenser, and the effect on the vacuum noted. By plotting weight of air admitted against volume of air pumped out, it is possible by extrapolation to determine the quantity of unmeasured air entering the condenser. In the case of the condenser of one of the 9,600-KW. sets at Rosherville, it was found that .04 lb. of air per second passed through the condenser in the ordinary way with the steam. By calculation this gave a volume of approximately 1,000 cu. ft. of air and vapour being dealt with by the air pump per minute. It was also calculated that the vacuum could be improved by about 3 per cent. if the air pump capacity were increased by 50 per cent. or if the normal volume of air passing through the condenser with the steam were reduced by one-half, that is to say, .02 lb. per second. We have not, however, succeeded in effecting such a reduction, and it would appear that the figure given, namely, .04 lb. per second, is the normal for condensers of this size.

The experiments proved the importance of the factors mentioned, but once a plant of this kind has left the factory it is too late to effect improvement by making alterations in design or construction.

All our feed pumps are steam driven. With the exception of four Clarke, Chapman reciprocating pumps at Simmer Pan, they are all of the steam turbine centrifugal type. Sixteen were supplied by the A.E.G., Berlin, and three, the latest installed, by Messrs. Weir, of Cathcart. These three pumps are the best on the system, they have been running for nearly four years, and have cost practically nothing to maintain. The steam from all feed pumps can be exhausted either to atmosphere or into the hot wells or feed tanks. The exhaust pipes from the hot wells terminate in a nozzle ejector, correctly shaped so as to avoid water hammer. As originally designed, the steam was first passed through a coil immersed in the hot well. This resulted in excessive back pressure, which materially restricted the capacity of the pumps, and the coils were therefore cut out. Except in the hottest weather, when the vacuum temperature and condensate temperature are high, we recover practically all the heat in the exhaust steam.

It is only rarely that we have been unable to utilise the whole of the heat energy in the feed pump exhausts, but some 18 months ago when the river temperature at Vereeniging rose to 36 deg. C., three-quarters or more of the heat in the feed pump exhaust was sent to atmosphere, the difference between the condensate and the feed temperature being only about 2.7 deg. C. This condition of affairs was principally due to the fact that there was only about five or six feet head at the feed pump suctions, and this illustrates the importance of considering this point in power station design. The hot well should always be placed at such a height that the feed pumps will keep their suction whatever the temperature of the feed water may be. All steam traps discharge into the hot well. The quantity of heat recovered in this way is indeterminate, but there is no doubt that the expense of carrying the drains to the hot wells is amply repaid in the saving of the heat effected. On the total quantity of water evaporated at all our stations, a 1 deg. C. gain in feed-water temperature is worth about £50 a month to the company.

The Power Company is a very large consumer of its own power. About 4.7 per cent. of the electric units generated at our different stations are absorbed in electrically driven auxiliary machinery, draught fans, service pumps, mechanical stokers, and other sundry auxiliary plant. Expressed in kilowatt hours this means that the electrically driven auxiliaries in the power stations use over 36,000,000 units per annum. This is incidental to an annual output of electricity and air of 840,000,000 KW.-hours. Even at 100 per cent. load factor this is equivalent to a load of 4,150 KW., which is a somewhat striking figure, and leads one to the conclusion that the efficiency of auxiliary plant should receive very careful consideration. It should also be borne in mind that the greater part of our auxiliary plant is steam driven, all the circulating water and air pumps for the large machines being turbine driven. If these were electrically driven the units used on the works would indeed become a really formidable total.

Efficiency in the operation of any station can only be obtained by close supervision. In commercial operation, although the same supervision cannot be exercised as in a test, the operating data returned should be sufficient and accurate enough to form a reliable opinion of the performance of the plant. The most difficult thing to measure is the quantity of steam used in the turbines. None of the ordinary forms of water meter we have tried gave us sufficiently accurate or consistent figures. The arrangement until recently in use at all our stations consisted of an orifice inserted in some convenient place in the condensate pipe, and the difference in the pressure on the up and down stream sides of the orifice was measured by means of a mercury manometer, a simple U tube. The quantity of water flowing through the orifice varies as the square root of this pressure difference. A scale fixed to the manometer gave us the rate of flow at any instant in lb./hour.

In commercial work, with readings taken every half-hour by the turbine driver and not a skilled observer, the results obtained were not as accurate as we would have liked, and we have therefore discarded this method of water measurement, and for the time being all the water figures are estimated.

The problem of increasing efficiencies is two-fold. First, how to use coal to the fullest advantage, both with regard to

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extracting the maximum amount of heat energy from it and also the recovery of the innumerable by-products which it contains. Second, how to use to the fullest extent the heat available when coal is used either directly or indirectly for generating steam in boilers. This problem is one of the very greatest importance from the economic and national point of view, especially in England. It is not of such great importance in South Africa as it is in industrial countries, such as Great Britain and the U.S.A. In South Africa coal is relatively cheap and the consumption is relatively low.

Steam power engineers, especially in England and America, have been investigating the problem principally from the point of view of increasing turbine-house efficiencies, quite apart from any possible increase in boiler-house efficiency, or the recovery of by-products. As a matter of fact, there is probably greater scope for economies in the boiler houses of the world than in turbine and engine houses; yet if we leave out the question of by-products, there is not the same margin for economies in a well-conducted boiler house as there is in the turbine house.

With the present design of plant annual boiler-house efficiencies of 76 per cent. and 80 per cent. are not unknown, but we should be very much surprised to hear of a turbine house returning an average annual efficiency of 20 per cent. per unit sent out. The chief reason for this is that turbine machines to-day work on such a small range of available energy, that although the turbine itself may be a relatively efficient machine, not more than 20 per cent. to 22 per cent. of the total energy is utilised even under the most favourable conditions. Until some genius arises who will show the way to recover the energy at present lost in the circulating water and which to-day, even in well-operated power stations, represents 60-70 per cent. of the total energy in the coal, the most promising direction in which to increase the available energy is by increasing both steam pressure and temperature.

With regard to the improvement in steam efficiency brought about by the use of higher pressures, it appears to us that increases in pressure should be balanced by increases in temperature, otherwise it is difficult to see that turbine efficiency will even remain as high as it is at present, unless some scheme of reheating between stages is adopted. This is because an increase in pressure alone will result in a lower dryness fraction at the low pressure end of the turbine. On this account, and at the risk of laying ourselves open to the charge of being conservative, we express the view that progress will best be served by increasing pressures, not at one bound to 500 or 600 lb. per sq. in., but by gradual stages, as although the theoretical gains which can be shown are very substantial, it is not at all certain that they can be realised in practice.

Considering the matter in all its bearings, we are of opinion that a considerable proportion of the gain in efficiency will also be neutralised by increased maintenance and capital cost.

In times of stress like the present the Government calls to its aid the entire engineering strength of the country. There is no stinting of public money for experimental work in connection with the war, and it is now realised that the work of the engineer is one of the principal factors in the war. Unfortunately, this view is only taken when it is too late to be of the greatest use. National greatness and strength in war are more dependent on the energies of a people in peace time, and we submit, as is the case to-day, so in normal times it is the engineer, using this term in its broadest sense, who plays the principal part in national greatness. This leads us to the conclusion that while to one man or to one firm of manufacturers, the decision as to whether he will risk his reputation or their financial position in a radical change in engineering practice, is a very great undertaking, to a Government such a burden is a light one. We submit, therefore, that pioneer work of this description, when endorsed by a representative institution or committee, should be cheerfully undertaken by the Government as a national obligation.

THE APPLICATION OF ELECTRIC WELDING TO SHIP CONSTRUCTION AND REPAIR.

We have received from Capt. James Caldwell, R.E., of the Welding and Labour-Saving Division of the Admiralty Labour Department, who has recently been investigating the above-named subject in this country and the United States, the following information :—

The systems of electric welding which are now being employed to a limited extent, with every prospect of considerable further application in the fabrication of ships, are :—

1. Resistance welding, comprising butt, spot, and line methods.

2. Arc welding, employing either bare or flux-covered metal electrodes.

Butt welding is suitable for the joining of bars which constitute the longitudinal members of a concrete ship, but the service applications in a shipyard are limited.

Spot welding has been largely used to unite sheets or thin plate where a continuous weld or joint is not required. The two sheets are placed between electrode clamps which press them together; current is then switched on, and the surfaces in contact are brought up to a welding heat. The pressure is maintained after current is off until sufficient cooling occurs. The sheets are then moved on to the next spot to be welded, and the operation is repeated. Work so welded is therefore united by a line of small welds or spots, and may be compared to flush riveted work.

Further developments of this method, which comprise the riveting of much thicker plates as required for the hull of a ship, have been applied in America recently. It would appear that spot welding is eminently suited to replace riveting and caulking to a very large extent in the future.

Line welding is somewhat similar to spot welding, with a continuous line jointure which is obtained by passing the steel between roller electrodes.

Whereas arc welding with bare metal electrodes has until quite recently, been almost exclusively used in America, the flux-covered metal electrode has had most extensive use in Britain.

(*a*) With the bare metal electrode system of arc welding an arc is struck between a rod of metal and the work. The heat then generated at this point melts a small pool on the parts to be welded, and additional metal is deposited from the electrode in a molten state, thereby forming a firm union between the new and the old metal, if certain precautions are adopted to ensure even application and the prevention of porous metal due to excess of current.

To prevent oxidisation the metal rod is sometimes coated with a sleeve of insulating material which decomposes with the heat, and surrounds the molten metal with an inert gas.

(*b*) The flux-covered electrode system of arc welding most commonly used in this country provides for the metal electrodes being encased in a flux composition which becomes molten at the arc so that the added metal is at no time exposed to oxidisation. When properly applied, this flux forms a silicate slag of suitable viscosity which floats on the metal surface until removed, when cold by tapping with a small hammer and using a wire hand brush. Arc welding, whether carried out with bare or flux-covered electrodes, has a wide application to ship construction and repair.

For carrying out spot welding alternating current is necessary. The supply voltage is immaterial, as a transformer forms part of each machine. With spot welding it was formerly understood that the metal adjoining the weld became very brittle when subjected to vibratory stresses, the line of juncture between plates containing a layer of oxide, which considerably weakened the weld, and difficulty was experienced in obtaining sufficient adhesion. However, with recently developed machines provided with gear to give sufficient pressure to close the plates, and by the use of increased current, the latter difficulties have been overcome, whereas crystallisation does not occur to any appreciable extent with thick plate work.

A spot-welding machine suitable for thick plates is a heavy tool weighing several tons, and is therefore most efficiently employed as a stationary plant. It is therefore recommended that in the first instance spot welders be confined to the fabrication of internal ship parts. Spot welding work may be made more or less watertight by reducing the spacing of the spots even to the extent of making adjacent welds overlap. When spot-welding bulkhead plates and framing, it is advisable for this reason to weld alternate spots in one operation, then transversing the work again to complete. Unfortunately at the present time spot welding cannot be applied extensively in this country owing to the impossibility of obtaining the necessary machines and suitable electrical apparatus.

No sweeping decision can be made as to the relative merits of arc welding by means of bare-metal and flux-covered metal electrodes. There are certain conditions that seem to preclude the universal adoption of any one of these methods.

Both bare and flux-covered metal electrodes are effective with direct-current supply, provided the voltage and current at the arc are kept within the desired range. To obtain reduction in the line voltage, a motor-generator or rotary balancer must be employed.

Bare-metal electrodes are not now suitable for use with alternating current, although there are certain investigations afoot, such as the "Holslag" transformer, that would seem to make it possible to use bare electrodes with A.C. supply. The results obtained with flux-covered electrodes are, however, quite satisfactory, and particularly good penetration is secured with certain types of electrodes. With the latter the supply may be taken direct to the arc through a "Holslag" transformer, or 110 volts may be obtained with a static transformer, the current regulation at the arc being maintained by a regulating resistance in series.

As regards the respective merits of bare and flux-covered metal electrodes for arc welding, apart from electric supply conditions, there is no reason why a correct weld by either method should not be made to approach the tensile strength of the original plate.

By virtue of the annealing properties of the slag and the absence of oxidisation in added metal, the flux-covered electrode is superior in respect of the ductility of the weld.

The flux may be made the vehicle of constituents which will give desired characteristics to the added metal. Porosity or piping will also be reduced by the use of flux-covered electrodes.

The bare-metal electrode is the cheaper if connected direct to the general electric supply system. It is, however, more usual practice in America to provide an auxiliary machine with substitutional resistance or other regulating features to

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give the correct current at the arc, whereas with flux-covered electrodes no such refinement is necessary.

The power required and the cost of the equipment vary with the number of welders in use, the character of the work, and the method employed. The larger the number of welders in simultaneous use the more closely the total power needed will approximate to the sum of the averages, so that installations providing for many welders are relatively less costly in regard to power plant than small installations, with only a few welders.

Comparing welding with riveting by eliminating the routine of marking and punching, reaming, and caulking, to say nothing of the planed butt straps and insertions at watertight joints, there is ample margin to cover the cost of similar construction by means of electric welding until the process is standardised, when costs would be further reduced.

The most important point in favour of extending the use of electric welding is the reduction in the amount of labour as compared with the present charge under this head, which is:—

1. Twenty-five per cent. for barge, tank, and deck structure.
2. Fifty per cent. for smith work.
3. Seventy-five per cent. for selected details.

Furthermore, superfluous material in the form of overlapping riveted plates and of angles and brackets would be considerably reduced.

THE "D.K. 30" VENTILATED TRAMWAY MOTOR.

The conditions under which tramway motors operate are well known to be the reverse of ideal. Many of the difficulties asociated with the design and operation of tramway motors would be obviated if a really satisfactory system of ventilation could be provided, and with this object in view Messrs. Dick, Kerr & Co., Ltd., have recently placed on the market a positively ventilated type of traction motor, which will strongly appeal to those engineers who favour the ventilated type of motor.

This machine, known as the "D.K. 30," is of the interpole type, and in general design follows the firm's standard practice. It is, however, supplied with either split frame (as illustrated) or box frame, which latter construction is now finding favour particularly abroad; the frame itself is of high-

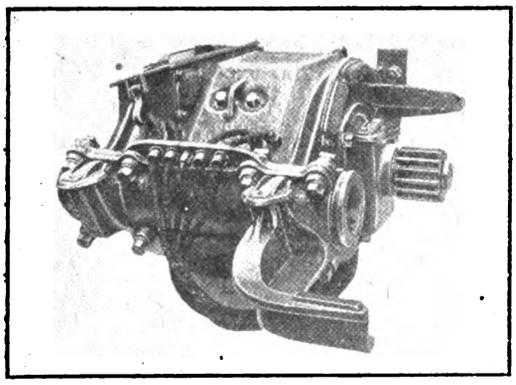

Fig. 1.—The "D.K. 30" Traction Motor.

permeability cast steel, fitted with separately cast armature bearing boxes on either side, which are firmly bolted to the frame. This gives a very rigid construction, and one which facilitates dismantling for inspection, as the armature can be retained in position while the bottom half of the split frame is removed or can be removed with it if necessary. The solid armature bearing boxes are also an effective preventative of oil creepage into the interior of the shell.

The main pole pieces are built up of laminated steel punchings, riveted together, and are interchangeable and fitted with former wound coils; these coils are specially insulated to withstand moisture and high temperature conditions, and are firmly held in position by flat steel springs, by means of which any shrinkage of the coil is automatically taken up. The interpoles are solid steel, with field coils clamped into position by screws.

The armature is of the firm's standard construction, special air ducts being provided in the core for ventilation purposes. To ensure that this ventilation is satisfactory and positive, a double-flow exhaust fan of compact form is fitted to the armature which draws one current of air through the armature laminations, and another over the field coils.

This air enters the motor casing through inlets of considerable area, which are located behind the commutator lid, where they are protected from dust and water, and is discharged through outlets at the pinion end, in a similarly protected position; both the air inlets and outlets are fitted with coarse protective screens, shaped so as not to restrict the volume of air entering or leaving the air ducts. The volume of air and its velocity are such that any dust entering the casing is carried right through and expelled, an operation which the smooth direct air-passages greatly facilitates, as also the fact that no reversal of direction of air current occurs in the motor.

The cooling effect resulting from this positive system of ventilation increases the continuous capacity of the motor to 70 per cent. of the one-hour rated capacity, as compared with a value of only 40 per cent. with the unventilated type of motor.

It is unnecessary to emphasise the value of this feature as it is obvious that in tramway operation the capacity of the

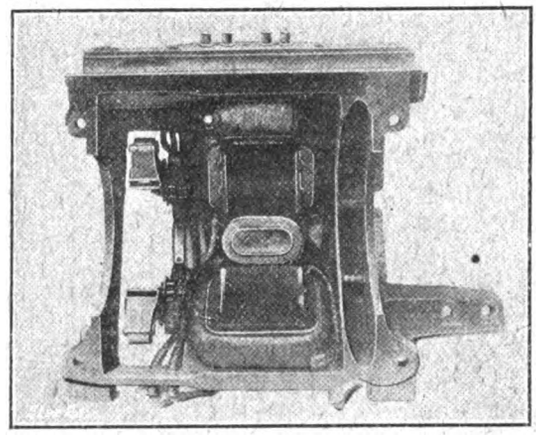

Fig. 2.—Bottom Half of Split Frame, showing Pole Faces.

motor for continuous operation during periods of 8 or 10 hours is far more important than its one-hour rating, and due to the cooler running conditions the life of the insulation is increased, as it is unlikely to suffer from the effects of overheating.

The bearings of the armature as well as those for the axle suspension are lubricated by means of wool waste and horsehair saturated in oil, a special channel being cast in the bearing box for oiling; the motor is also adapted for ring-lubrication, and owing to the oil storage capacity provided, the bearings will operate for long periods without attention.

The motor is fitted with the firm's standard brush gear; the axle is provided with a forged steel pinion cut from the

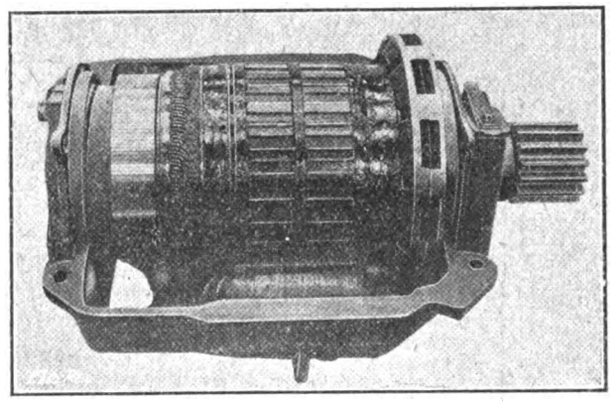

Fig. 3.—Armature, showing Double-flow Exhaust Fan.

solid, which meshes with a cast steel gear wheel, the gearing being enclosed in a malleable iron case supported from the frame.

The "D.K. 30" motor is designed for a narrow (one metre) gauge, and rated at 40-H.P. when operating on 500 volts at a speed of 520 R.P.M.; it is claimed that it represents a great advance on existing designs, even of the ventilated type, both in efficiency and all-round reliability, and is specially adapted for use under the conditions met with in British tramway operation.

Electric Salt Extraction in Norway.—A company, with a capital of 20,000,000 kroner, is about to start the exploitation on a large scale of Prof. Helland Hansen's method for extracting salt from sea-water. It will probably be found expedient to erect several works along the coast, as more electrical energy becomes available. The comparatively large capital is necessary on account of the large plant needed, pumping stations, &c., absorbing the bulk of the power: the production of the salt itself only requires a small amount of energy. Stavanger has been mentioned as likely place for the first factory, and the Glaamfjord for second.

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NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

New Watertight Lantern.

MESSRS. SIMPLEX CONDUITS, LTD., of Garrison Lane, Birmingham, have recently issued a mailing card, No. 676, dealing with their new deep watertight lantern, of which the following is a short description :—The lantern is cast with a deep recess in the top, into which the lampholder fits. The deep cast body and standard well glass make a pleasing, well-balanced combination, and avoid the necessity of stocking extra deep well glasses, which at the present

FIG. 1.—SIMPLEX WATERTIGHT LANTERN.

time are more difficult to obtain than the standard glasses. This deep-body lantern, fig. 1, used with the firm's new sheet-metal shade, throws the light downwards, and none is wasted by horizontal rays. The inner reflecting surface is white, and if regularly cleaned it is claimed that a better light is given on the ground than with any other lantern on the market. The card will be sent to readers upon request.

New Arora Fires.

Two years ago we recorded the progress made by the ARORA CO., of Loughborough, Leicestershire, which started work in May, 1915, in premises which already contained a foundry and engineering workshop; since then the demand for the firm's electric fires has developed so much that the erecting shop has had to be extended to about five times the original floor space, and the output for 1918 is likely to be three times that of 1917. A leaflet which is now being issued describes two new Arora fires : a 4-KW. fire, and

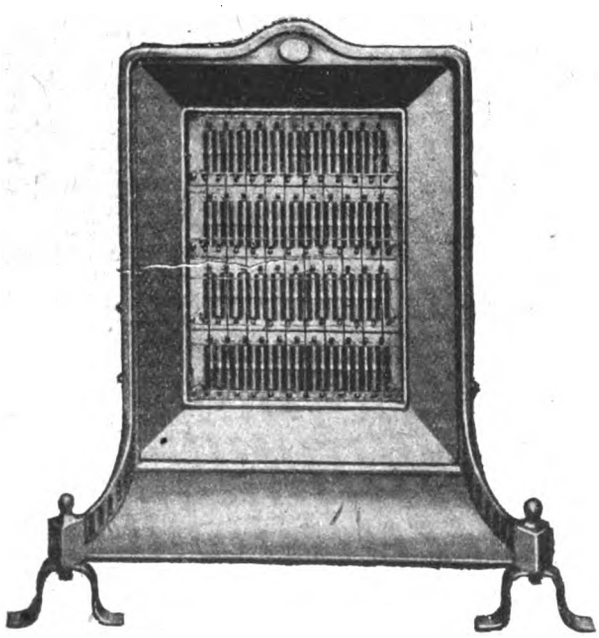

FIG. 2.—"ARORA" 4-KW. FIRE.

a 1-bar fire, No. 10, the latter being suitable for small rooms and kitchens. We illustrate herewith (fig. 2) the large fire, which resembles the smaller patterns previously made, but is standardised with 1,000-watt bars instead of 750-watt elements, and is controlled by three 10-amp. switches; the fire stands 23½ in. high, and weighs 35 lb. The firebox is interchangeable, and is easily attached to front castings of various finishes. The small No. 10 pattern is reduced to the simplest form, consisting of two strong castings which contain one 750-watt bar. It measures 10¾ × 4½ × 3 in. high, and weighs 7 lb.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C 1.

13,455. "Hammer interrupters for radiotelegraphy." SVENSKA AKTIEBOLAGET GASACCUMULATOR. August 19th. (Sweden, September 14th, 1917.)

13,459. "Electric burglar-alarm systems." T. GUNN, LTD., & H. J. CRIBBLES. August 19th.

13,473. "Regulators for dynamo-electric machines." REMY ELECTRIC CO. August 19th. (U.S.A., July 19th, 1917.)

13,474. "Regulating devices for dynamo-electric machines." REMY ELECTRIC CO. August 19th. (U.S.A., August 18th, 1917.)

13,476. "Electrical ignition systems." A. PRESS. August 19th.

13,477. "Energiser circuits." A. PRESS. August 19th. (U.S.A., August 15th, 1917.)

13,493. "Combined electric switch and starter panels." M. PEDDER AND A. PERRY. August 20th.

13,499. "Directive wireless telegraphy." E. R. CLARKE. August 20th.

13,510. "Signalling on primaries of telephone or telegraph phantom circuits." E. S. RITTER. August 20th.

13,518. "Alternating-current generators." T. F. WALL. August 20th.

13,520. "Combination night-light and electrical heating apparatus." T. G. F. JORGENSEN. August 20th. (Norway, August 20th, 1917.)

13,521. "Ignition devices." E. C. R. MARKS (Splitdorf Electrical Co.). August 20th.

13,534. "Vibrating decelerating relays." V. BREEZE AND A. WEST & CO. August 20th.

13,536. "Method of determining direction of distance sources of electromagnetic wireless radiation." F. ADCOCK & R. E. ELLIS (Adcock). August 20th.

13,539. "Pocket or portable electric lamp." I. CHKLIAR, W. KING (Chkliar & Theodor) AND B. THEODOR. August 20th.

13,544. "Dynamos for electric arc welding." F. C. GIBBONS. August 21st.

13,549. "Electrical fuse distribution box." R. T. NORTON & A. C. ROBINSON. August 21st.

13,578. "Automatic telephone systems." J. H. TAYLOR. August 21st. Ges. L. M. Ericsson & Co.). August 23rd.

13,583. "Magneto-electric machines for ignition in internal-combustion engines." BRITISH L. M. ERICSSON MANUFACTURING CO. & A. BROOKS. August 21st.

13,607. "Treating gases and vapours electrically." W. T. HOOPNAGLE. August 21st.

13,614. "Operating distant devices by electro-magnetic waves." A. G. BLOXAM (Russische Akt. Ges. L. M. Ericsson & Co.). August 21st.

13,633. "Apparatus for sending messages in the Morse alphabet." H. O. ANDREWS & RODNEY ENGINEERING CO. August 22nd.

13,642. "Cleaning metals by electrolysis." I. JASCOWITZ. August 22nd.

13,653. "Electrically-heated balloons." J. W. MEEK & F. J. TURQUAND. August 22nd.

13,691. "Ignition mechanism of internal-combustion engines." W. G. IKIN. August 22nd.

13,698. "Electrical device for automatically indicating correct temperature of electrically-heated steel before quenching to obtain correct hardening thereof." H. ALEXANDER, A. IMBERY & W. T. VINT. August 22nd.

13,717. "Electric adapters, &c." N. MCLEAN. August 23rd.

13,722. "Trip switches for controlling electric circuits." P. S. BROOK AND J. A. HIRST. August 23rd.

13,733/4. "Electric heaters." J. R. QUAIN. August 23rd.

13,752. "Alternating current dynamo-electric machines." BRITISH THOMSON-HOUSTON CO., F. H. CLOUGH, H. W. TAYLOR & F. P. WHITAKER. August 23rd.

13,756. "Electrical instruments for signalling on railways." F. W. LEAKE AND TYER & CO. August 23rd.

13,757. "Means for indicating corrections to be applied for deflection or elevation when firing at moving targets." A. G. BLOXAM (Russische Akt. Ges. L. M. Ericsson & Co.). August 23rd

13,758. "Automatic telephone systems." J. H. TAYLOR. August 21st.

13,767. "Electrical relays." C. B. HARLOW. August 23rd.

13,791. "Selecting-switches for automatic telephony systems." AUTOMATIC TELEPHONE MANUFACTURING CO. & J. SAVIN. August 24th.

13,810. "Electrical synchronising gear for aeroplane guns." N. PENTY. August 24th.

PUBLISHED SPECIFICATIONS.

1917.

2,740. ELECTROSTATIC MACHINES. D. K. Morris. February 24th, 1917. (117,821.)

5,693. MAGNETOMETERS FOR MEASURING WEAK MAGNETIC FIELDS. J. L. Valente de Cruz. April 23rd, 1917. (Cognate application, 7,444/17.) (117,825.)

9,312. ELECTROMAGNETIC LOCK-OUT SWITCH. A. West & Co. and R. P. Bossom. June 28th, 1917. (Cognate application, 13,616/17.) (117,830.)

10,952. ELECTRIC DIAPHRAGM HORNS. E. C. R. Marks (Sparks-Withington Co.). July 30th, 1917. (117,838.)

11,289. SELF-REGULATING DYNAMOS. A. H. Midgley and C. A. Vandervell and Co. August 4th, 1917. (117,849.)

11,399. AUTOMATIC REGULATOR FOR ELECTRIC MACHINES. J. Gehrig. August 8th, 1917. (116,853.)

12,114. COOLING APPLIANCES FOR SPARKING PLUGS OF INTERNAL-COMBUSTION ENGINE CYLINDERS. J. Pomeroy & F. L. Varty. August 23rd, 1917. (117,859.)

15,394. SYSTEMS OF ELECTRIC TRANSMISSION. British Thomson-Houston Co. (General Electric Co., U.S.A.). October 23rd, 1917. (117,867.)

16,339. DEPOSITION OF METALS BY ELECTROLYSIS. M. A. Bolton & A. Walker. November 8th, 1917. (117,872.)

1918.

262. ELECTRICALLY-OPERATED DIAPHRAGM HORNS. W. H. Petersen and Allmanna Svenska Elektriska Aktiebolaget. January 4th, 1918. (117,881.)

Decimal Coinage.—A Royal Commission has been appointed to consider and report on the question of placing our currency on a decimal basis and as to whether, if a change is advisable, the Decimal Coinage Bill introduced into the House of Lords by Lord Southwark should be adopted. Lord Emmott is chairman. Communications may be addressed to "The Royal Commission on Decimal Coinage," Treasury Chambers, S.W. 1.

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THE

ELECTRICAL REVIEW.

VOL. LXXXIII. SEPTEMBER 13, 1918. No. 2,129.

ELECTRICAL REVIEW.

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NOTICE TO READERS.

In view of the Order recently issued by the Paper Controller, readers are urged to place a definite order with their newsagents for regular supply of the ELECTRICAL REVIEW weekly. In the event of difficulty arising in so doing, a subscription rate order should be forwarded direct to these offices, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

PROGRESS OF THE I.E.E.

THE *Journal* of the Institution of Electrical Engineers for July, which has just been issued, contains in its "Institution Notes" evidence of the continued activities of the Council during the recess. The most important matters before the electrical industry at the moment are the Board of Trade Reports on Electric Power Supply and on Electrical Trade after the war, and the Council has appointed a Committee to report on them, which will include representatives not only of all the more important bodies directly connected with the industry, but also of some whose connection is indirect. The titles of these bodies are given elsewhere in our columns, and in view of the breadth of selection which has been exercised, we are somewhat surprised to note the omission of certain others whose claims, as measured by the importance of the interests which they represent, are at least of equal weight. For examples, we may name the Association of Consulting Engineers, the British Engineers' Association, the Electrical Contractors' Association, and the Faraday Society. We by no means favour the formation of large and unwieldy Committees; but we are puzzled to know why some are taken and the others left. The Committee as constituted will include representatives of private interests—the British Electrical Federation and Edmundsons' Electricity Corporation—on the same basis as the I.M.E.A. and the B.E.A.M.A. But why these two? and if these, why not other important companies?

In this connection we may also draw attention to the Whitley Report, which has been generally accepted almost throughout the industrial world: while there is no obligation resting upon the Council of the Institution to take that Report into consideration in appointing the Committee, would it not be an appropriate occasion on which to put in force the spirit of the recommendations of the Whitley Committee, by inviting the Associations which represent the subordinate ranks of the industry to nominate representatives? We have in mind, in particular, the Electrical Power Engineers' Association, the formal recognition of which by the I.E.E. is recorded in the *Journal*, and the Electrical Trades Union. It is well known that the latter body, to put the matter in a mild form, is not in good odour with the electrical engineering profession, for various reasons; but we submit that that is not an adequate ground for ignoring its existence. The closer association of employers and employed, of engineers and operatives, is now one of the cardinal principles of British industrial policy; to talk about it whilst refraining from action is not merely evidence of insincerity, but also a decidedly harmful course of procedure, and we suggest that this important Committee is precisely one of those bodies upon which Labour is justly entitled to claim representation.

Another interesting item in the "Notes" relates to the promotion of the Provincial branches of the Institution from the rank of "Local Sections" to that of Territorial "Centres." We are not sure that the term is quite the best that could have been selected: while we do not suppose, in this connection, that a centre is a point within a circle, from which every part of the circumference is equidistant, it is rather startling to read "The Irish Centre to include the whole of Ireland." We grant, however, that this definition is in perfect harmony with the traditions of the Sister Isle. But in spirit this important step commands our whole-hearted approval; by their efficiency, ability, and energy the quondam Local Sections have abundantly

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demonstrated the justice of their claim to rank on a footing of equality with the parent stem, and we congratulate them upon the recognition of this fact. Privileges should carry with them corresponding responsibilities, and we are glad to see that this is also recognised in the decision of the Council to delegate to the Territorial Centres some of the functions hitherto exercised only by the Council itself. Incidentally we may recall a one-time agitation for the constitution of that which was known as "The Institution"—namely, the membership attending the London meetings — as the "London Local Section": it appears to us that the new system of nomenclature greatly strengthens the arguments in favour of this course, and we venture to suggest that the "Metropolitan Centre" be added to the list, as *primus inter pares*.

No reference is made to the status of the foreign and colonial branches of the Institution; surely something might be done to develop these on similar lines.

It is interesting to compare the development of the Institution and its sturdy off-shoots with that of the British Empire, as accelerated by the war. In both cases we find a parentage of locality, but a brotherhood of personnel, and just as the Dominions, growing in strength and influence, have advanced from the position of dependencies governed from headquarters, first to that of limited self-government, and finally to that of complete autonomy, together with an increasing representation in the Grand Councils of the Empire, so has the Institution by similar stages evolved an organisation on lines which form a remarkably close analogy with the Imperial system. The driving force in each case has been the pressure of public opinion, and thus the climax constitutes a triumph for those democratic principles the final vindication of which is the supreme war aim of the Allied Nations.

Apropos of nothing in particular, the Council tacks on to its resolution a clause relating to the co-operative formation of local Engineers' Clubs, which we are sure will commend itself to the members. We note with pleasure, too, that at the initiative of the I.E.E. a "Commercial Electrical Development Committee" has been formed, which is a separate organisation independent of any other body, and will immediately consider the development of electrical cooking and heating. This is an excellent beginning; but we hope that, as we infer from the title of the new Committee, it is only the beginning, and that the Committee will take a vastly wider view of its functions than is suggested by its nominal *raison d'être*. We hope, in fact, that we see here the germ of a new and permanent "Industrial Committee"—of an organisation which will eventually fill those gaps which are still so plainly visible in our electrical organism, and will do for the electricity supply industry in this country what the Society for Electrical Development and the National Electric Light Association have done for the United States. We shall be glad to know in due course the constitution of the new Committee, and the programme of operations which it proposes to carry out; and in the meantime, we congratulate the Council on the getting under way of developments which, though few in number, are of material importance, and must have involved a very considerable amount of labour and negotiation.

Empire Communications.

The appeal of the Canadian editors for the Empire Press Union to use its influence to secure better, quicker, and cheaper facilities for the dissemination of news throughout the Empire (Elec. Rev., July 26th, p. 74), has now been endorsed by their *confrères* of the Australian, New Zealand, and South African Press. The visit of these Colonial and Dominion leaders of thought to this country is an event of the first importance, for it has enabled them to secure at first hand, from personal observation, information concerning the munitions activity of the Mother Country, the readiness of the Fleet for all emergencies, and the operations at the battle front "over there." Something was known of these achievements and of the spirit of the Mother Country through the restricted service of news supplied over the cables; but it has required this actual visit for the whole story to be fully understood. They will return to our kith and kin to tell them many things they ought to know already, but do not. Naturally, it has been impossible to publish either here or in the Colonies, all that the newspaper-man considers valuable "copy," but, apart from restrictions which have necessarily to be imposed in the interests of national security, there are other obstacles standing in the way of the circulation of information throughout the Empire. Such circumstances quite reasonably reinforce the demand that has been made again and again, in the interests of Empire life and its fullest development, for ampler facilities to be made available for telegraphic transmission of news. Nothing can do more to secure co-ordination of thought, unity of aim, interest and action, speedy conduct of commerce, and utilisation of Empire resources, than the generous provision of cabling or wireless facilities. Some of the Australian visitors, while paying well-merited compliments to the service afforded by the British cable companies, are emphatic in their references to the insufficiency of the existing cables, and want at least, and soon, the duplication of the Pacific cable. They also find the land-line charges in Australia so high as to prevent the small, and more or less distant, country papers from publishing much information. Probably this part of the handicap forms a domestic problem of their own, and one for which they can find a remedy; it is hardly a matter which we at Home can materially influence. The same remark applies to the inefficient service between their big cities, where messages, it seems, have been, during the war, taking twice the usual time owing to congestion and general inefficiency. Others of our visitors are hopeful concerning the possibilities of wireless telegraphy, while some authorities ask for two new cables across the Atlantic, one across the Pacific, and the use of wireless telegraphy up to the fullest limit of scientific achievement. There does not seem to be unanimity concerning whether facilities should be State-owned, but there is a general demand that the information communicated over them shall not be State-controlled. This view is extremely important, for it is most undesirable that intelligence transmitted from Home should be under suspicion as being subject to Government colouring. A spoon-fed Press at any time is nauseous to reputable journalists, and it is entirely opposed to democratic tendencies. Censorship there must be up to a point under conditions of warfare such as now prevail, but after the war the Press, both Home and Colonial, resist to the death any effort to shackle it—if such an effort there be. It has been pointed out by an editor from South Africa that any cable service conveying news which is to be consumed by the native races must be operated on a strictly impartial basis. Conceivably in some such cases even the statement that such a service was entirely British would not carry conviction to the native mind—it might even carry suspicion with it.

The more the subject of Empire telegraphic communication is studied and discussed the more important does it prove to be, calling for large enterprising and statesmanlike policy in ensuring, as quickly as possible after the war, the fullest, cheapest, and most expeditious means of keeping the whole of our great Family in continuous touch.

In the *Times* Trade Supplement for September Mr. Llewellyn Preece has an article on "An Imperial Cable: a True Bond of Commonwealth," in which he emphasises the importance of a full supply of Press news to all the Dominions as a means for enabling the separated peoples to enter into real sympathy with each other. He advocates "one long electric girdle round the globe" as the most economical system, and discusses the questions of cost and charges in some detail. Apparently he does not regard a wireless system as a practicable proposition, compared with cable, in respect of capacity, speed of transmission, accuracy or reliability, but he points to its being well within the realms of possibility that the speed of signalling over cables may be increased. The article is well worthy of study by those who are taking an interest in the subject. Mr. Preece remarks that if the British Empire is to be transformed into a true league of independent nations, it is above all things essential "that means shall be provided which will enable these several nations to work together harmoniously, and to ensure that intimate intercourse is established between them all. Interchange of news must far exceed that possible at present."

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British Science.

The exhibition of British scientific products at King's College, which closed on Saturday after four weeks' run, proved remarkably successful, in view of the general belief that the English people had no interest in science: more than 30,000 persons paid for admission, and after a few days' experience it was found desirable to extend the hours of opening and to keep the doors open on Saturday afternoons. The exhibition was also visited by many men in uniform, who were admitted free of charge.

Prof. R. A. Gregory, chairman of the Organising Committee, expressed some disappointment that the Government had taken no official notice of the exhibition; we sympathise with him and the Committee, but are not in the least surprised. What else can be expected of a Government composed of men who know nothing of science, or, at any rate, knew nothing until it was forced upon their attention by the war? The fight is by no means over yet—the fight to secure adequate recognition for scientific work, to drive home the lesson that without science the nation cannot prosper, and to compel the educational authorities to encourage and develop the teaching of science to the utmost, in order that there shall eventually be an adequate supply of trained men to direct our industries—and our Government—on scientific lines.

We are glad to know that it is proposed to hold an exhibition of British science and invention annually in future, and trust that the idea will be carried out.

Railway Electrification.

Many causes have contributed in recent years to the development of a strong movement towards the electrification of steam railways in all parts of the world, and while, no doubt, little can be done towards this end during the war, there is every reason to believe that when peace returns this will become one of the most important and pressing questions that will then arise. Amongst the factors which have influenced the growth of opinion in this direction may be cited the urgent necessity of economising fuel, the scarcity of labour, the dearth of raw materials, and the need for improvement in transportation facilities.

In countries which possess but scanty fuel resources, or none at all, such as Switzerland and Italy, but which are blessed with an abundance of natural water power, the adoption of electric traction is obviously inevitable, and as we have noted from time to time, plans are being projected on an enormous scale to carry out schemes of a most comprehensive nature. Proposals have been submitted by the managers of the Swiss Federal Railways to the Council of Administration which involve an expenditure estimated at from £120,000,000 to £160,000,000, to be spread over a period of 30 years. In Italy preparations are under way for the electrification of the whole of the railways in the north, together with the supply of electricity for all industrial purposes on a gigantic scale. France, like Italy, already possesses a considerable mileage under electric traction, and contemplates important developments in this respect, while Norway and Sweden have carried out noteworthy schemes, and have large projects in view. In the United States we find the greatest development, for there electric traction has been put to the severest tests in main-line operation, and has been proved capable of handling the heaviest loads on stiff gradients with efficiency and reliability far in advance of steam haulage.

In all these countries large supplies of water power are available, and the arguments in favour of electrification are irresistible. But even where fuel is the only source of electric power, a very strong case has been made out for the conversion of the railways; it has been proved beyond question that very great economies of fuel result from the substitution of electric for steam power, that the number of electric locomotives required to maintain the service is far less than in the case of steam, and that important economies are made also in operating and maintenance staff and in the cost of repairs. The possibility of recuperating energy that would otherwise be expended in braking on long gradients has also been demonstrated in actual practice, and the greatly-increased traffic which can be handled on electric railways is a powerful argument in favour of the newer system.

The fact that, in the words of an American authority, "to-day electrified installations make use of the very heaviest high-speed, heavy-tonnage equipment in the world," speaks for itself: the same authority remarks that "the unquestioned reliability of this form of motive power has been proved in the severest service"; and it is reported that Mr. McAdoo, Secretary of the U.S. Treasury and Controller of Railways for the War, is seriously considering the idea of electrifying the whole of the railways of the country.

In Austria, the Ministry of Railways proposes to utilise all the water power available in the Alpine district and in Dalmatia, and to electrify as much as possible of the railways south of the Danube, on the single-phase system, which is recommended on the basis of German experience.

In this country such water powers as are available are too small and too remotely situated to affect the railway problem, except in a few localities; but none the less, the matter is of pressing urgency, for coal is at a premium and must be economised with the utmost care. Fortunately, in no country in the world, with the possible exception of Belgium, is the traffic so dense as it is in England, a condition particularly favourable to electric traction; the experience gained on every section of railway electrified up to the present has strengthened the case for electricity, and the trend of public opinion has set strongly in that direction. There is, therefore, every reason to anticipate that the matter will be seriously taken up by the authorities directly conditions permit of it, and main-line traction will soon become one of the most important functions of electricity in this country.

Coal Troubles in Spain.

According to information to hand from our Special Correspondent in Spain, the question of coal supply and distribution is again acute in that country. In Madrid the dry season has reduced the amount of electrical energy available from the hydro-electric stations, and the stand-by steam plants have been left practically without coal. In their endeavours to economise fuel the Madrid authorities discontinued the supply of energy during the early hours of the morning. This resulted in the dislocation of the production of the daily newspapers and the paralysis of many small services, both public and domestic. The general chorus of protest has forced the authorities to grant a continuous supply once more, and the Commission of Supply is now instituting a system of coal rationing which will be effective throughout the country. Naval and military factories, electric supply stations, and gas works will be granted all the fuel they need, and the local Committees of Supply will endeavour to ensure a full supply to private factories and domestic users.

The official figures of the production of Spanish coal mines during 1917 have just been published. The total production was 5,972,474 metric tons, of which 310,914 was anthracite. The output during preceding years was as follows:—

1913	4,292,522	metric tons.
1914	4,424,439	" "
1915	4,686,723	" "
1916	5,588,674	" "

The *Gaceta de Madrid* of August 18th publishes an order decreeing that in all the great centres of electrical consumption there must be committees established composed of producers and consumers, and presided over by the Governor of the Province. These Committees will make an inventory of the amount of energy used, will make reports to Madrid on the subject of local distribution and consumption, and will also propose limitations and restrictions.

In Alicante it has been decided to suspend the supply of electricity between the hours of 3 a.m. and 6 a.m., and again from mid-day till 2 p.m. In Valencia various trade unions have threatened to bring about a general strike in the city in the event of any restriction of supply being enforced.

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USEFULNESS OF LOG. PAPER.

By A. B. EASON.

This article is written to emphasise the value of using logarithmically-ruled paper in plotting the results of tests, and in doing various calculations. Attention is called to such paper because one so very seldom sees it used for graphs in English technical journals and scientific reports. In American and German journals its use is more common.

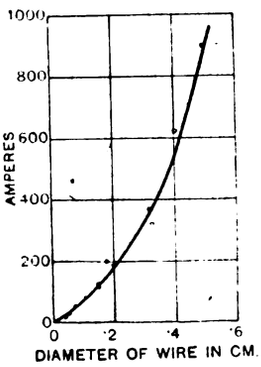

Fig. 1.—Amperes to Fuse Copper Wires in Enclosed Fibre Tube Fuses.

There is little doubt that, so far, its value is either not appreciated by some engineers, or they are not aware of its existence.

For instance, in Clapham's "Arithmetic for Engineers," published in 1916, there is a detailed description of how to plot curves on plain squared paper; but log., polar, and

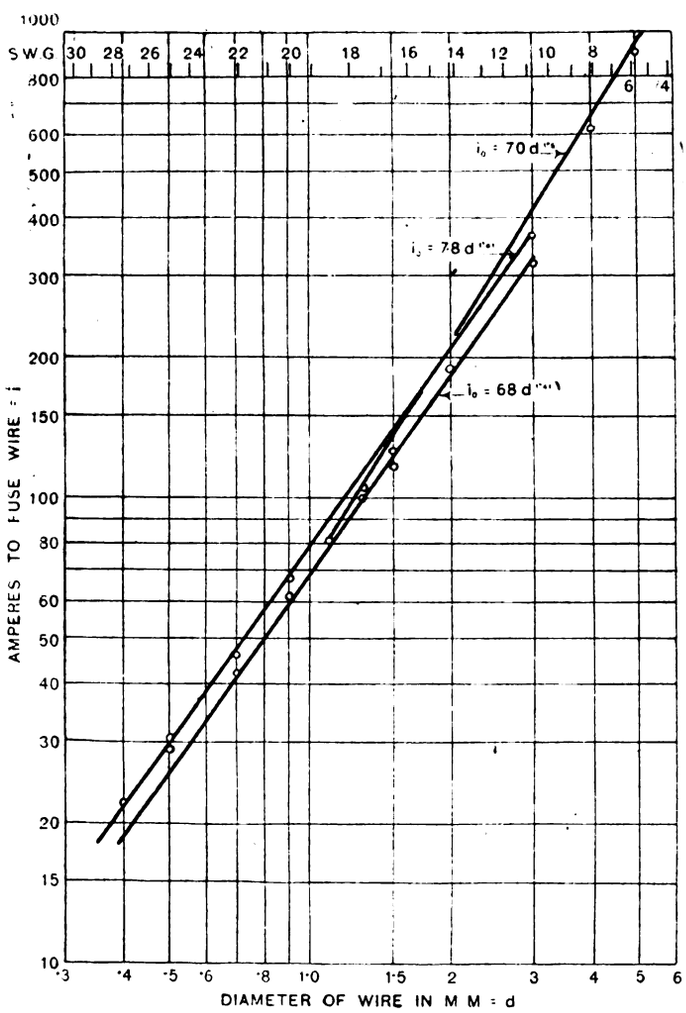

Fig. 2.

co-ordinate papers are not mentioned. By "log. paper" is meant graph, or scaled, paper with the rulings proportional to the logarithms of numbers, as on the slide rule; the ruling may be arithmetical in one direction and logarithmic in the other, or it may be logarithmic in both directions.

The advantages of log. paper over plain arithmetic-squared paper are twofold.

(*a*) Quantities ranging from 1 to 100, or to 1,000, can be plotted, and both 1 and 1,000 can be read to the same degree of accuracy; on plain paper, if quantities, say, 500 to 1,000 are shown, it will be impossible to read quantities of the order 1 to 20 or so. Compare fig. 1, which will not show accurately the fusing current for a 0·4 mm. wire, with fig. 2, which shows it to be 22 amperes.

(*b*) In many cases, graphs which are curved on plain squared paper become straight lines when plotted on log. paper; this occurs when the graph represents an equation, $y = A x^n$. A curve $y = A e^{nx}$ will be represented as a straight line on paper ruled arithmetically one way and logarithmically the other way. It would take a considerable time to find the law of the curve in fig. 1, but the law is readily visible in fig. 2.

Consider some examples plotted on each type of paper. I have calculated the probable normal fusing currents for copper wires in enclosed, or cartridge, fuses. Various sizes of fibre case and various lengths were chosen, and the different values of the fusing currents are shown in fig. 2 for any particular diameter: the lower fusing current is for the larger fibre case, and the upper one for the smaller case. The probable law which the fusing currents follow is marked on fig. 2; this could not be so easily done by inspection of fig. 1. Another example is given in figs. 3 and 4, which show the heat generated in telephone switchboard cables when traversed by various currents. The laws of heating

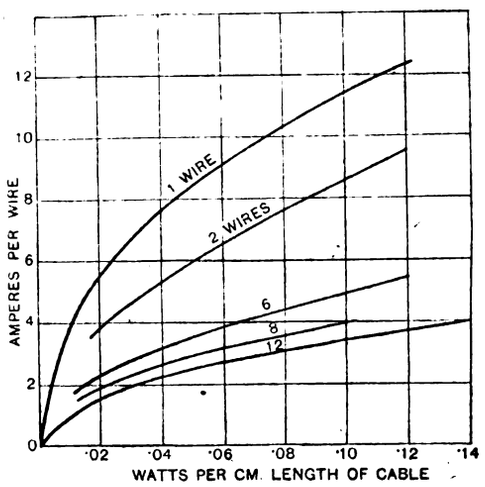

Fig. 3.

cannot be deduced easily from fig. 3, but fig. 4 shows—Watts per cm. = constant (ampere)$^{2\cdot2}$ = $A n i^{2\cdot2}$, where n = the number of wires carrying current. Also—

10,000 A = 4·8, 5·02, 5·2, 5·24, 5·63, 5·7,
when n = 1 2 4 6 8 12.

For any number of wires exceeding 12 one may say that—

Watts per cm. = 0·00057 $n i^{2\cdot2}$.

One can easily interpolate the values for 11, 10, 9, 7, 5, 3 wires by drawing straight lines on fig. 4; it would take much longer to draw in suitable curves in fig. 3.

If no printed log. paper is available, and one has results which might usefully be plotted on log. paper, one can plot the numbers on ordinary closely-ruled squared paper, using one's slide rule as the scale; if the numbers are to be plotted with log. scale both ways, this is a poor makeshift. Paper could also be ruled locally, using either the slide-rule divisions or by direct calculation from the values of the logarithms.

In various reports in English technical journals, one comes across graphs plotted on plain squared paper, but the logs. of the quantities are plotted instead of the quantities: this gives exactly the same straight line or curve as would be given on log. paper; but the meaning of the graphs are not so clear as when the values of the numbers are placed against the scales. Further, if the curves are being used, one must have log. tables or the slide rule to convert the points on the curve to actual quantities.

Now as to the method of getting log. paper. There are

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at least two kinds of log. paper on the market, viz., with rulings 1 to 10, and with rulings 1 to 100. Larard and Golding in "Practical Calculations for Engineers" (Griffin, 1914), mention the first type of paper, and show how numbers varying between, say, 50 and 350 can be plotted on such paper by dividing them all by 50, so as to bring the variations between 1 and 10; it is far preferable, however, to plot the numbers directly, viz., on paper which has rulings

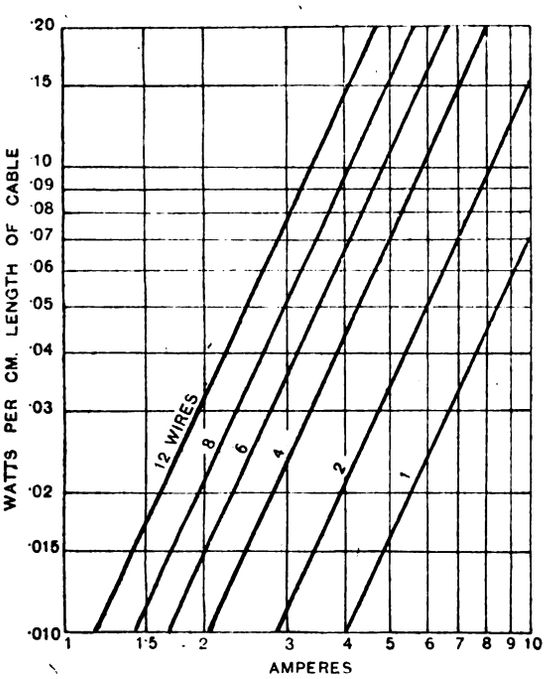

FIG. 4.—Watts Generated per cm. in 21 or 84-wire (23 S.W.G.) Cable by various currents circulating in various numbers of wires as shown. Watts = (constant) (ampere)$^{2\cdot2}$.

showing 50, 100, up to 1,000; to do this one must have paper ruled 1 to 100, or 10 to 1,000; then values of the graph can be read off directly without having recourse to any multiplier. Log. paper ruled 1 to 10 is obtainable from Pye & Co., Cambridge, and from Mallandain, 51, Cheapside, London; paper ruled 1 to 100 is obtainable from A. G. Thornton, Ltd., King Street, Manchester. There may be other sources of supply, and, if so, I should be glad to hear of them.

NEW ELECTRIC FURNACES.

AN article by Messrs. H. W. GILLETT and A. E. RHOADS in the *American Machinist* of August 24th, 1918, describes a new type of electric-arc furnace developed by metallurgists of the United States Bureau of Mines.

With the huge tonnage of brass required for war purposes, the use of the small units—averaging 200 lb. per charge—in which crucible melting is done by the brass rolling mills is an anachronism. Besides the avoidance of crucibles and the ability to melt larger charges, electric melting (in a suitable type of furnace) decreases the loss of metal by oxidisation and volatilisation, prevents the taking-up of sulphur from the fuel, gives better and more healthful working conditions, and has many minor advantages, such as freedom from handling and storing fuel and ash. Electric furnaces give crucible quality of metal without using crucibles.

However, not every type of electric furnace can be used for brass melting. Brass is made up of copper and zinc, and zinc is volatile at brass melting temperatures. The direct-arc type of electric furnace used for steel melting, such as the Heroult, can be used only on bronzes practically free from zinc, because of the high local temperature of the melt under the arc.

Indirect arc furnaces, such as the Rennerfelt, can be used on brasses carrying up to about 20 per cent. zinc, but are not suitable for ordinary yellow brass on account of the formation of a superheated layer on the surface of the melt directly under the arc, and the resulting volatilisation of zinc.

Induction furnaces of the ordinary horizontal-ring type, like the Rochling-Rodenhauser, cannot be used on brass or bronze because the high electrical conductivity of these alloys requires a secondary current so high that the "pinch effect" causes rupture of the secondary ring.

Hence it has been necessary to develop types of furnaces radically different from those in use for steel in order to meet the requirements of brass.

At the Chicago Bearing Metal Co.'s works two 1-ton Snyder and two 1-ton Rennerfelt furnaces are melting bronze for railroad bearings, high in lead, but practically free from zinc. The metal losses are not much reduced from previous practice in crucibles and open-flame oil furnaces, but the furnaces are making savings in melting cost as compared with either the crucible or the open-flame furnaces under present conditions.

The Philadelphia Mint is melting nickel and coinage bronze in a 1,000-lb. Rennerfelt furnace. The Gerline Brass Foundry Co. melt Monel metal, red brass, and brass containing up to about 20 per cent. zinc in an 800-lb. Rennerfelt.

The Baily furnace uses a single-phase granular resistor, the heat from which is reflected down on to the hearth from the

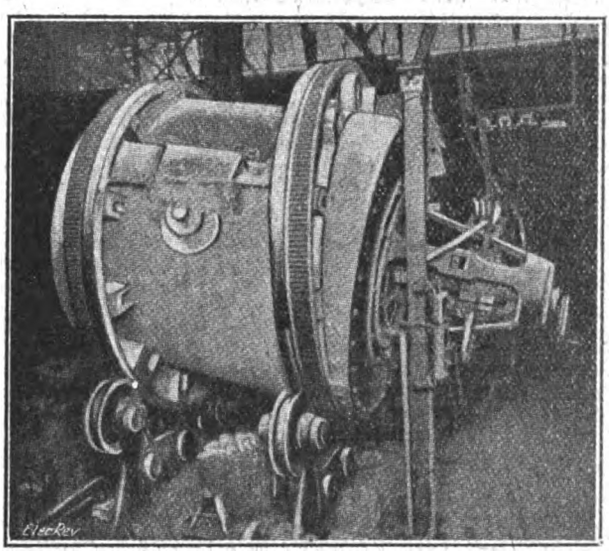

FIG 7.—ROCKING ELECTRIC BRASS FURNACE.

roof. It takes charges of about 1,000 lb. This furnace is applicable to alloys of any zinc content, reduces metal losses, avoids crucibles, and gives good working conditions. The main drawback of this type of furnace is that the source of heat is not close to the melt, and the heat must be reflected down from the roof.

The Ajax-Wyatt furnace is a single-phase induction furnace in which the secondary ring is in the form of a loop below the level of the hearth proper, so that the hydraulic head of the metal in the hearth opposes the rupturing effect of the "pinch" force, thus avoiding the troubles that make horizontal-ring induction furnaces inapplicable to brass.

The metal heated in the secondary loop is constantly ejected at one part of each opening from loop to hearth, and colder molten metal drawn in at another part of the opening. These fountains of hot metal issuing from the resistor melt the charge in the hearth. The constant circulation of metal is a most desirable feature, and gives a product of remarkably uniform chemical composition.

Because of the compactness of the furnace, the generation of heat within the metal itself, and the stirring action, vertical-ring-induction furnaces are extremely efficient as regards power consumption. The power factor, in the sizes so far built, is satisfactory. The furnace must be started with a charge of previously melted metal, and sufficient metal to fill the loop must be retained when pouring. The metal in the loop must never be allowed to solidify, or the lining will be ruined. These facts make it difficult to change from one alloy to another, and require that the furnace be run 24 hours a day, or else receive enough power at night to keep the metal in the loop fluid. No lining has yet been found that will withstand alloys containing over 3 per cent. of lead and the furnace has been developed mainly for yellow brass. The furnace saves zinc, avoids crucibles, and shows so low a power consumption on 24-hour operation that it can doubtless be used to advantage in rolling-mill practice, even under normal prices of fuel and crucibles.

Besides the four types mentioned above, each of which has found commercial use where conditions were suitable, there are four other furnaces that have reached a semi-commercial stage, but are still under experimental development.

None of these types seems quite fitted to that common set of conditions where a furnace may be called upon to melt successive heats of alloys differing widely in composition, to handle both alloys free from zinc and those high in zinc, and to operate cheaply on a 9- or 10-hour day.

In its study of electric brass melting during the past five years, the Bureau of Mines has developed a rocking-type of furnace, which may perhaps help to fill this gap.

In the ordinary indirect-arc type of furnace, the heat is applied above the melt, and as hot metal is lighter than colder metal, there is little circulation in the bath. In an alloy high in zinc the surface will reach the boiling point of

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the zinc while the bottom is scarcely melted. Such heating creates a high pressure of zinc vapour within the furnace, so that if it is not tightly closed zinc is lost continually. If the furnace is sealed tight, the pressure may even blow out the roof or door. In case the furnace holds tight and the pressure is not relieved till the spout is opened for pouring, a long hissing stream of zinc vapour then shoots out, burning in the air. This local overheating is the cause of the failure of the indirect-arc furnace to handle alloys high in zinc without large metal losses

The obvious way to overcome this trouble is to stir the melt so vigorously that the temperature of the melt is practically uniform, and the superheating of the surface prevented. The most practical way to stir the melt is by the principle of the cement-mixer, by turning the furnace bodily, so as to stir the contents thoroughly while being heated. Constant rotation of a cylindrical furnace placed more or less horizontally, but preferably at a slight angle with the horizontal to produce endwise motion of the melt during rotation, with electrodes entering at the ends of the drum and an arc struck between the electrodes, should not only stir the charge thoroughly, avoid surface over-heating, and thus prevent zinc losses, but should also give a well-mixed alloy. By washing the walls with metal the heat stored in the walls and roof should be largely taken up in the metal instead of passing out. The power consumption should therefore be low. As the walls are washed with metal their temperature can rise but little above the temperature of the metal, which should give a good life of lining.

Instead of rotating the furnace through a complete revolution, which would involve difficulty in keeping the metal out of the joints between the door and the door opening, as this opening should be on the circumference of the drum rather than on the end, and in making brush contacts to the electrodes, it appears simpler to rock the furnace back and forth so that the molten charge just fails to reach the door at either end of its rocking angle.

Laboratory tests having demonstrated the probable usefulness of this type, a furnace of commercial size was designed. The Detroit Edison Co. refined the design, made the working drawings, constructed and erected the furnace, which is shown in the accompanying illustration.

The drum is 5 ft. in diameter by 5 ft. long. The lining is 12 in. thick, and consists of Sil-o-cel brick on the outside, special heat-insulating brick in the middle layer and corundite brick (a very refractory firebrick high in Al_2O_3) as the actual hearth lining. The hearth is 3 ft. long by 3 ft. in diameter, taking charges of 1,300 lb. and upwards. The electrodes are 4 in. diameter graphite, threaded for continuous feed, and are adjusted by screw-operated supports of the lathe-slide type. Single-phase, 60-cycle current, stepped down to 120 to 130 volts, is used, 30 K.V.A. being available. Electrode adjustment is by hand, and to stabilise the arc an external reactance is used which brings the power factor of furnace plus reactance, measured at the furnace switchboard, to about 0.85. The open-circuit voltage falls to about 106 to 116 volts under load. The current varies between 1,000 and 2,000 amperes, 1,650 amperes being about the average. The power input can be varied by altering the length of the arc, and runs from 100 to 200 KW., averaging about 165 KW.

The flexible leads and the water hose for electrode cooling are given slack to allow of rocking the furnace.

The rocking of the furnace during melting is done automatically by means of a control device which can be set to give a "safe rock" of 80 deg., the limit of motion being such that the metal just does not run into the spout. After the charge has begun to melt, the "safe rock" is started. It is called the "safe" rock because the angle is such that solid charge will not fall on the electrodes and break them. A complete oscillation on safe rock takes 13½ seconds.

During the safe rock the solid metal is washed about in the molten part of the charge, and is tumbled over, so that fresh surfaces receive direct radiation from the arc. As melting goes on, the rocking angle is increased by turning the handle of the control device from time to time, until, when the metal is all melted, the furnace is on the "full rock" of about 200 deg. On full rock the metal washes the whole circumference of the hearth save the height of the charging door and a few inches above and below it, so that metal does not splash into the door joint. A complete oscillation takes 33½ seconds.

The reversal of the 5-H.P. motor at either end of the rocking angle is done by contactors, operated by solenoids actuated by the contacts on the control device.

When it is desired to depress the spout past the limiting point of the automatic rock, for pouring, the control device is switched out and the solenoids are operated by a reversing switch.

From 102 tons of metal melted in strict comparison with coke-fired crucible furnaces, the rocking electric furnace produced 1.8 per cent. more metal from the same charge than did the coke fires. The alloys melted ran from 90 per cent. to 66 per cent. copper, 1 per cent. to 9 per cent. tin, 1½ per cent. to 26½ per cent. lead, 0 to 30 per cent. zinc.

There was no difficulty in draining the metal completely from the hearth, and alloys of different composition could be made one after the other without contamination by metal remaining from the previous heat.

On the basis of power read on the high-tension side of the transformer, the consumption was, with 10-hour operation, 336 KW.-hour per ton, on red brass poured at 1,180 deg. C. average temperature. For 24-hour operation the figure is about 260 KW.-hour per ton for red brass.

The electrode consumption was 1½ lb. per ton, equivalent to about 40 cents at present electrode prices.

As near as can be estimated, the relining cost for labour and material should be well under 50 cents per ton with a corundite lining when melting red brass poured at 1,150-1,200 deg. C. If only yellow brass, poured at 1,100 deg. C. is melted, the lining cost will be still lower. If very hot bronze is to be produced, say at 1,300 deg. C., the roof and upper portions of the ends should be lined with zirkite bricks.

Accurate temperature control is very easy in the rocking furnace, since at the end of a heat, after the "full rock," the walls are no hotter than the metal, and there is no heating-up of the charge from hotter roof and walls when the power is shut off, as is the case with those types of furnace where the heat is reflected downward from the roof. After cutting off the arc, the temperature falls very slowly, about 2 or 3 deg. C. per minute. By running the arc a minute or so every 10 or 15 minutes, a charge can be held at pouring temperature for an indefinite period.

One man can operate the furnace, with the aid of a helper while charging. Were automatic electrode control used, which could easily be done, one man could probably attend to two furnaces.

The output per man-hour was greater from the rocking furnace than from the coke fires. The working conditions are much less severe and more healthful with the electric furnace than with the coke fires, and a man of less rugged physique than is required for coke fires can readily operate the rocking furnace.

Various modifications and improvements in design are being incorporated in other furnaces of this type now being built for Detroit firms.

Comparing the cost of melting on a 10-hour schedule in the rocking electric furnace and in the coke fires of the plant at which the test was made, the sum of the cost per ton of charge for electric power, interest and depreciation, electrodes, linings, and for heating ladles, is just about one-half of the cost per ton of charge of the single item of crucibles at present prices and at present crucible life. The value of the metal saved by the electric furnace is about twice the cost of the coke used by the coke fires. Hence a huge saving is possible by electric melting under present conditions; and even at pre-war prices for crucibles, coke, and metals, the rocking furnace will show a smaller, but still a distinct, saving. On 24-hour operation the balance in favour of electric melting is still more marked.

The rocking-furnace is somewhat more efficient than the direct-arc and unrocked indirect-arc types, very much more efficient than electric furnaces of types in which heat is reflected on to the charge from the roof, and very little less so than the induction furnaces.

In magnitude of metal losses, the rocking furnace gives at least as good results as any other type of electric furnace. The only possible loss is from the stream of metal while pouring, as the furnace is sealed tight while running. Volatilisation from the stream while pouring is, of course, about the same in all types of furnaces.

In closeness of control of the temperature of the melt the rocking furnace is superior to any save the induction type. In thorough mixing of the charge, the rocking type is about on the same plane as the induction type, and markedly superior to the other types, where, in large sizes, segregation in the bath may be a serious problem.

From the electrical point of view, the rocking furnace does not have so steady a load, and hence, on this core, is not so desirable as the induction furnaces or granular resister furnaces. It does not require special transformers, as the granular resister type does. It lacks the electrical advantages of multiphase furnaces. In first cost, the rocking type should be no more expensive than other electric furnaces.

At the conclusion of the tests conducted by the Bureau of Mines, which covered over 300 heats, the experimental furnace was put on regular production by the Michigan Smelting & Refining Co. Four 1-ton rocking furnaces are being built for this company and two for the Electro Bronze Co.

(To be continued.)

South Africa.—ELECTRICITY IN WATERWORKS.—The report of the Rand Water Board for the past year states that the electrolytic production of chlorine for sterilising water turned out successfully, the cost being equal to chloride of lime at £18 per ton, whereas the local price is £50 per ton. The plant is now to be placed nearer the reservoirs, and even better results are expected. The Board has now two electrically-driven Sulzer pumps at the Zuurbekom station, each capable of raising 5 million gallons per day, and a new turbo-centrifugal pump, capable of raising 5½ million gallons per day, against a head of 1,100 ft., is to be installed at the Zwantkopjes station. As a precaution against damage by electrical disturbances, the electrical plant at the pumping station is now shut down during thunderstorms; last year damage to the extent of £166 was done to the plant, which was shut down for a total of 159 hours, on 97 occasions.

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ELECTRIC POWER SUPPLY IN BRITISH EAST AFRICA.

A Bill dealing in a comprehensive manner with electric power supply is now awaiting its final reading in the Legislative Council of the Protectorate. The measure is designed to foster and promote bulk supply methods, and to ensure standardisation.

Public and local authorities must adopt the Standards and Specifications of the British Engineering Standards Committee. The standard system for the Protectorate will be three-phase at 50 periods, excepting for special purposes, and, excepting the supplies to authorised distributors and for special purposes, the pressures of supply will be 415 and 240 volts.

All apparatus to be used in connection with a standard system, by a licensee, must comply with these standards, and that which may be used by others on a standard system must be marked when usual or necessary as to its capacity or value, in terms of British standards.

Practically every form of energy which industrialists in the Protectorate will require must be obtained from or by the conversion of electrical energy generated by water power, internal-combustion engines, or oil-fired boilers. Consequently, a demand for apparatus is developing which should not be neglected by British manufacturers.

The Government Electrical Engineer (Mr. James McBlain) will be pleased to receive catalogues and other information, with prices where possible, relating to hydraulic, internal-combustion, and steam types of prime movers, electric generators and motors, transformers, E.H.P.-transmission line materials, split-phase and other control and switching apparatus, indicating and recording meters, testing and measuring apparatus, &c.; also relating to apparatus for any industrial application of electrical energy, including farm and electroculture equipment, electrolysers, ozonisers, automobiles, batteries, and battery-charging, coffee drying and roasting, steam raising, mashing and distilling, casting and welding, cement burning, domestic heating and cooking, and X-ray and electro-medical equipment, &c., &c.

Inquiries from those interested are solicited, and should be addressed to the Government Electrical Engineer, Nairobi, British East Africa.

THE BRITISH SCIENTIFIC PRODUCTS EXHIBITION.

(*Continued from p. 222.*)

Siemens Brothers & Co., Ltd., London.—Included in the electromedical apparatus exhibited by this firm is an X-ray outfit for a general practitioner, suitable for operation with direct current, the apparatus being fitted with a mercury interrupter, 12-in. spark induction coil, and switchboard. The coil is mounted upon a pedestal, and the whole apparatus forms a most convenient installation for use either in a general practitioner's consulting room or a small hospital, as it obviates the necessity of setting apart a large room for the accommodation of an X-ray installation. The main portions of the apparatus are in a compact and convenient form. The induction coil is mounted on the top of the wooden screen, which is adapted to form a protective screen for the operator. This is accomplished by lining the inside with lead and fitting a lead-glass observation window. Beneath this window a switchboard is fitted on which are mounted the variable resistance, switches, measuring instruments, &c.; a shelf is provided for the mercury interrupter so that the whole of the combined apparatus, including the induction coil, switchboard, mercury interrupter, and overhead wiring for the X-ray tube can be wheeled into position for work and afterwards wheeled back into a convenient corner of the room.

The diathermy apparatus forms a convenient method of producing high-frequency currents for use in electrotherapeutics; it enables the temperature of the body to be raised in the treatment of diseases, the deeply-seated regions of the body being heated, not merely the superficial tissues. The apparatus consists of the necessary transformer for raising the pressure to about 2,000 volts, a spark gap similar to that which is used for wireless telegraphy, a hot-wire ammeter, variable inductance, adjustable resistance, and condensers, all being suitably arranged on a table fitted with large castor wheels to render the apparatus tractable.

There are also shown rotary converters of 2 K.V.A. capacity for converting from direct-current supply to alternating current, for use with the diathermy apparatus, and consisting of a Siemens standard semi-enclosed protected type machine with two bearings fitted in end shields.

Another exhibit is a mercury interrupter (new model), complete with motor, fitted with switch for varying the number of interruptions per revolution, and another switch for adjusting the time of the "make" current, complete with gas taps for connecting to a gas supply for use with a gas dielectric.

A heliodescent lamp outfit has considerable therapeutic value, its chemical and heat radiation having been found very advantageous in the treatment of many complaints. It is very abundant in ultra-violet and violet radiation, as the filament glows at a very high temperature. The outfit includes a large nickel-plated reflector fitted with a wooden handle to enable the lamp to be moved into position for treatment. The reflector is suspended from a bracket so that it can be adjusted in any direction and then secured by the clamping screws provided.

A quick-break foot switch (improved model) is designed so as to enable the X-ray operator to darken the room automatically while screening the patient and at the same time to switch on the current for working the X-ray installation, or *vice versa*.

The Coolidge control outfit exhibited is intended for use with a Coolidge tube to provide by means of a small generator the necessary energy for heating the filament. This motor generator is adequately insulated and mounted on porcelain feet; it has an output of 5 amps. at 12 volts.

A screening stand is shown provided with large protected tube box, diaphragm, counter weights, and adjustment for holding the fluorescent screen and plate holder. This means of adjustment is of great use when screening a patient in a vertical position. The tube box is arranged so that it can be used either in the vertical position in conjunction with the stand or in conjunction with a simple table for horizontal radiography.

The "Simple" X-ray couch is fitted with a compressor for arresting the movement of internal organs during radiography, and is arranged with stereoscopic scales for localising foreign bodies.

The Rapid Magnetting Machine Co., Ltd., Birmingham, is exhibiting photographs of the "Rapid" (Thompson-Davis patent) electro-magnetic ore separator (fig. 7), together with samples of minerals magnetically separated by the machine, and also samples of the same minerals before separation. In the case of the minerals of different colours the clean separation can be judged quite readily even by the uninitiated person. Before the war the manufacture of magnetic separators for feebly magnetic ores had been practically the monopoly of two German firms, but the exhibitors can now offer an apparatus

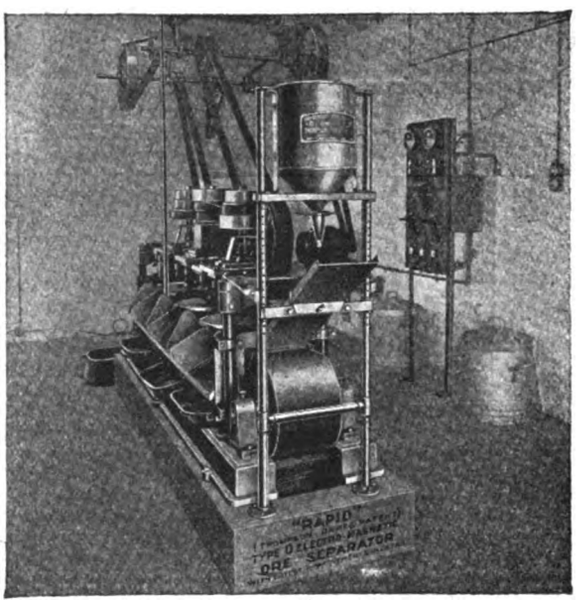

Fig. 7.—"Rapid" Electromagnetic Ore Separator.

which they will guarantee to give equal separation to that obtainable on the German apparatus. It may be constructed to remove first highly magnetic material, and iron, and afterwards products of varying magnetic permeability. It is made with two, three, and four poles with two or three separating disks. Briefly described, it consists of powerful vertical electromagnets stationed under a travelling feed belt, on to which the material is delivered, passing the poles successively. Above the belt, at a suitable distance from the first pole, is a horizontal revolving iron disk of larger diameter than the width of the belt. The edges of this disk are magnetised by

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induction sufficiently to attract iron and highly magnetic material from the ore on the feed belt, which, as the disk revolves, is carried on its edge out of the magnetic field, and, when overhanging the belt, falls off by gravity and is there collected. The ore passes along until it reaches the next revolving disk, which is situate above and between the two magnet poles, where the magnetic lines of force are concentrated through the feed belt and ore to the disk, which is shaped so that an intense induced magnetic field is produced on its edges on that section actually over the magnet poles, attracting the feebly magnetic material, and depositing it whilst overhanging the edge of the feed belt where the magnetic influence is nil. As the ore passes the edges of the revolving disks successively it is subjected to the influence

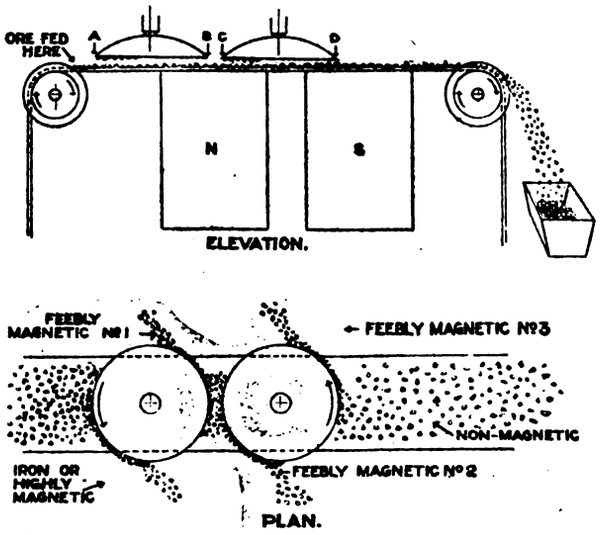

Fig. 8.—Diagrammatic Sketch of Separator.

of the magnet twice at one passing, and by the introduction in tandem of the extra pole pieces and disks of suitable construction, the number of magnetic products can be increased. It is also possible to arrange the disks in such a manner that two distinct products can be obtained from each disk. The "Rapid" machine is provided with adjustment by which the angle of the disk can be regulated relative to the feed belt; the disks may be adjusted vertically and the magnet poles laterally; the speed of the feed belt is variable; the strength of the magnets is controllable by rheostat; the automatic feed is adjustable to suit any grade of ore; and lastly, all adjustments can be made whilst the machine is running.

(To be concluded.)

Lectures.

The British Scientific Products Exhibition, which closed on Saturday, September 7th, has been an unqualified success from whatever point of view it is considered. The exhibits gave a fairly representative idea of the progress made in this country in the application of scientific and industrial research, and it would be a great pity if efforts were not made to follow up the initial success achieved by the British Science Guild. It is not generally known that the entire financial responsibility of the exhibition was undertaken by the British Science Guild without the support of any of the Government departments, and it is rather a sad reflection that none of the Ministers whose departments are concerned with industrial questions found even the time to pay the exhibition a visit.

One feature of the exhibition has been a series of lectures. A wide range of subjects has been covered by the various lecturers, and a great deal of interest has been aroused in the problems discussed. In the course of a lecture delivered by Mr. A. Newlands, M.Inst.C.E., engineer-in-chief of the Highland Railway, the question of developing the water resources of this country was discussed. Mr. Newlands holds the view that not only will the development of our water resources provide us with the energy that we require, but its proper development is to some extent bound up with the reorganisation of our industrial life. Cheap power and a greatly extended use of it is an imperative necessity, and the continued neglect of the water-power possibilities of this country is a very serious economic waste. In the latest Census of Production Report it is shown that while the total horse-power of industrial engines in Great Britain and Ireland is approximately 10½ millions, of this only 178,000 H.P., or 1.6 per cent., is represented by water power. In Mr. Newlands's opinion water-power could very easily be drawn upon for one to one and a half million H.P., or over 10 per cent. of our requirements. It is estimated that while there is available for development from water-power in Great Britain 10.9 H.P. per square mile of area, only 0.91 H.P. is actually utilised. Mr. Newlands is of the opinion that the place of water-power in industry lies in the utilisation of it as far as possible in territory where industrial activity can be recreated, or where none ever existed. This raises a very important sociological problem which it is desirable that our scientists and engineers should consider in a serious spirit. The energy derived from water power can be transmitted electrically over large areas, and made available where practicable for the varied requirements of agriculture, both in the field operations and in the farm buildings. Here it would help to eliminate much of the drudgery of this important industry, while at the same time coming into service for the purpose of rural transport. As regards industries, it is only necessary to mention the manufacture of aluminium, the electrochemical industries, and the fixation of nitrogen to show what enormous possibilities exist in the development of these industries by the application of the large power supplies which would be made available by the utilisation of water. The saving of coal, too, through the development of our water-power resources, is an item the importance of which cannot be over-estimated. But this is not the only consideration, for it has distinct and far-reaching possibilities and advantages of its own, and if, as is generally believed, we must enormously increase our national production to re-establish our national position, the utilisation of water power will be necessary.

Mr. L. Gaster, in a paper on illuminating engineering in peace and war, claimed that the provision of appliances for artificial lighting was essentially a "key" industry. Since the outbreak of the war, he said, considerable progress had been made, and manufacturers had triumphed over many difficulties. This was particularly noticeable in regard to electric incandescent lamps, carbons for arc lamps, and other essential commodities. The obtaining of tungsten from the ore is being done in this country on a far greater scale than before the war. Apart from the manufacturing side, Mr. Gaster laid great stress upon the study of the proper use of light, its application to various problems, and its distribution.

In radiology the outbreak of war found a condition of unpreparedness in common with other branches of medicine. Adequate staffs and large quantities of new apparatus had to be provided for many new departments. Dr. Robert Knox described this state of affairs in a lecture on the practical uses of radiography. The backward state of the industry described as prevailing four years ago is all the more remarkable when it is remembered that although X-rays were discovered by Prof. Röntgen, the discovery could not have been made but for previous scientific research carried out in England. Further, since the original discovery of X-rays, the two greatest advances in this connection were in a large measure due to professors at King's College, the original Crookes "focus" tube having been adapted to X-ray purposes by Sir Herbert Jackson, and the Coolidge tube, though brought out in the U.S.A., was based on the experimental results obtained by Prof. O. W. Richardson working on lines laid down by Sir J. J. Thomson, of Cambridge. The importance of the industry associated with radiography is great, and it promises to become greater in the future. Dr. Knox stated that experience gained in the administration of X-ray departments on a large scale, such as had been possible during the war, had taught the necessity for the standardisation of apparatus. The task of rapidly equipping numerous departments would have been easier, and the standard of work done better, had this standardisation of apparatus been achieved before the outbreak of war. If we are to hold our own in competition after the war, research work must be carried out in connection with the production of essential apparatus and X-ray tubes. This need was emphasised by the lecturer, who stated that lately important research work had been carried out in this country. Dr. Knox stated that the intensifying and fluorescent screens at present in use were an advance on those formerly imported. Manufacturers of X-ray plates had more than held their own, and the production of a trustworthy photographic paper upon which X-ray negatives could be produced directly was one of the achievements of the war period. Dr. Knox described the most striking of recent applications of X-rays and radium as that used by Mr. Percival P. Cole in connection with his operative work on injury to the face and jaws. Mr. Cole's name was also associated with another new development in plastic surgery, the depilatory power of X-rays having been used to destroy hair in portions of the scalp and face which were used in plastic surgery. More than once in the course of his lecture Dr. Knox insisted on the need for encouraging research and bringing about the co-operation of all interested in the work. He said that steps were in progress with a view to forming a British school of radiology and physicotherapy.

In the course of a short lecture on electrical development after the war, Mr. C. H. Wordingham, C.B.E., President of the I.E.E., said that the term electrical industry was a very wide one; it embraced many industries, and electricity was invading all other branches of engineering. No engineer would in the future—he might almost say in the present—be able to perform the duties of his branch without some knowledge, and in many cases an intimate knowledge, of electrical science. Electrical development had made rapid strides, as was evinced by the uses to which electricity was put on board ship, especially in the case of warships and submarines. On a modern battleship electricity was made use of in almost every conceivable manner; the progress that had been made with the electrical propulsion of ships,

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especially in America, was very promising, and this would be more widely adopted when hostilities ended.

In the works and factories here in this country electricity had played a great part during the war; it would not have been possible for our munition works to produce the output they had done without the aid of electricity. Another recent development was the electric furnace; it was an important application of electricity, and had made large strides. After the war it would make still greater strides if a cheap and abundant supply of electricity were available. Again, the electrical driving of rolling mills was a further development that had made headway recently; this was important inasmuch as it showed what electricity was capable of doing. A steel rolling mill performed the hardest and most trying work that any machine was called upon to do, and this was done efficiently by an electrical drive.

The Admiralty was a large user of electricity; it was made use of in almost every conceivable manner. It was used in many ingenious ways for detecting the enemy's movements and intentions both on land and sea. Recently a submersible electric pump had been developed which was extensively used for salvage work, and it had accomplished very good work indeed.

After the war it would be necessary that there should be an abundant and cheap supply of electricity. At present there was a large number of small generating stations, and only very few large ones, such as those at Manchester, Birmingham, and Glasgow. To the small stations a large amount of credit was due; they had done pioneer work, and had paved the way for the so-called super-station, about which we are hearing so much just now. But the time had now come when it was necessary that these small stations should be superseded; it was not intended that they should all go at once; the most inefficient would be done away with first, and the process would thus be a gradual one. The advantages that would accrue from such a scheme would be an improved load factor, larger individual generating units, the location of the station could be chosen independently of the area to be supplied, and, lastly, there was the question of fuel economy. It was absolutely essential that our irreplaceable fuel supplies should be conserved, and the super-station scheme would help largely to bring this about. A combination of gas works and central electric generating stations would produce cheap power, and at the same time conserve fuel by enabling the by-products of the coal to be reclaimed. There were some areas where a cheap supply would never be available, nevertheless it was necessary that a supply should be available in all areas—in the country districts for agricultural purposes, as well as in the densely-populated ones for manufacturing. It would be necessary, therefore, to set off the cost in one place against that in another, so that a low price might be charged over the whole country. In his opinion, electricity could be generated on a large scale profitably, and sold to consumers at a low price. Further benefits that would result from this super-station scheme would be the standardisation of voltages and periodicities, and therefore also of apparatus. This, in turn, would enable manufacture to be carried out on a large scale in a uniform manner. At the present time too many manufacturers were making the same mistake; they were trying to cover too much ground at once, and producing too large a variety of articles. It would be a misfortune if combines were formed and the small firm swept away. In his opinion, there was plenty of room for a few large concerns and the small ones as well. The differences and jealousies that existed in the past would have to be swept away, and the small firms should combine in such a way that each firm could restrict itself to the manufacture of one class of apparatus, for which it was best equipped, and of which it had most experience. In this way they would obtain better results, and would be able to present a united front to tackle the home and foreign markets.

Since the commencement of the war it had become apparent that very few people in this country understood the importance of key industries, or even realised that such industries existed. Germany, however, fully appreciated the position, and took advantage of it. As an illustration of this, the manufacture of carbon electrodes could be mentioned. Only one firm was manufacturing carbons in this country prior to the outbreak of war; it was done for many years at a loss, but, by the help of the Admiralty, both with grants of money and scientific advice, this firm was able to continue manufacturing in spite of all opposition and competition. The Admiralty was the only department that foresaw the serious position that would arise were the supply of carbons to be cut off; it therefore insisted upon a supply of British-made carbons being available. Another Government department attempted to follow the example set by the Admiralty, but it go itself into trouble, and the attempt had to be abandoned.

The magneto industry was another that could be mentioned; only those who understood how difficult it was to manufacture such a highly-complicated machine as a magneto would appreciate the difficulties that had had to be overcome. It was largely due to an officer in the Royal Naval Air Service that we were at present successfully manufacturing magnetos in this country. Insulating material was another very important commodity; every branch of the electrical industry depended upon it, and in that respect we ought to be entirely self-supporting.

The prospect for the development of the electrical industry after the war depended to a large exent upon labour; it was a question of whether labour (both head and hand labour) was prepared to put its shoulder to the wheel and produce in large quantity or not. There was a large amount of latent ability amongst the labour class; one only had to look at some of the Labour leaders to understand what labour was capable of as a class. Labour should be given a larger share, not only in the profits, but also in the direction of affairs. If Labour was allowed to see and know more of what went on behind the scenes, he firmly believed that many of the difficulties and misunderstandings that were constantly cropping up at present would entirely disappear. The Government only recognised those who were organised; engineers had therefore realised that they must organise themselves as the men that they controlled were organised; this they had decided to do, and it would shortly be accomplished.

Mr. C. A. Darling, lecturing on high-temperature processes and products, described the various methods of welding. This had superseded the old blacksmith's method, and foreshadowed the passing of riveting. It provided a new opening for partially-disabled soldiers, many of whom were welders. Electric arc welding had made great strides during the war; the rivetless ships were now being constructed by the use of arc welding, and American investigators were of the opinion that we were ahead of America in this matter. There was a striking increase in the number of electric furnaces for smelting, and though the cost of power was high, it was compensated for by the superiority of the high-class steel that was obtained. He suggested that high temperatures might displace the centre of gravity of our industries, for if super-power stations were established in London, as had been proposed, London might become a steel centre. He called attention to the various products of electric high-temperature furnaces, some of which had been neglected. But power could now be got as cheaply at Tyne-side as at Niagara, and there was no reason why we should not manufacture the same products. A college of research into electric furnace products was needed, for the subject offered vast possibilities for the future.

Dr. W. Rosenhain, in the course of a lecture on aluminium and its alloys, said that lightness itself was of little value; what was wanted was a combination of lightness and great strength. There were many moving parts in light machinery in which the extensive use of light alloys would appear to offer a large field for real advance. Aluminium and its alloys demanded the serious attention of British and Imperial industry. For aircraft and military purposes it had the importance of a key industry, and it was an industry which must not be neglected.

Mr. J. L. F. Vogel, lecturing on tungsten, said that the attempt to make tungsten in England before the war was no sufficiently determined. He himself had been connected with Dr. Stenhardt in running a small factory in London, where abqut 300 tons were produced, but the company lost money, as it was impossible to meet German competition. During the period 1906 to 1913 the British Empire produced about half the output of tungsten ores. Since the commencement of the war the output of ore had risen to close upon 20,000 tons per annum, and the U.S.A. had become the largest producer, increasing its output from 1,400 tons in 1913 to about 7,000 tons in 1916, while the Empire production for 1916 was somewhat under 6,000 tons. He emphasised the necessity of keeping the British Empire sources of supply in the hands of British-born citizens. When war broke out there was only four months' supply in this country, but a factory was started, and one of the most serious problems with which munition makers were faced was solved. He believed the industry would be maintained in this country if it were given a fair chance.

Dr. E. E. Fournier d'Albe exhibited the optophone, invented by himself in 1914. This remarkable, but in manipulation simple, instrument is supplied by the Medical Supply Association, Gray's Inn Road, E.C.1, and it is the outcome of a series of researches on the half-metal selenium, carried out mainly at the University of Birmingham. The optophone was first shown to the Royal Society in 1914, and it is described as "the first radical solution of the problem of how to enable the blind to read ordinary print." A small disk is made to rotate rapidly by means of a minute electric motor. The disk is provided with five concentric circles of holes corresponding to musical notes. The disk is illuminated from below by a small electric lamp and condenser. A slit above the disk cuts out a radial portion, so that a line of five luminous dots is seen from above. A small image of this line is thrown upon the upper surface of a glass plate, and is thus focused upon any point laid flat upon the glass. The lamp, disk, and lenses are mounted on a carriage which can be moved from right to left by a handle. The top of this carriage bears a selenium tablet, which is placed in circuit with a battery and telephone. The glass plate with its stand forms a book-rest, which is moved to and fro at right angles to the printed line by means of a line-changing head. This head moves with audible clicks, and by counting these the operator can get the next line correctly into position. Practical proof was given by a blind student, Miss M. Jamieson, who, after only 90 hours' experience of the optophone, had attained a speed of 10 words per minute in reading. It was stated that with a little more practice she confidently hoped to raise the limit to 25.

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CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Future of Coal Using.

I am interested in the article on p. 125 of your current issue by Mr. W. H. Booth, which is short, but very much to the point, regarding the use of coal in large generating stations, which have been so much to the front of late.

If there is one sure way of wasting coal it is to put down the big generating station with steam plant, such as has been suggested for London.

Such a proposition is a mad-brained suggestion of the large-unit schemer, who can see not much further than a big unit proposition of the steam type, with massive chimneys and plenty of waste gases, which he cannot see, but they are going into the atmosphere all the same.

Electricity can be generated as cheaply in half-a-dozen stations spread along the Thames at convenient points as at one central point, and such a scheme has far more to commend it than the central scheme.

Mr. Booth points out that: "Given a means of so arranging electrical supply that waste heat can be supplied to all households concerned within a limited radius, an enormous fuel economy would be secured."

What is the good or use of talking about grand schemes of electrical supply to save coal when the greater user of coal, namely, the householder, and the heating of houses are left out of the question? If generating stations are to be supplied on a large scale, then let the whole problem of generating electricity be combined with the greater one of saving coal in our households, by arranging a sensible scheme of domestic heating in connection therewith.

I very much wish Mr. Booth would give an article on such combination, as he is about the only authority in this country who is capable of dealing with the problem as it should be handled. I go further, and say that Mr. Booth is one of the engineers on practical economies who ought to be in the front giving advice to the Reconstruction Committee, and not in the background criticising the Committee's report.

Mr. Booth's article is valuable at this stage, but I hope he will deal with the matter exhaustively, so that it will command the attention of the Reconstruction Committee.

John I. Hall.

Kingston-on-Thames, *September 7th*, 1918.

Where are we Going To?

The somewhat pessimistic imagination of Mr. R. W. Paul has evidently left him brakeless, as his particular 'bus seems to have smashed up altogether. To his 'bus-like imagination it appears industry is going to the dogs; to the average trade unionist, it just appears he is on the fringe of something tangible and reasonable for his output in life.

The said output has been so long *solely* in the control of the limited liability system, but the spectacle of the trade unionist being in a position to tackle the aforesaid trusts, and play that part in industry which they are entitled to, seems to excite the direst foreboding on the part of Mr. R. W. Paul.

"A one-time member of this Union, who for several years watched the progress of our electrical pioneers towards, or through, the bankruptcy courts" evidently has some qualms concerning the E.T.U. controlling the industry. Well, the present writer had just as many in the past concerning Dick, Kerrs, Westinghouse, Cromptons, &c., &c., but a merciful providence in the shape of John Bull poured milk and honey into these concerns, with the result of their return to something like financial stability.

In this area the E.T.U. is endeavouring to use its best efforts for the apprentices, especially from the technical point of view, but with the employers' claim of sole control, and *their* idea of technical training, the effort to produce the right article "to flabbergast the Hun" is making slow progress.

Under the E.T.U. control, good jobs will be found for competent men; the "Are-you-in-the-know" and public school boy will get a back seat, and the fortunate individual receiving "three times the district rate for swanking around" will receive a period in "quod."

The past virility shown in this Empire has produced excellent results for one class only, and Mr. Paul will do well to understand that something apart from petty bureaucracy is in the field, and the pals of the electrical trade will have stronger stuff to sweep aside than bureaucrats.

"The directors of the British Empire" have, again, belonged to one class, and the hideous caste system (that old man of the sea on the workers' back), by which they have controlled trade, commerce, and mankind, has been an all-too-potent factor in our history, and "class consciousness" keenly describes the position.

The E.T.U. will welcome the "hundreds of businesses," and say let them all come, "honest enterprise," merit, respect, and esteem.

It seems to have been Mr. Paul's misfortune to have been governed by the truculence of the individual, and the combination to which he belongs. Oddly enough, the writer has had the same experience, only the truculent gentleman was the employer, the combination behind him the Contractors' Association, and the reward offered scanty enough to have starved Old Mother Hubbard. 'Nuff said; I am going to work!

J. W. Woolley,
Electrical Trades Union.

Whitley Bay, *September 9th*, 1918.

The Percentage Error.

Mr. A. T. Bullen's method of remedying one error by another inaccuracy is wrong. The meter in question is obviously 40 per cent. fast, and the correct method of dealing with the matter was a sum in simple proportion, *i.e.*, 140 : 40 : : 400 : 114, giving the allowance on the account as 114 units on the meter's registration of 400.

Gadgett.

London.

In dealing with the question of percentage error, the writer was moved solely by errors which *had* occurred through the exact meaning of the figure quoted by the test room being misunderstood.

While "Gadgett's" method is perfectly correct, it is not in universal use, nor will it ever be, because the majority of meter errors of the future will be within the region of 3 to 5 per cent., and the addition or subtraction of 3 per cent. makes very little difference whether it is based on the registered units or the correct units.

The mental method, therefore, will be the most used (*i.e.*, deducting 3 units for every 100 registered), as it has in the past, and it is for this reason that we should state the percentage error as so much per cent. of the units registered.

"Gadgett" calls it an inaccuracy, but it is not inaccurate to say that, of 400 units registered by my meter 28.5 per cent., or 114, were over-charged.

A. T. Bullen.

Eastleigh, *September 11th*, 1918.

Falk, Stadelmann & Co.

May I call your attention to a paragraph in *John Bull* of September 4th, 1918, *re* Messrs. Falk, Stadelmann & Co., which I think would be of much interest to electrical readers?

The Cable Makers' Association.
L. B. Atkinson, *Secretary.*

London, W.C., *September 10th*, 1918.

The following is the cutting referred to:—

HOW TO BECOME BRITISH.

A STUDY IN COMMERCIAL EVOLUTION.

Even in war-time it is quite an easy matter for a Germhun commercial undertaking to become as British as an East End whelk-stall. Observe how it is done. In the sweet, bygone days of peace Messrs. Falk, Stadelmann and Co., of London, Glasgow, and Manchester, manufacturers of the "Veritas" gas mantle and other lighting requisites, had names and addresses which would have been excellent passports to Potsdam. The Falks, the Thurnauers, and the Pappenheimers ruled the roast, and were unashamed of the fact that their places of residence were at Nurnberg, Hochberg, or elsewhere in the land of the Huns. Since then, however, all is changed. In the fifth year of war Messrs. Falk, Stadelmann & Co., Ltd., are "all-British," as that term is understood at Somerset House, the latest summary of Share Capital issued under official authority being a highly interesting document. Wonderful measures of "reconstruction" have been carried through. It is true that even now the trail of the Hun is not quite extinguished. The Chairman of the Company, Mr. Max Falk, though now a British subject, is compelled to acknowledge Wurtemberg as his "nationality of origin," while the other directors, Messrs. Victor Falk and Louis Thurnauer, coyly admit that it was in Wurtemberg and Bavaria respectively that their infant eyes first beheld the light.

Glancing at the Shareholders' List, we find that the Public Trustee has taken a hand, 49,367 Preference Shares held by Mr. Bernard Thurnauer, of Nurnberg, and afterwards vested in the Custodian of Enemy Property, having on May 1st, 1917, been restored to the Company, although for what consideration is not apparent. Much the same thing seems to have happened in the case of 1,000 Preference Shares once held by Mrs. Pauline Israel, of Hochberg. Upon the whole, it is clear that our obliging authorities have offered this Company every assistance in their efforts to clean up their shop front.

WAR ITEMS.

Non-Ferrous Metal Industry Act.—A further list of those to whom licences have been granted under this Act appears in the *London Gazette* for September 10th.

Munitions Tribunal Case.—We are informed that at the Edinburgh Munitions Tribunal J. G. Jones, jointer and overhead linesman, claimed back money under the 12½ per cent. award from October, 1917, to February, 1918, from the Musselburgh Tramways Co. The company held that Jones was not entitled to make such a claim as he had been away from their employment for over six months, and had not claimed earlier. The Tribunal granted the claim as there was no specified time in the award in which to make the claim.

To be Wound Up.—Under the Trading with the Enemy Acts the following company has been ordered to be wound

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up:—Electro Osmose Syndicate, Ltd., Imperial House, Kingsway. Syndicate formed to purchase patent rights for the purification of clay. Controller: J. R. Tulloch, 4B, Frederick's Place, Old Jewry, E.C.2.

Trading With the Enemy.—The "London Gazette" for September 6th contains further additions to the lists of persons and bodies in the following countries with whom trading is prohibited:— Argentina; Bolivia; Brazil; Chile; Colombia; Cuba; Denmark; Ecuador; Greece; Guatemala; Hayti and Dominican Republics; Honduras; Mexico; Netherlands; Netherlands East Indies; Panama; Persia; Salvador; Spain; Sweden; Venezuela.

The Future of Russia.—Sir G. Buchanan, in a speech delivered in London last week, after stating that a peace which left Germany supreme in Russia and mistress of the East would be little short of suicide, said that we must respond to Russia's agonising cry for help. Colossal as was the task before us, we must assist her in the economic reconstruction that must precede the political reconstruction. We must be prepared to supply her, when the proper moment arrived, with expert advice, with capital, and with all the machinery necessary to restart her moribund industries, to render her agriculture more productive, and to revive her export trade, without which the depreciated currency could not recover.

Germany and After-War Trade.—Some of the German papers are devoting a good deal of attention to Allied preparations for improved export trade organisation after the war, and to British economic defence proposals and the prospect of their succeeding. In July, the *Vossische Zeitung*, recognising that all England favoured an economic war, but was not unanimous as to its duration and method, was urging those who advocated a "peace by understanding" to pay close attention to the subject. The suggestion was that advantage be taken of this difference of opinion, because nothing was more important for Germany's future than that such a war should be mitigated as far as possible, and its duration shortened. *Der Welthandel* in August was discussing some of the measures taken by France, America, and England during the war for the promotion of foreign trade. It is admitted that after four years of war Germany is faced with a great task in the foreign trade problem. One of its first necessities after the war will be to find out the real state of things in the world markets. For this purpose, capable commercial experts must be sent to investigate the changes in trade caused by the war; the German Commercial Expert Institute must be brought up to date; the consular service must be reorganised—men of practical commercial experience must occupy such posts; the Information Service must be expanded, and it must be under Government control; and so on. Something has been done by way of propaganda—through films and otherwise, and quantities of literature has been sent abroad to bring home to the foreigner "the prosperity of German economic methods," but the writer regrets that "there is no widely circulated German organ in foreign countries, and expresses the desirability that some of the existing papers should be translated and put on the foreign markets. He advocates the organisation of sample fairs and the establishing of large stores in the Balkans or the Near East, like the Americans did in Turkey. There is more of the same kind of thing, all of which ends with what reads like an appeal for the German Government departments to strengthen and develop foreign trade organisations, as schemes for expanding these organisations are expected to prove effective weapons in the coming economic struggle. By a stroke of the sword the Prussian War Lords cut off their foreign trade in August, 1914. Doubtless if the Prussians even thought seriously about their Empire trade interests at all they expected that after a short war, and a speedy crushing of their unprepared foes, they would quickly recover from the temporary stoppage of exports, and would swing along with an appropriate goose-step on to fuller commercial world domination. But the German commercial god or idol, like their military one, has had a great fall, like "Humpty Dumpty," and not all the economic writers in Germany, nor all the Hindenburgs and Ludendorffs, will easily be able to put its broken parts together again. But there will be a great effort to do so—that has always been obvious enough.

Exemption Applications.—At Oswestry, exemption until January 1st was conceded to W. H. Farrar (39, grade 2), electrician.

At Rochdale, in the case of two employés of the Rochdale Municipal Tramways, ordered by the Tribunal to join up, it was stated that all tramway appeals were to be adjourned pending consideration of the staff as a whole, and the decision in the two cases was cancelled. In the case of a tramway employé at Halifax, the appeal was adjourned for three months to await instructions.

Hereford Tribunal has granted exemption until January 15th to A. J. Rowberry (34, grade 1), electrical engineer.

At Aberystwyth, exemption was sought for H. Humphreys (41, grade 2), mains foreman with the Electric Light Co. It was claimed that he was in a certified occupation. With the assent of the National Service Representative, six months were conceded.

At Oxford, the Electric Tramways, Ltd., appealed for Victor Hill (36, grade 2), a skilled motor mechanic, and two months' temporary exemption was conceded.

BUSINESS NOTES.

Carbon Business in Argentina.—A concern called Le Carbone (late Lacombe et Cie) has been formed, with a capital of 2,800,000 fr., to manufacture and sell carbons and any products relating to the electrical industry. The company is to operate in the Argentine, and the representatives in Buenos Ayres are Messrs. Leon Pariand & J. L. Sidler.—*Review of the River Plate.*

Exports to China and Siam.—In the *Board of Trade Journal* for September 5th between six and seven pages are devoted to consolidated lists, revised to August 23rd, 1918, of persons and bodies in China and Siam to whom exports may be consigned.

A further list of persons and bodies in China to whom exports may be consigned appears in the *London Gazette* for Sept. 10th.

German Porcelain Industry.—According to the *Münchner Neueste Nachrichten*, disputes are proceeding in the German porcelain industry and trade with reference to the present high prices for porcelain products. The Association of East German Porcelain Factories, which has its headquarters at Altwasser, in Silesia, repudiates a suggestion that these prices are unduly high. Certain factories which, in virtue of army contracts, have enjoyed full employment and a full supply of coal, or which had large accumulated stocks at their disposal, have enjoyed temporary prosperity, and compensated themselves for the severe losses of previous years. For the factories without such special advantages—and these form the great majority—the prices fixed by the Association of German Porcelain Manufacturers do not counterbalance the increase of prices for raw materials, &c., and the restriction of producing capacity (through decrease of coal supplies) to one-fourth of the peace production. The conditions at present prevailing in the industry not only prohibit any reduction of prices, but urgently call for a further increase. The dealers desire to bring about a crisis in the Association of German Porcelain Manufacturers; but the manufacturers have every reason not to let this desire be realised.—*Board of Trade Journal.*

Book Notices.—"*Journal* of the Institution of Electrical Engineers." Vol. LVI, No. 276. July, 1918. Also Index to Vol. LVI. London: E. & F. N. Spon, Ltd. Price 7s.—This issue contains the following papers:—"Transient Phenomena in Electrical Supply Systems," by Prof. E. W. Marchant; "Mechanical Design and Specification of the Turbo-Alternator Rotor," by S. F. Barclay; "and the Discussion on "The Control of Large Amounts of Power."

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVII, No. 8. August, 1918. New York: The Institute. Price $1.

"Works Lighting." By Daniel H. Ogley. 1918. Pp. 134, figs. 66. London: Iliffe & Sons, Ltd. Price 7s. 6d. net.

"Magnetism and Electricity for Home Study." By H. E. Penrose. Pp. 515, figs. 224. London: Wireless Press, Ltd. Price 5s. net.

Liquidations. — Anglo-Colonial Engineering Co., Ltd.—Meeting, October 11th, at Balfour House, Finsbury Pavement, E.C., to hear an account of the winding up from the liquidator, Mr. G. E. Corfield.

Rotherham Electrical Engineering Co., Ltd., Rotherham.—September 23rd is the last day for receipt of proofs for dividend by the liquidator, Mr. J. C. Clegg, Figtree Lane, Sheffield.

Steel's Electric and Engineering Co., Ltd., Poplar.—Liquidator (Mr. H. de V. Brougham) released September 3rd.

For Sale.—The stock, &c., of Messrs. H. M. Ashton, Ltd., electrical engineers, of Southampton (voluntary liquidation), are to be sold by auction.

Lantern Slides Wanted.—Mr. J. Glynn Williams, 4, Blaen Naut Street, Duffrynville, Cymmer, Port Talbot, will be glad to hear from any manufacturers willing to lend on hire films or lantern slides on matters dealing with their manufactures for lecture purposes during the coming winter.

Social Club.—The employés of Messrs. A. Kershaw and Son, Ltd., scientific instrument makers, and the Kershaw Optical Co., Ltd., Leeds, have formed a social club, to promote recreation and social intercourse amongst its members. Under its auspices a cricket match, in which both ladies and gentlemen took part, was played on Saturday last.

Catalogues.—British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C. 4. — Folder giving a short explanation of the Government Lighting Restrictions (Household Fuel and Lighting Order, 1918) as revised. Small quantities overprinted with contractors' names and addresses will be supplied free on application.

New Electric Heating Elements.—Recent improvements in the Schoop metallic spraying process include electric heating elements produced by this method. An American patent of M. W. Schoop describes a method of using this process. The metal is deposited in the form of a spiral on a rotating insulating tube by moving the holder of the squirting apparatus along the tube as it rotates. Guard plates are provided for preventing the spray from widening out.—*Electrical Review and Western Electrician.*

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LIGHTING AND POWER NOTES.

Argentina.—Fuel Shortage.—To cope with the shortage of coal, the Government has supplied the German Transatlantic Electricity Co. with river vessels for the transportation of wood, and the company has purchased large quantities of maize for use as fuel. For the same purpose the Buenos Aires Gas Co. is considering the purchase of 4,000 tons of low-grade flour!

Australia.—Tasmania.—The absence of hydro-electric power is the chief cause of the delay in the progress of the electrolytic treatment of zinc-lead sulphides at the Mount Read and Rosebery Mines. The company requires a small amount of power in the first instance and a large amount a few years hence. The manager of the Tasmanian Hydro-Electric Department states that the Yolande River scheme had been investigated, and would yield about 5,000 H.P. The King River scheme would produce 45,000 H.P. continuously, and the lower auxiliary scheme on the King River would produce 15,000 H.P. He expresses the opinion that it will not be many years before all the power will be in use.

Balmain.—The Council has decided not to purchase the undertaking of the Electric Light and Power Supply Corporation.

Sydney.—The E.C. recommends that authority be sought for additional loans, to the extent of £500,000, for future operations in connection with the Council's electric lighting undertaking, the balance available against the £500,000 authorised to be raised by the State authorities being £31,415, for further capital outlay. In connection with the £500,000, upon which the Council has been working, although the State authorities have sanctioned the loans, no replies have been received from the Federal Treasury to the Council's application for sanction to borrow.

Victoria.—The Premier of Victoria states that the sources of electrical energy in the State are to be co-ordinated and controlled by one body, consisting of technical and business men. It is not intended to allow private enterprise to exploit the brown coal deposits, but the Government is open to consider proposals from those interested regarding water-power schemes.

Kiewa Hydro-Electric Scheme.—The Minister of Water Supply has announced that it has been decided to allow a private enterprise to utilise the water power of the Kiewa River. The lease is to be for 15 years, or, under certain conditions, for 50 years. The company is to produce a bank guarantee of £30,000, to agree to terms as to the price to be charged for energy, and to supply energy to the north-eastern centres before going further afield.

Melbourne.—A deputation of the Electrical Traders' and Contractors' Association has protested to the Minister of Public Works against the proposals of the City Council to install electricity in small houses on the hire system, on the ground that the scheme would not be run on commercial lines, and that apparatus would ultimately be sold at cost price, or less, to increase the sales of energy, to the detriment of electrical contractors. The Minister agreed to consider the matter again.

Birkenhead.—Price Increase.—The following is the scale of charges to be put into force by the T.C. on October 1st, showing the increase over pre-war rates in parentheses:—Within the borough, lighting, flat rate, 6d. per unit (50 per cent.); maximum demand, 8d., 4d., and 2d. (33 per cent.); prepayment meters, 6¼d. (39 per cent.); power, up to 1,500 units per quarter, 2¼d. (50 per cent.): above 1,500, 1½d. (50 per cent.); heating and cooking up to 1,500, 1¾d. (16⅔ per cent.): above 1,500, 1½d. (50 per cent.). Outside the borough, prepayment meters, 7¼d. (45 per cent.); power, 2¾d. (37½ per cent.); heating and cooking, 2½d. (25 per cent.). All special consumers will be charged an extra 7½ per cent., making a total advance of 40 per cent.

Birmingham.—Wages.—The semi-skilled and unskilled employés of the Corporation have applied to the Committee on Production for the extension to them of the award of 3s. 6d. per week recently granted to the engineering trades. If granted, it will increase the Corporation's wages bill by £70,000 per annum.

Burnley.—Sale of Plant.—The Bury Electrical Plant Co. has been informed that the Corporation is not prepared to give an option to purchase certain obsolete plant at the electricity works, but is willing to sell the plant outright for £725, provided that a deposit of £250 be made immediately.

Calder Valley (Yorks).—Strike.—The strike notices of the employés of the municipal authorities of the Calder Valley have been withdrawn, and the dispute referred to the Ministry of Labour.

Canada.—Water Power.—In connection with the application of the Aluminium Co., of America, for permission to construct a dam on the St. Lawrence River for hydro-electric purposes, the Minister of the Interior and the Minister of Customs are visiting Washington to confer with the United States Government with a view to the joint development of power at Longsault Rapids.—*The Times.*

Carrickmacross.—Public Lighting.—The Lighting Co., at the request of the U.D.C., has reduced its tender for electric lighting from 10d. per unit to 9d., and the Council has decided to postpone the lighting of the street lamps for a month.

Continental.—Italy.—An increase of capital from 15,000,000 lire to 32,000,000 lire is under consideration by the Società Elettrica della Sicilia Orientale in order to carry out its large programme in the interior of Sicily. Its name is also likely to be changed to Società Generale Elettrica della Sicilia.

There has been formed at Milan the Società Idroelettrica dell'Ozola, with a capital of 1,000,000 lire, for the purpose of constructing hydro-electric plants in the province of Reggio Emilia.

With a capital of 5,000 lire, there has been established at Verzuolo the Società Idroelettrica Monviso-Verzuolo, for the construction of hydro-electric installations.

The amalgamation of the Società Astese di Elettricità with the Società Chierese di Elettricità, with currency from April 30th, 1918, is announced.

Dewsbury.—Price Increase.—The Electricity Committee has recommended that the advanced charges for electricity recently decided upon be deferred until January 1st next.

Dublin.—E.L. Restrictions.—The Electricity Committee has postponed further consideration of the question of reduced supply for industrial and lighting purposes pending a report on the subject from the Dublin Industrial Development Association.

Dudley.—Price Increase.—The Electricity Committee has recommended the T.C. to agree to the increase of 12½ per cent. (making 37½ per cent. over pre-war prices) in the price of electricity supplied within the borough by the Shropshire, Worcestershire and Staffordshire E.P. Co.

Eastbourne.—Year's Working.—In his annual report for the year ended March 31st, 1918, the borough electrical engineer states that during the year ten electric welding machines for the motor-'bus department were added to the load, and 68 street lamps were converted from gas to electricity; 102 arc lamps and 141 incandescent lamps are installed for street lighting, although, owing to the war, these are not all in use. The number of consumers increased by 106, to 2,934. The load factor was 19·77, compared with 18·45 in the preceding year, and the maximum load was 1,415 KW., against 1,202. The income for the year amounted to £39,221, against £31,213, and the expenditure was £20,862, against £16,768. Capital charges absorbed £13,586, leaving a net profit of £4,773, against £843. The renewals fund stands at £10,422. Units sold totalled 2,450,473, against 1,944,528, and included lighting 1,218,208, against 1,077,583: power 583,530, against 400,389; heating 573,395, against 415,234; cooking 61,609, against 46,987; and public lighting 13,731, against 4,335. The works cost per unit was 1·29d., against 1·24d., the total cost, excluding capital charges, being 1·94d., against 1·96d. The average revenue per unit was 3·83d., against 3·85d.

Keighley.—Price Increase.—The Electricity Committee has recommended the Corporation to increase the charges for electricity for lighting by 1d. per unit, and for power, to consumers not under sealed agreement, by ½d. per unit, commencing October 1st next.

Larne (Co. Antrim).—Public Lighting.—The Council has accepted the tender of the E.L. Co. for public lighting for three years at £761 per annum, less £40 during war restrictions, with an option to end the contract at the end of the first year on payment of £830, less £40. This is an increase of 40 per cent. on the pre-war charge.

London.—Hackney.—Wages.—The B.C. has complied with the award of the Committee on Production, increasing the war bonus to technical staff and employés at present receiving a bonus of £1, plus 12½ per cent., by a further 3s. 6d. per week.

Luton.—Loan Sanction.—The Corporation has received L.G.B. sanction to a loan for the purpose of electricity extensions; the loan is repayable within 30 years, at 5 per cent. interest on the outstanding balances.

Shropshire, Staffordshire and Worcestershire E.P. Bill.—The cost of the petition against this Bill amounted to £1,335, and is to be paid by the local authorities concerned on a rateable value basis.

Stretford.—Proposed Loan.—The Electricity Committee is to apply to the L.G.B. for permission to borrow £26,100 for the erection of a sub-station and the provision of cable and plant, in connection with a supplementary supply of electricity,

Swansea.—Year's Working.—The annual accounts of the Corporation Electricity Department for the year ending March 31st last show that the income increased by £3,306 and the working expenses by £3,881; capital charges increased by £551. The net profit was £3,255, compared with £4,412 in the previous year. The chairman stated that it was a matter for congratulation that they had been able to maintain their position without increasing the cost of energy during the year, and also to make a profit. In the current year the prices had been increased by 12½ per cent., but that was already covered by workmen's bonuses and the extra cost of coal. This is the first increase in charges at Swansea since the commencement of the war. Services, costing £14,000, were met out of reserve, as loans could not be obtained. Sinking funds, reserve fund, and capital expenditure out of revenue and reserve totalled over £100,000, which was 38 per cent. of the capital.

National Electricity Supply.—In view of the Government proposals for the linking-up of electricity undertakings, and the possibility of the Corporation taking over a larger area, the chairman and vice-chairman of the E.L. Committee and the

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engineer have been instructed to attend the forthcoming meeting of the I.M.E.A. at Birmingham.

Fuel Economy.—In order to reduce the quantity of coal used for the production of electricity for the tramways, the Electricity Committee has instructed the engineer to experiment with the use of coke and coke breeze in place of coal.

Wallasey.—Price Increase.—The T.C. has increased the charges for electricity for lighting by ½d. per unit, and for power, cooking, and heating by ¼d. per unit.

Walsall.—Loan Sanction.—The L.G.B. has sanctioned the borrowing by the Corporation of £4,000 and £2,304 for the purposes of the electricity undertaking.

Price Increase.—From the end of September the T.C. is increasing the charges of electricity for all purposes by a further 10 per cent.

Wolverhampton.—Year's Working.—The accounts of the electricity department for the year ended March 31st last show a deficit of £9,124. Fuel cost increased from £28,930 to £67,589, or from ·405d. to ·508d. per unit.

TRAMWAY AND RAILWAY NOTES.

Accrington.—Wages.—The T.C. has increased the wages of tramway conductresses by 5s. per week, making £2 10s. per week of 60 hours after one year's service.

Australia.—Melbourne Tramway Control.—It is proposed that the Melbourne tramways shall all be controlled by one body of 17 members, 15 to be elected by the ratepayers, 1 to be nominated by the Government, and a permanent chairman.

It is also proposed that the accumulated surplus on the cable tramways, amounting to about £827,000, shall form the nucleus of a sum for the liquidation of the indebtedness of the City of Melbourne to the State.

Brighton.—The B. of T. has extended the Brighton, Hove, and District Railless Traction Act, 1911, for one year.

Burnley.—Reduction of Service.—The Electricity Committee has considered the instructions of the B. of T. to reduce by 15 per cent. the consumption of coal for tramway purposes, and has notified the Tramway Committee that unless steps are taken within 14 days to arrange for such reduction, the electrical engineer will carry out the instructions as may be thought best.

Canada.—Wages.—The Winnipeg Electric Railroad Co. has refused to meet the demands of its employés for increased wages, on the ground that the additional burden would cause the bankruptcy of the company, and it is reported that the men will apply for a Conciliation Board.—*The Times.*

Continental.—Germany.—The regulations for the delivering up of metals by public bodies have been strengthened by new demands. Tramways and secondary railways have already given large quantities of metal, which has been removed from their carriages and overhead lines, to the Government. The encroachments on the line material have necessitated replacement by at least equal quantities of substitute metals, which were very difficult to obtain. Tramway companies are now making attempts to find means of putting still greater quantities of metal at the disposal of the Government, and it is probable that they will now remove the internal fittings of the cars, although they contain only a moderate quantity of the metals required.—*E.T.Z.*

Italy.—The Società Anonima Ferrovie Torino-Ciriè-Valle di Lanzo has increased its capital from 2,300,000 lire to 10,000,000 lire, for the purpose of electrifying the whole of its network within the period of one year.

Spain.—Application has been made to the Spanish Government for a concession to construct and work an electric tramway between Laviana and La Felguera (Province of Oviedo).

Ellesmere Port.—Proposed Light Railway.—The B. of T. has held an inquiry into the application of Messrs. Levenstein, Ltd., to construct a light railway at Hooton, in connection with their development scheme.

Keighley.—Railless Traction.—The Tramways Committee recommends an increase of tramway fares from an all-round level of 1d. to 1½d. The railless cars; it is stated, are a burden, largely owing to war conditions. During August 1st increased takings of £476 on the ordinary cars were almost counterbalanced by a decrease of £435 on the railless system. Out of the balance of £1,200 last year £762 was used to clear off a deficiency on the railless undertaking and £279 towards reducing the general debt on the undertaking, the balance of £170 being applied to reserve and renewals account, which had hitherto existed more or less in name only.

Lewis.—Proposed Electric Railway.—According to a correspondent, Lord Leverhulme is considering the construction, after the war, of 100 miles of electric railway on the Island of Lewis, which he owns. Power is to be obtained from the water of Loch Grimsharder.

London.—Wages.—At a meeting of men and women employés on the London underground railways on Sunday last, a resolution was passed protesting against the "shuffling tactics" of the Union officials and the Government in regard to the recent demands for equal pay for male and female labour, and also warning the Government that they would accept no other settlement than the levelling up of wages by giving the women 12s. 6d. per week war bonus. Another meeting to consider further action is to take place in a fortnight from the last meeting. According to the daily Press, the vice-president of the London District Council of the N.U.R. said that the brief strike was only a prelude to what was to come if the bonus was not granted, and next time the strike would spread to the Provinces. He said that "unless the bonus was granted, irrespective of what it might mean to the country, or to Tommy at the Front, or to the dividend-mongers, they would show that they had learnt to organise a strike on a big scale."

L.C.C.—Two tramway cars collided on Saturday evening, when a driver and a woman conductor were injured and had to be removed to hospital.

Rochdale.—Service Restrictions.—The T.C. has decided to suspend the Sunday morning tramway service, and to seek powers to increase fares. The question of reducing the week-day service is under consideration. As a result of arbitration awards there is an additional expenditure of £10,000 over last year on wages alone. The Tramways Committee has offered a bonus of 1s. 6d. to drivers when the consumption of energy per car-mile registered at the power station is reduced by 10 per cent.

Shipley.—Price Increase.—At the next meeting of the Bradford T.C. a proposal to advance the price paid to the Shipley U.D.C. for electricity for tramway purposes by 20 per cent. is to be put forward.

TELEGRAPH AND TELEPHONE NOTES.

Argentina.—A strike of 10,000 postal and telegraph workers at Buenos Ayres is reported.

China.—Owing to the great number of dialects in use in China, there is considerable difficulty experienced by "Central" in the use of the Chinese telephone. In an address recently delivered by Mr. Harry S. James before the Engineering Society of China, it was recommended, therefore, that the automatic telephone should be adopted in China as a possible solution of many of the problems encountered in the use of the manual telephone in cosmopolitan communities.—*Journal of Electricity.*

Russia.—It is stated by the daily Press that telegraphic communication with Western Siberia has been re-established.

CONTRACTS OPEN AND CLOSED.

OPEN.

Atherton.—September 16th. U.D.C. Two 110-kw. single-phase transformers. See "Official Notices" August 30th.

Bristol.—September 26th. Electricity Committee. Six months' supply unwashed small coal. Chief Engineer & Manager, The Exchange, Corn Street.

London.—Office of Works.—September 16th. Supply of electric bell fittings. See "Official Notices" September 6th.

Manchester.—September 13th. Corporation Electricity Committee. 3½-ton electric tipping wagon. See "Official Notices" August 23rd.

Spain.—Tenders have just been invited by the municipal authorities of Don Benito (Province of Badajoz) for the concession for the electric lighting of the town until the end of 1926.

South Africa.—October 23rd. Union of South Africa. Department of Posts and Telegraphs. Copper wire, &c., telephone apparatus (bells, blocks, boxes, coils, protectors, rosettes, switches, switchboards, &c). Tenders to Union Tender Board, Union Buildings, Pretoria. Specifications, &c., may be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence), London.

Stockton-on-Tees.—September 20th. Corporation District Fund, Gas and Electricity Committees. Stores for six months. See "Official Notices" to-day.

Warrington.—September 18th. Electrical goods for a year, for the B. of G. Mr. A. Bottomley, Clerk, Bewsey Chambers.

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CLOSED.

Australia.—P.M.G.'s Department, Victoria :—
Fuses, &c., £711.—Western Electric Co. (Aust.), Ltd.

Department of Defence :—
Six 2-H.P. motors, £141.—Australian General Electric Co.

Department of the Navy :—
One Otis passenger lift with Australian made accessories, £1,172; one 2-ton goods lift (Otis), £1,302.—Standard Waygood Hercules, Ltd.

Commonwealth Ship Construction :—
Electric lighting installaton, £3,411.—Sutherland & Ashman.

Prime Minister's Department :—
926 telephone relays, £370.—Automatic Telephones (Aust.), Ltd.

Victorian Railways Department :—
Flexible tubing for power signalling, £112.—General Electric Co.
45 time element relays for power signals, £1,213.—General Railway Signal Company.

Victorian State Coal Mine :—
Waterproof sockets for E.S. lamps, 10d. each; insulated rubber tape, 5s. 9d. lb.—Australian General Electric Co.

—Tenders.

Burton-on-Trent.—Council Tramway depôt extension :—
Building work.—G. Hodges & Son, £1,519.
Ferro concrete work.—Lumbrick & Co., £603.

Glasgow.—Corporation Housing Committee. Tenders. Installation of electric lighting at Garngad Housing Scheme. Allan, Arthur & Ure.

Sheffield.—E.C. Tenders recommended :—
Two 25,000-kw. turbo-alternators, with Worthington-Simpson condensing plants.—C. A. Parsons & Co., Ltd.
16 boilers. Stirling Boiler Co., Ltd.
A. Reyrolle & Co., Ltd.—Six panels, 3,300-volt, three-phase switchgear.
Brown Bayley's Steelworks, Ltd., John Brown & Co., Ltd., and Cammell, Laird & Co., Ltd.—300 tramway tires each.

Wakefield.—City Council. Electric wiring, &c., at the Maternity Home. Percy Parker, £104.

Walsall.—T.C. :—
Brush Electrical Engineering Co.—Annual supply consumers' transformers.
British Westinghouse Co.—Consumers' switchgear.
Walsall Electrical Co., Ltd.—Repairing electric wiring installation at Gas Works, £164.

FORTHCOMING EVENTS.

Institution of Mining Engineers.—Friday, September 13th. At 11.15 a.m. At University College, Nottingham. Presidential address.

Iron and Steel Institute.—Friday, September 13th. At 10 a.m. At the Institution of Civil Engineers, Great George Street, S.W. Autumn meeting.

Birmingham and District Electric Club.—Saturday, September 14th. At the Swan Hotel, Birmingham. At 7 p.m. Paper on "Graphs and Calculating Diagrams," by Mr. J. F. Avila.

Salford Technical and Engineering Association.—Saturday, September 14th. At 7 p.m. Lecture on "Steam Turbines," by Mr. E. Lee.

NOTES.

Separating Slate from Coal.—At a meeting of the Engineers' Club of Philadelphia, U.S.A., on April 2nd, a description was given of a new method of separating slate from coal. The invention is based upon the fact that if any relatively finely-divided insoluble material, such as sand, be mixed with a certain quantity of water, and if the mixture be continuously agitated, the mixture will exhibit the physical characteristics of a true liquid of high specific gravity. Such fluid masses can readily be produced by the use of seashore sand having specific gravities up to about 1·72. On putting a mixture of coal and slate into a fluid mass of this character, the slate at once sinks to the bottom, while the coal floats, the separation being complete. Apparatus embodying this principle, with conveyors to remove the coal and slate continuously, is under construction for experimental purposes. The inventor is Mr. T. M. Chance, of Philadelphia.

A Liverpool Electricians' Strike.—According to the Manchester *Daily Dispatch*, Liverpool electrical workers struck work last week on the non-Union question. "For some time the shop stewards in the Electrical Trades Union have been agitating in favour of compelling supervising engineers, foremen, and charge hands to join their craft Union, and in consequence members of the staffs of electrical undertakings have been approached lately with a view to their joining the E.T.U. In a number of instances in Liverpool supervisors and foremen have refused to join a Trade Union. The situation was discussed by the district executive of the Union on Tuesday night last week, but the rank and file took the matter into their own hands and decided to down tools at once." It is understood that later last week the number of men affected was increased to about 1,000.

A report in the *Daily Dispatch* on Monday stated that the Ministry of Munitions had intervened, and the Electrical Trades Union had been asked to send representatives to London that day to discuss the dispute. It was stated that there was every probability of a settlement being arrived at.

Proposed Swiss National Trade Mark.—In connection with our editorial comments of last week concerning German penetration, neutral productions, and the use that German agents would make of accommodating labels denoting falsely the origin of enemy manufactures, the following reference in the *Board of Trade Journal* to the proposed introduction of a Swiss Trade Mark may be studied with interest :—

"A copy of the Regulations under which it is proposed by Swiss Chambers of Commerce to establish a Swiss national trade mark under the name of S.P.E.S. (Syndicat pour l'Exportation Suisse) discloses the fact that the mark will be confined to firms two-thirds of whose capital is Swiss and to goods that are made in Switzerland exclusively by the Swiss. Thus any foreigners manufacturing in Switzerland will not be able to use this trade mark for goods manufactured by them in Switzerland. The object of the trade mark, it is stated, is not to place foreigners at a disadvantage, but to ensure that any articles bearing the mark SPES are to be really of Swiss manufacture. In addition, the mark is directed against German penetration, as numerous firms are known to be ostensibly Swiss, but in reality German. The President of the Geneva Chamber of Commerce states that the control of these will not be easy, but the Committee are alive to the probability of improper use of the mark, and they consider that it will be necessary for Swiss manufacturers to bring cases of this character to official notice. No foreign firms are to be prevented from manufacturing in Switzerland, but, not being Swiss, they are to be debarred from using the trade mark. With regard to the possibility of the extensive misuse of the trade mark by exporting merchants, it may be necessary to add the manufacturers' name to the trade mark. This may not be acceptable to exporters, and if impracticable and the trade mark fails as a result to protect Swiss manufacturers, it is considered probable that the Chambers of Commerce concerned will propose its abolition."

The City's National Kitchen.—The National Restaurant in New Bridge Street is not only a popular success, it is equally successful financially. Mr. C. F. Spencer, the Director of National Kitchens, has submitted to the Food Controller a statement on the working of the restaurant during the three weeks ending August 24th. For this period the weekly net profits were £50, £70, and £73. In each case provision was made for the full rent, management charges, reserve for renewals, interest at 5½ per cent. per annum on capital, and depreciation at 10 per cent. per annum. It was claimed by the catering trade that the restaurant could not pay with the quantity and quality of the food given and the cheap prices charged. The surplus of £70 a week, which appears to be maintainable profit, however, is equal, Mr. Spencer says, to 70 per cent. per annum on the capital outlay, and would be enough to repay the capital within 18 months; 17,925 persons took meals at the restaurant during the week ending August 24th; the average price of each meal was just under 6½d., and the cost slightly over 5½d., after making provision for all charges, and the net profit was ·986d., or nearly 1d. a meal. Further restaurants are to be established in London and the provinces.

Ministry of Munitions and Control of Electricity Supply.—The following regulation is now substituted for Regulation 11A under the Defence of the Realm Consolidation Act :—"11A. The Minister of Munitions, with a view to maintaining or increasing the supply of light, heat, or power for the purpose of the production, repair or transport of war material or any other work necessary for the successful prosecution of the war, may

(*a*) by order direct that lights of any specified class or description shall be extinguished, or their use restricted to such extent, between such hours, within such area, on such premises, and during such period, as may be specified in the order; or

(*b*) prohibit, restrict, or otherwise regulate and control the supply, or means of supply, of electricity to, or its use in, any premises or class of premises, or any place or undertaking,

and if any person having control of any light, or occupying or having control of, or managing, or being in charge of, premises in on or in connection with which any light is used acts in contravention of any such order as to lights, or if any person fails to comply with, or acts in contravention of, any order or requirement hereunder as to the supply, or means of supply, or use of electricity, he shall be guilty of a summary offence against these regulations:

"Provided that (i.) this regulation shall not apply to any lights required to be kept lighted by a competent naval or military authority, or other officer authorised by him for the purpose, or under any order made under Regulation 11 by the Secretary of State or the Secretary for Scotland; and (ii.) no order or requirement shall be made for the closing of any power station belonging to any local authority, or for the connection of any such power station with any other power station except with the concurrence of the appropriate Government Department, and if any question arises as to which Government Department is the appropriate Government Department, the question shall be finally determined by the Treasury."

Educational Notes.—University College, University of London.—The new session in the Faculty of Engineering begins on September 30th. We have received a copy of the prospectus, giving details of degree courses, &c., and scholarships offered.

Goldsmiths' College, University of London, New Cross, S.E.—Engineering Department.—The next session commences on Monday, September 23rd. Full particulars are given in our advertisement pages to-day.

London County Council Hackney Institute, Dalston Lane, E.C.—The new session commences on September 23rd. Particulars are given in our advertisement pages to-day.

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Appointments Vacant. — Switchboard attendant for Southampton Electricity Works (51s. 10d.); attendants for Camp Hutment electric lighting installation; resident engineer for generating station in India (550 Rs. a month); assistant mains superintendent (60s. + 20s. + 12½ per cent.) for the Croydon Corporation Electricity Works; jointer wireman at Curragh Camp; second technical assistant (£250) for the County Borough of Newport Electricity and Tramways Department; switchboard attendant for the Battersea Corporation Electricity Department. See our advertisement pages to-day.

Municipal Tramways Conference.—The annual Conference of the Municipal Tramways Association is to be held at Leicester on September 26th and 27th.

Birmingham and District Electric Club.—The second half of the 1918 session opens to-morrow night, at 7 o'clock, at the Swan Hotel, New Street, Birmingham, with a paper by Mr. J. F. Avila on "Graphs and Calculating Diagrams." Later events for this year are:—

October 12th.—H. F. Steventon, "Some Modern Applications of the Gyroscope."
November 9th.—H. W. Dipple, "Automatic Telephones" (also visit to Dudley new Automatic Exchange).
November 23rd.—Ladies' Night. Lantern Lecture and Concert.
December 14th.—Annual Meeting.

Electric Vehicle Progress.—According to the Electric Vehicle Section of the N.E.L.A., New York, last month two New York ladies drove an "electric" a distance of 95 miles in one afternoon on one battery charge, using 200 ampere-hours. During the night the batteries were charged, and the following morning a distance of 77·5 miles was covered, using 170 ampere-hours. While resting, a matter of three hours, the batteries were boosted, leaving then for New York, a distance, with detour, of 80·9 miles, 200 ampere-hours being used. Over 253 miles were covered in a day and one-half of travel. The electrical energy used cost $2 50, or less than 1 cent per mile. This was not a "stunt" of a special car operated by a selected driver, but a trip made by a standard—and not new—car, driven by its owner, in this case a woman.

A demonstrating car, as manufactured by a Cleveland concern, recently travelled a distance of 78 miles on 172 ampere-hours in 3 hours 50 minutes. This route was over dirty roads and through very hilly country. Upon arrival there was considerable current left in the battery. On the return trip the distance covered was 100·8 miles on one charge; time, 6 hours 19 minutes; current used, 220 ampere-hours. The roads for the most part were hilly.

In South Africa the electric vehicle continues to make rapid headway, whereas little over five years ago the "electric" was virtually unknown. So rapidly and successfully did electric vehicle transportation development become in and about Johannesburg, that the local electricity supply company found it advisable to extend its activities, whereupon the service idea was introduced. Electric vehicles are sold without batteries from a general garage, which keeps batteries charged in readiness for any demand. Such, indeed, is the perfection of this system, that for $39.50 a month a car is not only kept in batteries, but is cleaned as occasion requires and maintained in repair.

In connection with energy costs, the following report of the Vice-Consul, Cape Town, will be interesting:—"Inquiries made in the principal cities of South Africa indicate that no restrictions have been placed on the use of electric energy for charging the batteries of motor vehicles save as to hours of doing so. In some cities certain regulations providing for higher charge per unit of current taken during peak load periods are in force; in others no energy at all is available for vehicles during such periods. In the city of Cape Town no restrictions are imposed regarding the use of electricity for propelling vehicles during any part of the day, providing always that the cables supplying the particular area where such energy is used are sufficiently large to carry the quantity demanded. The charge per unit of energy for such purpose is 1d. between the hours of 11 p.m. and 8 a.m., and 2½d. for the remainder of the day. Energy is also supplied at special rates where the consumer guarantees to use 100,000 or more units per annum. Such rates, however, depend on the quantity guaranteed and the conditions under which the energy is taken."

The demand for American-built electric vehicles by European countries continues to exceed the supply and available shipping facilities. Spain is the latest country to evidence a desire to utilise, on a large scale, electric vehicle transportation, not only for immediate use to help out in emergency conditions, but more particularly to form the basis of a systematic mobile transportation development to meet conditions which will obtain with the return of peace. To such end, several engineers, representing important Spanish interests, have been in the United States making investigations of electric vehicle developments there preliminary to effecting arrangements for the importation and manufacture of electric vehicles and parts. At this time gasolene, in Spain, costs about $2.00 per gallon, and consists of about 50 per cent. alcohol. Its use is not permitted by passenger-cars, and only very restricted quantities are available for commercial truck use, most of the fuel being reserved for Government transportation requirements. While this condition is abnormal, and likely to be relieved with the return of peace, yet, even then, the cost of gasolene in Spain will be likely to continue at a high figure. On the other hand, electricity, largely produced by water power, is at present available for charging electric vehicle batteries at 2 cents per KW.-hour.

Institution and Lecture Notes.—Institution of Electrical Engineers (Students' Section).—The Committee of this Section invites offers of papers from student members for reading before the Section during the forthcoming session, 1918-19. Full particulars of the papers, giving titles, probable date of reading, &c., should be sent as soon as possible to the Honorary Secretary of the Students' Section, Mr. R. L. Smith-Rose, B.Sc., 76, Maryon Road, Charlton, S.E. 7.

Company Fined.—According to the daily Press, a fine of £50, with 10 guineas costs, has been inflicted at Uxbridge on Bernard Wingfield (formerly Weisengrund), manager of the Power Plant Co., West Drayton, for breach of the Household Coal Order. He was accused of having made a false declaration as to the amount of coal he had in stock. For aiding and abetting him the Power Plant Co. was fined £5 and a further £5 for supplying industrial coal to its hostel.

Wanted, a Book!—Referring to our leaderette last week, a correspondent remarks that the A.C. book which we outlined is precisely the book he has been trying to procure for years, but has at last given up as unobtainable. He is by no means alone in his quest.

On the other hand, with reference to our remarks in passing on other books that were wanted, the Agricultural Electric Discharge Co., Ltd., of Gloucester, has sent us a copy of its brochure entitled "Increased Food Production," which has been published to show what has been and what can be done to increase food production by electric stimulation. The long-extended investigations of this company, under the supervision of Mr. Newman and with the advice of Sir Oliver Lodge, are familiar to our readers; but this publication certainly goes a long way to fill the gap in our literature on electroculture to which we incidentally drew attention. Naturally, it deals mainly with the company's own experiments, and the apparatus which it has developed for the purpose on a commercial basis, but it also gives summarised particulars of the scientific aspect of the subject, the results obtained by various experimenters, and the present position. We are interested to note that in a special experiment on 1 acre last year, designed to ascertain the effect of electrical stimulation after the wheat was "stooled"—that is, when the number of shoots from each root was fixed, and any increase in production would be confined to the number and size of grains—an increase of 33 per cent. was recorded, entirely due to increase in the size of the ears. The discharge was not applied until May 26th. In the ordinary case, when the stimulus is applied at an earlier stage, the number of ears is also increased, so that a gain of 50 to 60 per cent. should be regularly obtainable.

Electrified Wheat..—The results of the first two thrashings of electrified corn are announced by Mr. H. H. Dunn, seed specialist, of Salisbury. In the *Daily Mail* last July it was stated that over 2,000 acres were then under electrified seed.

The electrification consists of soaking the seed in a weak solution of common salt or calcium chloride, passing a comparatively small electric current through the grain in soak for a few hours, and then slowly drying it in a kiln.

Wheat grown at Fort St. Cleer, Liskeard, Cornwall, says Mr. Dunn, showed 28 per cent. increase on grain and 40 per cent. on straw. Oats grown at Moreton, near Dorchester, showed a gain of 61 per cent. on grain.

A Large Power Plant.—The Victoria Falls and Transvaal Power Co., which is said to be the largest power undertaking in the British Empire, was formed in 1906 with the object of supplying electrical energy to the gold mines and other consumers in the Witwatersrand area, excluding the Johannesburg municipality. In 1908 the largest group of mines now controlled by the Central Mining and Investment Corporation decided to electrify its mines and purchase all its power, both electric and compressed air, from the Rand Mines Power Supply Co., a subsidiary company of the Victoria Falls and Transvaal Power Co. There are, therefore, two separate power companies working under separate licences granted by the Government in terms of the Power Act passed in 1910, but both concerns are controlled and operated by the same management and staff. The capacity of the power stations installed is:—Rosherville, 64,000 H.P. (electric generators); Rosherville, 50,000 H.P. (air compressors); Simmerpan, 56,000 H.P. (electric generators); Brakpan, 40,000 H.P. (electric generators); Brakpan, 10,000 H.P. (air compressors); Vereeniging, 58,000 H.P. (electric generators); Robinson, 24,000 H.P. (electrically-driven compressors); total capacity of plant installed, 302,000 H.P. Approximately 837,000,000 units, or 1,120,000,000 H.P.-hours were sent out of the generating stations in 1917. This involved burning over 1,000,000 tons of coal, a large proportion of which consisted of duff, a by-product from the collieries. The total number of units sold for lighting, power, and tramways by the public utility companies and municipalities of Greater London for the year 1916 was about 450,000,000 units, or about 40 per cent. less than the units sold by the Victoria Falls and Transvaal Power Co. to the mining industry on the Witwatersrand. The compressed air supply is stated to be much the largest in the world. During 1917, 2,000,000 tons of air passed through the main pipe network from the two compressor stations to the mines for use in driving rock drills, &c. At the time of maximum load each day, air is delivered at the rate of about nine tons per minute.—*Iron and Coal Trades Review.*

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Municipal Openings for Disabled Men.—Local War Pensions Committees have received from the Ministry of Pensions a communication in which their attention is directed to the local public services as affording suitable openings for disabled officers and men. Tramways and electricity supply are mentioned as follows:—

Tramways.—Managing and supervisory posts, drivers, conductors, foremen, yardmen, timekeepers, engineers, blacksmiths, carpenters, painters, and labourers.

Electricity Supply.—Managing and supervisory posts, collectors, engineers, enginemen, fitters and repairers, foremen, timekeepers, carpenters, painters, stokers, labourers, yardmen, &c.

The object of the Ministry is to secure such positions for these men as they afford a reasonable prospect of permanency. Their employment is, of course, subject to the reinstatement of former officials who may be away on war service.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Oxford Street, W. 1.

Corps Orders No. 38, by Lieut.-Colonel C. B. Clay, V.D.:—

Captain of the Week.—Capt. W. Hynam.

Next for Duty.—Capt. W. Darley Bentley.

Sunday, September 15th.—Commandant's Parade, at Waterloo Station, 8.45 a.m., for work at Esher. Dress: Drill Order, without rifles. Mid-day and tea rations to be carried.

Monday, September 16th, to Saturday, September 21st.—Drills as usual.

C. Higgins, *Capt.* R.E., *Adjutant.*

Greek Tour of British Industrial Centres.—The tour of Greek Commercial Delegates, which has been organised by the Federation of British Industries, commences on Sunday next, September 15th, with the arrival of the company at the Ritz Hotel in London. On Monday evening they will be entertained to dinner by the Government at the Carlton Hotel. Luncheon at the Mansion House on Tuesday will be followed by the Federation Dinner at the Ritz at night. On Wednesday the works of Callender's Cable and Construction Co., Ltd., at Erith, will be visited. On Thursday the Delegates will proceed to Birmingham, and there will be dinner and a reception at Queen's Hotel at night. On the following Friday, Saturday, and Monday various important manufactories in that city will be visited. Tuesday and Wednesday, September 24th and 25th, will be similarly spent at Nottingham and Lincoln, and after a brief stoppage at Derby on Thursday the journey will be continued to Liverpool, where the works of the United Alkali Co. (Widnes) and Lever Bros., Ltd. (Port Sunlight) will be visited on September 27th and 28th. In the following week two days (September 30th and October 1st) will be spent at Manchester (British Westinghouse Works, Crossley Motors, Ltd., and Ashton Bros. & Co., Ltd.). Later events in the programme are as follows:—October 2nd and 3rd, Sheffield (T. Firth and Sons, Ltd., J. Brown & Co., Ltd., Vickers, Ltd., Hadfields, Ltd.): October 4th, Bradford (Sir Titus Salt, Bart., Sons & Co., Ltd.); October 5th and 6th, Harrogate; October 7th and 8th, Leeds (J. Fowler & Co., Leeds, Ltd., and other works); October 9th, 10th, and 11th, Glasgow (N. British Locomotive Works Co., Carron Co., Beardmores, Stewarts & Lloyds, Ltd., and a trip on the Clyde); October 12th, visit to the Grand Fleet; October 14th, Edinburgh; October 15th and 16th, Newcastle and Middlesbrough (Armstrong Whitworths, Hawthorn Leslie's, Cargo Fleet Iron Co., Cochrane and Co., Dorman, Long & Co., Ltd.); October 17th, Saltburn-on-Sea; October 18th, Port Talbot (works visits); October 19th, Swansea (works visits); October 20th, 21st, and 22nd, Bristol and Bath (works visits). On Wednesday, October 23rd, the Delegates will return to London, where a Federation luncheon will be served, and the Association of Great Britain and Greece (Industry and Economics) will be formed.

The foregoing will show what a full programme has been arranged for the education of our visitors respecting British manufacturing capacity and activity in war-time. The Federation of British Industries has certainly resolved to leave nothing undone that shall ensure fitting hospitality for the guests in all the great centres that are to be visited. The Federation officials attached to the tour are Sir Chas. Dundas of Dundas, Mr. E. L. Hill, M.I.Mech.E., M.I.E.E., and Mr. H. W. Babington-Browne. The following are the names of the delegates:—

H. E. Mons. Michalocopoulos, Minister of Agriculture.
Mons. A. Skintzopoulos, Industrial Inspector of the Greek Ministry of National Economy.
Mons. B. Zamanos, Member of Parliament and Founder of the Vodena Cement Works.
Mons. L. Oeconomides, Chemical Manufacturer.
Mons. J. Damala, Finance and Banking.
Mons. A. Tsitis, Cotton Spinner.
Mons. C. Malikopoulos, Importer of Textiles.
Mons. E. Caralopoulos, Iron, Steel, Machinery, and Development Schemes.
Mons. M. Kazazes, Importer of Agricultural Machinery.

Batti-Wallahs' Society.—After a lapse of 18 months, 40 members of this Society held a lunch meeting recently, at the Holborn Restaurant, with Mr. L. M. Waterhouse in the chair. Owing to the success of the gathering, it was decided to hold a similar lunch meeting on Monday next, September 16th, with other like functions on the third Monday in succeeding months.

Electric Traction.—According to *Engineering*, Mr. G. M. Woods suggests a method by which he claims goods trains can be hauled electrically over the same tracks as electrically-propelled passenger trains, without increasing the load peaks beyond the limit which would be attained with the passenger service alone electrified. To this end he suggests that the goods hauled should be concentrated on the basis of light passenger traffic. In this way the load factor of the whole electric installation would be raised to a maximum, and the capital cost of the necessary equipment reduced to a minimum.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Aberdeen Tramways Committee recommends the appointment of Mr. W. Forbes, traffic superintendent and assistant manager, as general manager, in succession to Mr. R. S. Pilcher, who goes to Edinburgh.

Mr. H. Webber, borough electrical engineer and tramways manager, Keighley, has been appointed by the Controller of Coal Mines as district engineer to the Keighley district.

Mr. H. E. Munday, charge engineer at Cheltenham electricity works, has resigned, having taken up a similar appointment with the Bedford Corporation electricity department.

Mr. B. Hall, of Chatham, has been appointed as assistant to the Keighley borough electrical engineer and tramways manager, at £200 a year.

Mr. T. W. Hibbert, Barnsley, has been appointed station engineer under the Doncaster Corporation electricity department, at £200, rising after twelve months' service to £250.

Mr. Irvine Lynch has been appointed collector of accounts in the Rathmines (Dublin) Electrical Department, at £200 per annum.

The Pembroke (Dublin) Council has increased the salary of the electrical engineer, Mr. S. L. R. Price, from £450 to £500 per annum.

The Walsall Tramways Committee recommends raising the salary of the tramways manager to £600 per annum as from April 1st last, rising by two yearly instalments to £700 per annum. The salary of Mr. D. Mills, chief clerk in the electric supply department, is to be increased from £150 to £175 per annum.

Roll of Honour.—Lieutenant L. G. Byng, M.C., Grenadier Guards, to whose death from wounds on August 24th we referred in our last issue, was the second son of the late Mr. G. Byng, founder, and until 1910, chairman, of the General Electric Co., Ltd., and Mrs. Byng, of 32, Bryanston Square. Lieut. Byng was born in 1888, and educated at Harrow. On leaving school he joined the General Electric Co., Ltd., of which company he became a director in 1910. In 1914, he joined the Inns of Court O.T.C. He received a commission in the Royal West Kent Regiment, but finally transferred to the Grenadier Guards, and had served with them in France since July, 1917. He fought in several battles this year, and gained the Military Cross under the following circumstances:—

When information was urgently required as to the enemy's position and movements, he went forward 600 yds. into "No Man's Land," and, although he passed many large parties of the enemy who were crossing his line of advance, he succeeded in penetrating into the enemy's main position. He remained there observing for over six hours, and returned with a prisoner and much valuable information. He showed splendid initiative, enterprise, and determination.

He was wounded whilst leading his company in a most successful attack with, as his commanding officer wrote, "his accustomed gallantry." He died in the evening of the same day. Brother officers write that his chief characteristic was cheerfulness under all conditions. His cheeriness, his ready wit, his gentleness and modesty, made him quickly a favourite in all circles in which he moved, and he was welcomed everywhere. His charming personality will be equally missed by the board of directors, as by the members of the staff of the General Electric Co., in which it had been hoped he would play a part of great responsibility. As will be remembered, his younger brother, Harry, died in 1915 of wounds received at the battle of Festubert.

Private C. Moss, Northumberland Fusiliers, who has fallen in action, was formerly in the Leeds Corporation Electric Light Department.

Lieutenant H. W. F. Ponter, the Queen's (Royal West Surrey Regiment), attached K.R.R.C., aged 29, who, it is mentioned in the *Times*, was killed while gallantly leading his men, had qualified as an electrical engineer, and, after serving his articles with a Bristol firm, he obtained appointments at Rugby and Manchester, and afterwards with the Metropolitan Railway.

Bombardier R. H. Sanderson, who was on the Carlisle Corporation electricity works staff, has been killed on his way to rejoin his battery at the end of his wedding furlough. He had gained the Serbian Gold Medal.

Mr. S. Crosby, senior Marconi officer on board a vessel sunk by enemy action, is a prisoner of war in Germany.

Lieutenant E. Morton, who has died of wounds, was formerly a premium pupil at the Whitehaven Corporation electricity works, and was later engaged on the Mersey Underground Railway.

Lieutenant F. H. Andrews, M.C., M.M., Gloucestershire Regiment, who has fallen in action, was in civil life engaged with Messrs. Lea, Son & Co., electrical engineers, of Shrewsbury. He gained the Military Medal and later the Military Cross.

Private A. Capper, South Lancashire Regiment, missing since November last, and now reported killed, was employed by Messrs. Connolly Bros.

Private C. Charlott, South Lancashire Regiment, reported

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killed after being missing since last year, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Flight Cadet J. E. Denton, R.A.F., eldest son of Mr. E. Denton, electrical engineer to the Pudsey Corporation, aged 18 years, met his death by accident whilst practising flying in a Yorkshire training ground last week.

Private J. S. Graham, formerly an electrician with Messrs. D. Colville & Sons, Clydebridge Steel Works, Cambuslang, has been killed in action.

Lieutenant-Colonel C. F. Rundall, who, after being superintendent of the Brennan Torpedo Factory, was in 1913 appointed chief instructor at the School of Electric Lighting, has been wounded in action. For his services during the war, Colonel Rundall has been mentioned in despatches on several occasions, and has been made a Companion of the Distinguished Service Order.

Seaman W. Whyte, formerly employed by Messrs. Haddow and Co., electricians, Glasgow, has been killed by his ship striking an enemy mine on August 2nd.

Private J. Hislop, who was formerly employed at the Langside depot of the Glasgow Corporation tramways, is officially reported killed in action.

Second-Lieutenant W. H. McCallum, formerly on the staff of the telephone department at the G.P.O., Glasgow, has been killed in action.

Private F. Temple, Grenadier Guards, a Cardiff tramwayman, has been presented by the staff of the Cardiff tramways department with a gold watch, chain, and pendant, in recognition of his winning the Military Medal. Mr. Arthur Ellis presided over the proceedings, and was supported by Mr. H. David (the traffic superintendent).

Private H. Daintith, Royal Fusiliers, killed in action, was employed by the St. Helens Cable & Rubber Co., Ltd., Warrington. Private D. Bradshaw, South Lancashire Regiment, officially reported to have died from wounds, was also an employé of the same company.

Private W. U. Priestley, London Regiment, wounded and in hospital at Huddersfield, was employed at the Blackpool Corporation electricity works.

Major F. A. Robinson, M.C., Tank Corps, formerly in the electric light department of the India-Rubber Co., Silvertown, and Driver J. P. Crosley, R.F.A., and Private H. F. Payne, East Yorks. Regiment, who were in the general office of the same company, have all been wounded in France, Driver Crosley seriously. Private W. F. Day, Machine Gun Corps, late of the electric light department of the company, died in hospital on August 13th after being gassed.

Obituary.—Sir Ratan Tata.—The death has occurred at the age of 47 years of Sir Ratan Tata, of Twickenham, who with his elder brother, Sir Dorab Tata, had much to do with the carrying out of the Tata Hydro-Electric Works from which Bombay receives power supply, a scheme the conception of which was due to their father, the late Mr. Jamsetjee N. Tata.

Wills.—Mr. R. W. Hornsby, of Grantham, left £159,873 gross, and £147,448 net personalty.

Mr. W. Booth, chairman of J. Booth Bros., Ltd., crane makers, Rodley, left £26,529.

A NEW LIGHTNING ARRESTER.*

The electrolytic lightning arrester is, as a rule, remarkably effective, but under sustained conditions supplementary protection may be employed to advantage. For the protection of the arrester under these conditions Mr. E. O. Schweitzer has conducted preliminary experiments on a device of his own invention, which is designed to open and close, or vary the resistance of the arrester circuit automatically at any time when it is in danger. The possible use of the electrothermal valve, as this device is termed, as a complete lightning arrester, entirely obviating the use of an arrester of the ordinary type, is indicated by the experimental data. A series spark gap is here required, as for other arresters. The electrothermal valve is shown in figs. 1 and 3; it consists of a vertical cylindrical chamber made of a bakelite tube (5) closed at the ends by cast-iron caps. The upper adjustable electrode (4) is of artificial graphite in the shape of an inverted four-sided pyramid supported by a steel rod (1), through which it makes electrical connection with the high-potential circuit to be protected. This rod passes through the stuffing-box (2) in the upper cap, in which it can be moved, when desired, to vary the distance between the electrodes. The lower electrode (6) is a flat plate of artificial graphite, permanently attached to the lower cap, which is earthed. So far ordinary city water has been used as the electrolyte. The chamber is provided with a small relief valve (3), and is also connected by a pipe to a reservoir by means of which a certain desired pressure is maintained in it.

The heat generated by the flow of current following a discharge through the electrolyte produces a pressure in the electrolytic chamber. This pressure is only partly relieved by the small valve, and in the meanwhile the resistance of the electrolyte decreases as its temperature rises, so that the current increases rapidly. Then the area of contact between the electrode and the electrolyte becomes less and less as the electrolye level falls, since the electrode tapers to a point. The decreasing area of contact results in an increasing contact resistance, and the current drops rapidly, although smoothly. Despite the decrease in current, heat is now being generated at a high rate at the contact surface, and the electrolyte is forced rapidly downward until contact is broken at the point of the electrode and the current becomes zero.

The needle valve now relieves the pressure, and if the impressed voltage has been removed the electrolyte will return rapidly to its original level. If, on the other hand, the impressed voltage has been maintained at its full value, the electrolyte rises only to a point where it makes contact with the tip of the electrode. This contact is so small and of such high resistance that the production of heat is exceedingly rapid, the pressure quickly rises, the electrolyte is immediately forced down out of contact with the electrode, and

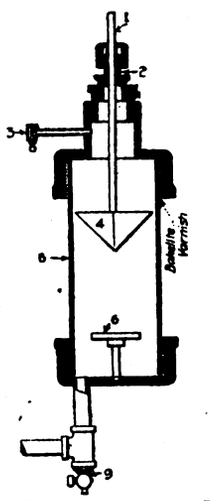

Fig. 1.—Electrothermal Valve.

the flow of current is but momentary. This last cycle is repeated over and over again so long as the impressed voltage is maintained, resulting in a momentary flow of current at brief intervals.

The higher the impressed voltage, the more rapid the operation of the valve, since a high voltage results in a large flow of current and a rapid generation of heat. If the impressed voltage is sufficiently low, a small flow of current may continue indefinitely without causing the valve to function. Other conditions remaining constant, the distance between electrodes governs the electrical resistance of the valve, and thus the magnitude of current flow. If the distance is short, the current flow will be large and the operation of the valve rapid. As the distance is increased the time required to open the circuit becomes greater.

If the distance between electrodes is very short and the impressed voltage high, an arc might form and maintain it-

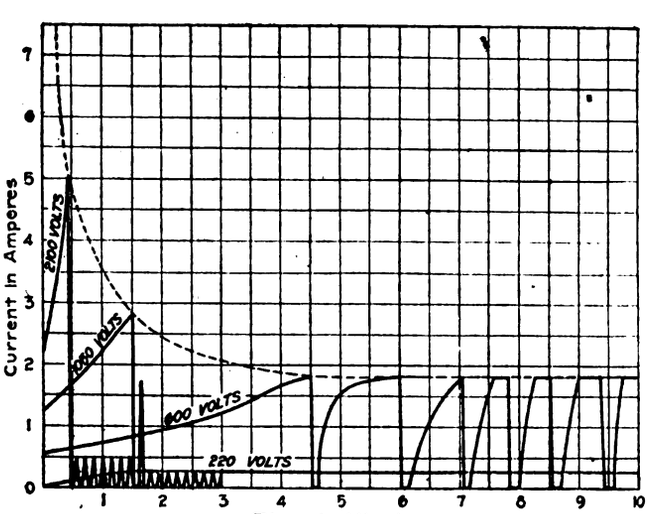

Fig. 2.—Time Characteristic of Electrothermal Valve.

self from the electrode after the electrolyte had been forced out of the way. This can happen only in case the normal voltage of the power line is sufficiently high to form an arc across the gap, since the duration of a disruptive discharge is too brief to cause such a result. The limiting electrode distances for different voltages have not yet been determined, and no such arc has ever formed during the course of the experiments.

The current-carrying capacity of the device may also be greatly increased by reducing its resistance. Increasing the cross-section of the electrolytic chamber, and at the same

* *Electrical World*, July 13th, 1918,

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time increasing the size of the electrodes, will also increase the valve's current-carrying capacity.

Adjusting the needle valve to have a greater orifice decreases the speed of operation, since the needle valve then prevents the pressure from building up so rapidly as before, and when the circuit has once been opened the electrolyte will re-establish contact with the upper electrode in a shorter time than before, since the needle valve will release the accumulated pressure more rapidly. The needle valve must be set at the point which will give the desired balance between speed of initial operation and speed of return to initial position, and then be locked in place.

An approximate idea of the speed at which the electrothermal valve operates at different voltages and the current which it carries can be obtained from the curves shown in fig. 2. These show the experimental results obtained at 220 volts, 600 volts, 1,050 volts, and 2,200 volts, these voltages in each case being impressed directly across the electrodes without the use of limiting resistance of any kind. At the beginning of each run the valve was at room temperature, and the impressed voltage was maintained at its full value for 10 minutes. The electrode distance was 3 in. (7.62 cm.) in each case.

At 600 volts the current rose from an initial value of 0.55 amp. to 1.80 amp. in four minutes and 30 seconds. From the maximum the current dropped abruptly to zero in about two seconds. After remaining at zero for a few seconds the current began to rise again, at first rapidly, then more slowly, finally reaching a maximum at about the same value as before, whence it again dropped abruptly to zero. This cycle was repeated over and over again up to the end of the run, but each cycle was of briefer duration than the one before it. After the third cycle the current remained approximately constant at its maximum for several seconds. By this time the electrolyte was very hot and its resistance low, resulting in a tendency for the current to reach a higher maximum than before. This tendency was opposed by the fact that the pressure above the electrolyte also increased more rapidly than before. At the maximum value of the current these opposing tendencies exactly balanced each other for an appreciable time, thus holding the current constant.

The operation at 1,050 volts was quite different. Starting at an initial value of 1.25 amp., the current increased more rapidly than before to a maximum of 2.80 amp., which was reached in 1 minute and 30 seconds. The point of inflection in the curve is still noticeable, but less distinct than before, because the action is now more rapid. As before, the current dropped abruptly from its maximum to zero. After a brief interval it rose again—not to the former maximum this time, but to about 1.75 amp., dropping immediately to zero. Thereafter the current did not at any time exceed 0.25 amp., a value which it reached intermittently until the end of the 10-minute test, at periods varying from about five seconds at the beginning to about two or three seconds at the end.

At 2,100 volts the current rose very rapidly from an initial value of 2.2 amp. to a maximum of 5 amp., which it reached in 25 seconds. It then dropped abruptly to zero as before. This time the action was so rapid that no point of inflection can be observed in the ascending curve. After the circuit was first opened, at the end of 25 seconds, the current never again exceeded a value of about 0.5 amp. Up to the end of the 10-minute run the electrolyte made contact with the electrode tip at intervals of three to four seconds. At each contact there was a momentary flow of current, about 0.5 amp. in value, which dropped to zero again almost instantly. For the sake of simplicity, the curve sheet does not show these rapid alternations of current from zero to 0.5 amp. after the first minute, but they continued substantially as shown during the remaining nine minutes of the test.

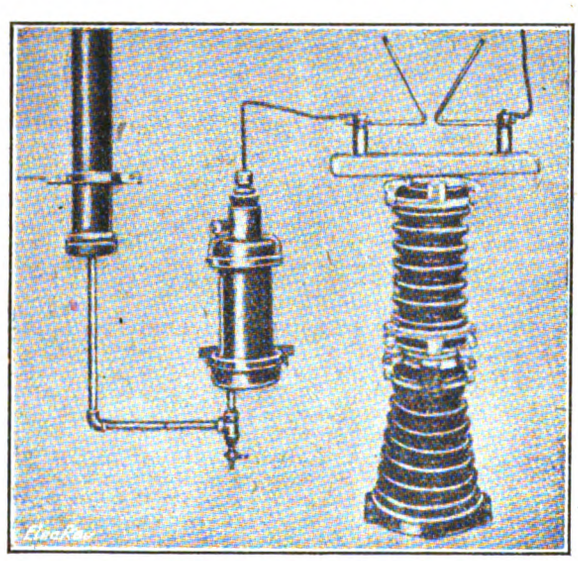

Fig. 3.—The Valve Connected up.

The flash of the arc each time contact was made and instantly broken could be distinctly seen through the ⅛-in. (3-mm.) bakelite-fibre wall of the electrolytic chamber.

The variation of electrical resistance during the four runs described, calculated from the observed values of voltage and current, was as follows:—

Impressed voltage.	Initial Resistance. Ohms.	Resistance of Maximum current. Ohms.
220	...	880
600	1,080	333
1,050	840	375
2,100	955	420

The resistance of the electrolyte itself decreases uniformly as the temperature increases, but the contact resistance between the electrolyte and the electrodes, always a considerable percentage of the total, and sometimes the governing factor, varies according to the impressed voltage and other conditions in a manner which is rather obscure, and does not lend itself to accurate prediction.

After some 20 or more separate runs had been made, the interior of the electrolytic chamber was inspected and found to be in perfect condition, despite the constant and rapid succession of high-voltage arcs which had been formed and broken during the tests. The upper electrode, which had acted as one terminal for these arcs, was as smooth and unpitted as it had been originally. The bakelite tube, the lower electrode, and the cast-iron caps all appeared to be in perfect condition. No test has yet been made to determine how adequately the electrothermal valve will take care of a disruptive discharge such as that caused by lightning. All tests so far made merely indicate how the valve will operate from the moment the power current begins to follow the disruptive discharge.

The device at present under test was built from guesswork. More information will be available when the tests are completed, and a larger unit can then be designed and constructed with some degree of precision.

It was foreseen that the electrolytic action between the electrodes would result in the decomposition of the water into hydrogen and oxygen, forming an explosive mixture above the surface of the electrolyte. To prevent the possibility of an explosion in the electrolytic chamber, which might occur when an arc forms at the moment the circuit is broken, the electrolyte was covered with a layer of transil oil. It is doubtful whether the oil is really necessary, as the quantity of gas formed during the brief flow of current must be small, and greatly diluted by a larger quantity of water vapour.

Although the electrothermal valve was originally proposed for use in series with an aluminium arrester, for the protection of the latter, it is apparent that it would be equally suitable for use as a self-contained lightning arrester. From the preliminary experiments so far completed it is evident that the valve possesses peculiar qualities which are advantageous in a lightning-arrester.

NEW COMPANIES REGISTERED.

Weston Electrical Instrument Co., Ltd. (151,376).—Private company. Registered September 6th. Capital, £10,000 in £5 shares. Electrical and mechanical engineers, ironfounders, metal workers, &c. The subscribers (each with one share) are:—A. Davy, Audrey House, Ely Place, E.C. 1, electrical engineer; R. J. White, 5, Thavie's Inn, E.C. 1, solicitor. The first directors are to be appointed by the subscribers. Registered office: Audrey House, Ely Place, E.C. 1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Budenberg Gauge Co., Ltd.—Issue on August 22nd, 1918, of £3,200 debentures, part of a series of which particulars have already been filed.

Egham and Staines Electricity Co., Ltd.—Particulars of £17,000 debentures created by resolutions of September 25th, 1912, and June 3rd, 1918, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £5,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

W. S. Jeal & Co., Ltd.—Memorandum of satisfaction in full on August 16th, 1918, of debentures dated September 3rd, 1915, securing £400, has been filed.

CITY NOTES.

Kalgoorlie Electric Tramways, Ltd.

Presiding at the annual meeting held in London on September 5th, Mr. O. Wethered said that the position was about the same as when they last met. Conditions in Kalgoorlie were no better, nor could they be for some time to come. A great number of people who formerly used the cars now walked or used bicycles. The cost of all tramway requirements had greatly increased, indeed it was almost impossible to get them. Tires which cost under £2 each were now £5 10s. if imported, and nearly £8 if purchased locally. Copper wire could not be

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obtained from England or America for Australia, but recently Japan had been supplying it. The arbitration proceedings respecting wages, &c., would cost the company about £1,200 per annum more. The operating expenses had been cut down to the lowest point, and they had been obliged to reconsider certain privileges that had been given to the public in the past. Workmen's tickets were to be advanced, and there was to be an extra 1d. on transfers from one section of the system to another. The manager, Mr. Stanley, was to be congratulated upon his handling of these matters, securing the changes mentioned without disturbing the friendly relations that existed between the company, the municipality, and the miners' unions. The returns for the first five months of 1918 showed an improvement of over £500. The Trans-Continental Railway was now running a bi-weekly service between Western Australia and the Eastern States. This should bring the company some benefit. The opening up of the vast area of land had great possibilities.

French Tramway Companies.

The report of the Compagnie Générale Parisienne de Tramways states that the passenger traffic and receipts increased in 1917, but the working expenses advanced in a greater proportion. Under the circumstances, the net profits receded from £18,000 in 1916 to £9,400 last year, which sum has been placed to the reserve fund.

The directors of the Compagnie des Tramways de l'Est Parisien report that the working of the tramways was becoming more onerous. The public authorities refused to grant compensation for the new burdens imposed on the company, and only offered interest-bearing loans repayable out of receipts in the years succeeding the war. If it had not been for the war contracts undertaken by the company, the directors would have been unable to meet the interest charges on the loans, but as these exceptional resources would stop with the cessation of hostilities, it was hoped that the local authorities would at last sanction an increase in the fares. The net profits realised in 1917 amounted to £16,000, as compared with £32,000 in the preceding year, which sums have been transferred to the renewal fund.

The Société des Tramways de Paris et du Département de la Seine, reporting on the year 1917, states that the Conseil d'Etat had established the principle of compensation for the greater cost of tramway working in certain cases, and the Ministry of Public Works had approved the raising of fares by several provincial tramway companies. So far, however, the same treatment had not been accorded to the tramways in Paris, but the precedents set imparted confidence in the result of the action instituted by the company before the Conseil de Préfecture. The gross profits earned in 1917 reached £21,000, as contrasted with £76,000 in the previous year. The financial and loan charges amounted to £67,000, which has been defrayed out of the gross profits, and the balance brought forward from 1916.

The Compagnie Générale Française de Tramways, which is financially interested in a number of French tramways, reports on the one hand an increase in the receipts earned by the various undertakings in 1917, and on the other an augmentation in the working expenses to a proportionately greater extent for the same reasons as those mentioned by other companies. It had been possible to obtain sanction to advance fares at Orleans, and the city authorities of Havre and Nancy had resolved thoroughly to examine the question, but Marseilles had declined, and legal action was contemplated in the matter. After meeting interest charges on and redemption of loans, the net profits in 1917 are returned at £122,000, of which £42,000 has been placed to the accident and renewal fund, and £80,000 allotted to the shareholders in the form of a dividend at the rate of 4 per cent. on the ordinary share capital of £2,000,000.

The Société Parisienne pour l'Industrie des Chemins de Fer et des Tramways Electriques, which is an investment undertaking, reports that the company continued to experience the effects of the war, which weighed all the more upon the company, as a large number of the concerns are situated in territory invaded by the enemy. The collapse of Russia had aggravated this situation, and although the directors were convinced that the prejudice was only temporary, they considered it prudent to devote the balance forward and the profits for 1917 to writing down the value of the undertakings. This depreciation applied on the one hand to the company's business in Russia, and on the other to the company's subsidiaries for African affairs, which were postponed through the war. The other companies in which the Société is interested were in practically the same position as in 1916, these including the Paris Metropolitan Railway, the Société d'Electricité de Paris, the Cairo Electric Railways Co., &c. The surplus for 1917 amounts to £132,000 on an ordinary share capital of £2,000,000, and after defraying general expenses and writing off £124,000, the balance of £2,900 has been carried forward.

The Compagnie Générale des Omnibus de Paris, which is principally a tramway company working in Paris, reports that notwithstanding a considerable increase in the receipts in 1917, the net profits did not permit of the payment of a dividend on the ordinary share capital of £3,320,000. The continued high cost of labour, fuel and of all raw materials, had absorbed the additional revenue yielded by the passenger traffic. All these causes were common to industries and trades, but whilst manufacturers and merchants recouped the additional expenses by raising their sale prices, the company's undertaking had still to charge the low fares which no longer corresponded to the services rendered. The city authorities, despite the suggestions made by the Ministry of Public Works, had refused to take effective measures in order to solve the difficulties which press on the tramway undertakings in the district of Paris, that is to say, to sanction higher fares or alleviate the expenses. Under the circumstances, the company had been compelled to proceed by legal action in order to obtain redress, and the directors had confidence in the result. Apart from the motor omnibuses requisitioned by the Army, the company possessed 581 motor cars and 348 trailers at the end of 1917, together with 208 vehicles of various kinds. As compared with the preceding year, the number of tramcar miles run decreased by 1.87 per cent., whereas the number of passengers carried increased by 9.96 per cent. It was estimated that the cost of electric power rose by 20 per cent. as contrasted with 1916, and that the total augmentation amounted to 175 per cent., as against the cost prevailing prior to the war. The total receipts from all sources were £1,469,000, and the total expenses were £1,208,000, leaving a balance of £261,000. After providing for the stamp tax on shares and debentures, and interest on the debenture issues of £3,840,000, and for the redemption of debentures, there remains a surplus and balance forward amounting to £25,000, which has been transferred to the next account.

Oxford Electric Co., Ltd.—Interim dividend of 5 per cent. per annum, less tax, on ordinary shares.

City of London Electric Lighting Co., Ltd.—Interim dividend of 6 per cent. per annum, less tax, on the ordinary shares.

County of London Electric Supply Co., Ltd.—Interim dividend of 5 per cent. per annum, less tax, on the ordinary shares.

Manila Electric Railroad & Lighting Corporation.—Dividend of 1¼ per cent. for the quarter to September 30th.

Globe Telegraph & Trust Co., Ltd.—Quarterly interim dividend on ordinary shares, 2s. per share, free of tax.

Shawinigan Water and Power Co.—Quarterly dividend of 1¾ per cent. (7 per cent. per annum).

Stock Exchange Notice.—The following have been ordered to be quoted in the Official List:—

Chile Telephone Co., Ltd.—Further issue of 22,000 shares of £5 each, fully paid (Nos. 66,001 to 88,000).

Calcutta Electric Supply Corporation, Ltd.—Units sold to consumers five weeks ended May 31st, 1918, 3,297,451, against 2,700,256 in 1917. Four weeks ended June 28th, 1918, 2,519,004, against 2,230,711 in 1917.

Eastern Telegraph Co., Ltd.—Second quarterly interim dividend of 1½ per cent. on the ordinary stock, free of income-tax.

STOCKS AND SHARES.

Tuesday Evening.

Markets round the Stock Exchange keep steady, and business in some sections shows a tendency to increase. At the same time, increased Labour unrest affords something of a check to financial enterprise. So far as illumination shares are concerned, the gravity of the position with regard to coal is arousing speculation as to how the companies are likely to be affected by the shortage that is now advertised so freely, and in the circumstances it is natural enough that there should be but little doing amongst electricity supply shares. This will affect the railways, of course, together with a hundred other important branches of daily life, and the announcement that the steam railway companies are considering a substantial curtailment in their services in the near future leads to the inference that the electric railways will also follow suit. Meanwhile, some are asking whether any measure of self-denial is to be laid upon theatres, music-halls, kinemas, and other amusement providers, where light is so lavishly used.

City of London Ordinary gave way ¼, but St. James's are similarly better. The feature in the electric list is the strength of lower-priced shares. London Electric Ordinary and Preference are both ⅛ up. Edmundsons have risen sharply, the Ordinary to 6s., the Preference to 55s., while the 4½ per cent. First Mortgage Debenture stock is better at 73, the 6 per cent. Non-Cumulative Preference rather lagging behind at 15s. 9d., although there are no shares on offer. Urbans have hardened to 4s. and the Preference to 40s. The 4½ per cent. Debenture stock in this case stands at 71½. In the foreign list, Cordoba Light & Power Ordinary have risen to 3s. 3d. These seem to be very speculative. The preference also are better at 13s. The Mexican issues are good, Mexican Light & Power First Bonds gaining 6 points at 63, and Seconds being better at 44. Pachuca bonds remain at 48½, and Monterey fives at 45½. Mexican Northern Power Bonds were taken on Monday at 18¼, and for almost anything with Mexico in its title there is more demand of the genuine order than has been witnessed for some time past. Calcutta Electrics are strong at 7½. The various Canadian issues are just steady, showing little variation one way or the other. Brazilian Tractions strengthened to 48½, and re-

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acted to 47¼, leaving them 1½ up on the week. Argentine issues are dullish.

Activity in Marconis is still the outstanding feature in the cable market. Lively dealings take place in the parent shares and in those of the subsidiary companies. Americans have risen to 30s. 3d., and Marconi Marines particularly are a strong spot at 65s. Marconis themselves show little variation. The market, however, is a good one, though it may be doubted whether there is not something of a weak bull account, so far as such a thing is practicable under existing Stock Exchange conditions. Still, those who are watching the market with a view to buying the shares may be able to get in more cheaply later on.

Chile Telephones are ⅛ lower, while United River Plates are 1/16 up. Westerns have risen to 16½ on the dividend announcement, and other stocks in the list keep firm. Telegraph Constructions are another 10s. to the good. On the other hand, Callenders at 11 have relapsed 10s., and small falls have occurred in Henley's, British Insulated, and British Aluminium, the reaction being natural enough considering the substantial rises that occurred in advance. Babcock and Wilcox further advanced to 4 1/16 to lose the 1/16 later on. The iron and steel market is hard as a whole, with a slight reaction in armaments following upon the extremely rapid rise which they enjoyed last week. India-Rubbers are ⅛ up, the preference rose 5s. to 8, and the 5 per cent. debentures at 96½ show a gain of 3½ points. The last-named are due for repayment in 1926.

There is not much doing in the rubber share market, where the tendency remains uncertain, while amongst base-metal mining shares, the only outstanding feature is the strength of those connected with copper.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Sept. 10. 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6⅝	—	£7 17 0
Charing Cross Ordinary	5	4	3⅛	—	6 8 0
do. do. do. 4½ Pref.	4½	4½	3½	—	6 18 6
Chelsea	3	5	3½	—	7 13 10
City of London	8	8	11⅝	— ⅛	7 0 8
do. do. 6 per cent. Pref.	6	6	9½	—	6 3 1
County of London	7	7	10⅛	—	6 17 7
do. do. 6 per cent. Pref.	6	6	9⅝	—	6 1 6
Kensington Ordinary	6	7	5⅛	—	6 17 7
London Electric	Nil	Nil	1½	+ ⅛	Nil
do. do. 6 per cent. Pref.	4	5	3½	+ ⅛	7 13 10
Metropolitan	3	4	3⅛	—	6 8 0
do. 4½ per cent. Pref.	4½	4½	3½	—	6 18 6
St. James' and Pall Mall	8	9	6½	+ ⅛	6 18 6
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	5⅛	—	7 13 3
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	97½	—	6 3 0
do. Def.	1½	1½	23¾	—	6 7 8
Chile Telephone	8	8	7⅜	— ⅛	5 8 6
Cuba Sub. Ord.	7	7	10½	—	*6 16 7
Eastern Extension	8	8	15⅛	—	*5 3 3
Eastern Tel. Ord.	8	8	158½	—	*5 1 0
Globe Tel. and T. Ord.	7	7	14⅜	—	*4 17 5
do. do. Pref.	6	6	10⅜	—	5 15 8
Great Northern Tel.	24	22	87½	—	5 17 4
Indo-European	18	—	57½	—	5 12 6
Marconi	15	20	4¾	—	4 11 6
Oriental Telephone Ord.	10	10	3⅛	—	3 4 0
United R. Plate Tel.	8	8	7⅜	+ 1/16	*5 3 3
West India and Panama	6d.	1/3	1⅜	—	*3 12 0
Western Telegraph	8	8	16½	+ ⅛	*4 17 0
Home Rails.					
Central London Ord. Assented	4	4	60½	—	6 12 3
Metropolitan	1	1	26½	— ½	3 16 2
do. District	Nil	Nil	26	+ ½	Nil
Underground Electric Ordinary	Nil	Nil	2⅞	—	Nil
do. do. "A"	Nil	Nil	8/-	—	Nil
do. do. Income	6	4	84	—	*4 15 3
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅜xd	—	6 9 9
Anglo-Arg. Trams. First Pref.	5½	5½	3½	—	—
do. do. 2nd Pref.	5½	—	2½	—	—
do. do. 5 Deb.	5	5	67	+1	7 9 3
Brazil Tractions	—	—	47½	+1½	—
Bombay Electric Pref.	6	6	10⅝	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	60½	—	8 5 4
do. do. Preferred	Nil	Nil	42	—1	Nil
do. do. Deferred	Nil	Nil	36	—2	Nil
do. do. Deb.	4½	4½	60½	—	7 0 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	50	—	Nil
do. 6 per cent. Bonds	Nil	Nil	42	—	Nil
Mexican Light Common	Nil	Nil	29	—	Nil
do. Pref.	Nil	Nil	41½	—	Nil
do. 1st Bonds	Nil	Nil	63	+6	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	4	—	3 15 0
British Aluminium Ord.	10	10	2	— 1/16	5 0 0
British Insulated Ord.	20	20	2 1/16	— 1/16	4 11 6
British Westinghouse Pref.	7½	7½	2⅛	—	5 9 1
Callenders	20	25	11	— ¼	5 13 8
do. 5 Pref.	5	5	4½	—	5 17 8
Castner-Kellner	22	20	3⅜	—	5 10 4
Edison-Swan, "A"	—	—	5/8	—	Nil
do. do. 4 per cent. Deb.	4	4	75⅜	—	5 6 0
Electric Construction	7½	10	1⅜	—	7 5 6
Gen. Elec. Pref.	6	6	10⅜	+ ⅛	6 5 4
do. Ord.	10	10	18½	—	*5 8 1
Henley	25	25	3 1/16	— 1/16	5 14 2
do. 4½ Pref.	4½	4½	4xd	—	5 12 6
India-Rubber	10	10	17½	+ ⅛	*5 16 9
Telegraph Con.	20	20	47½	+10/-	*5 1 0

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 11th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£100	..
a Ammonia, Muriate (large crystal)	"	£77	£2 inc.
a Bisulphide of Carbon	"	..	..
a Borax	"	£48	..
a Copper Sulphate	"	£64	£1 dec.
a Potash, Chlorate	per lb.	2/4	..
a " Perchlorate	"	2/-	..
a Shellac	per cwt.	£17 5/-	..
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	"	£35	..
a " Lump	"	£25	..
a Soda, Chlorate	per lb.	1/1	..
a " Crystals	per ton	17l/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c " Tubes (solid drawn)	"	..	..
c " Wire, basis	"	..	..
c Copper Tubes (solid drawn)	"	1/8½ to 1/9	
g " Bars (best selected)	per ton	£161	..
g " Sheet	"	£161	..
g " Rod	"	£161	..
d " (Electrolytic) Bars	"	£137	..
d " " Sheets	"	£161	..
d " " Wire Rods	"	£145	..
d " " H.C. Wire	per lb.	1/5⅜	..
f Ebonite Rod	"	8/-	..
f " Sheet	"	2/6	..
a German Silver Wire	"	2/6	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	3/8	5d. inc.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£37	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	6d. to 8/-	..
e " " " medium	"	8/6 to 6/-	..
e " " " large	"	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/10	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	..	..
n " Wire, Nos. 1 to 16	per lb.	5/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

New Type of Oscillograph.—A new oscillograph constructed by C. Heintze, Berlin, is remarkable for its simplicity in construction and working. The whole operation is automatic, and takes place on the throwing-over of a switch.

The device is arranged only for instantaneous exposure, and a gas-filled metal-filament lamp is provided as a source of light. When the controlling switch is operated, the photographic plate is released, and in falling short-circuits momentarily a resistance in series with the lamp, so that it glows very brightly for an instant. Furthermore, in its fall, the plate connects the movement of the oscillograph into circuit. The contacts are so arranged that the brightening-up of the lamp begins earlier and ends later than the time of entry and departure of the sensitive plate into the ray of light, and the oscillating motion begins and ends at moments chosen, so that a small section of the zero line is depicted at the beginning and end of the curve produced on the plate. When the switch is released, a controller flies back to its original position and cuts off the current from the whole apparatus, thus preventing the magnet coils and lamp from being left permanently in circuit. —*E.T.Z.*, July 11th.

Fuel Economy.—The Coal Controller has issued figures which show a serious falling-off in the estimated output of coal during the first 32 weeks of this year compared with the output during the corresponding period of last year. The net deficiency is nearly 13½ million tons, or about 8·7 per cent. In the four weeks ended August 17th there were 1,714,800 tons less than in the corresponding period of 1917. This diminution of supply occurs at a time when extra demands for many million tons of coal are being made for the American Expeditionary Force, for the urgent military requirements of France and Italy, for the British Navy and for the manufacture of munitions; and also when stocks for industrial works, for public utility undertakings, and for household purposes are lower than ever.

An Order, entitled the Household Coal (Requisition) Order, 1918, has been made by the Board of Trade empowering local fuel overseers to commandeer trucks of coal consigned to private consumers that may arrive at stations, and to use the coal in the public interest.

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THE DUTIES OF THE PROGRESS DEPARTMENT.

By W. J. HISCOX.

In view of the importance of the "Progress Department" in the organisation of a modern engineering works, it is hoped that the following series of articles, based on actual experience, will be of service to works managers.

The Drawing Office—The Tool-Drawing Office.

(*a*) *The Drawing Office.*—The receipt of the official order may be said to mark the commencement of the Progress Department's association with the contract, for the preliminary correspondence which led up to its acceptance does not constitute the first stage, although this correspondence may, upon receipt of the official order, be transferred from the Preliminary Correspondence File to the Works Order File. The order, upon receipt, is recorded, either in a book or upon a card, together with the section leader's name, and is then filed to await the receipt of the detail instructions. As a rule, it lies with the Drawing Office to issue these instructions, but the Progress Department is liable to press the Drawing Office in the event of any unnecessary delay.

The issue of the necessary drawings is of interest to the progress-man, for a perusal of these will familiarise him with the various details required in connection with the complete unit, and it is essential, therefore, that a blue print, or a reduced photograph of each drawing, is issued to the Progress Department at an early date, each drawing being marked with the order number of the job it is intended for, or, in the case of repetition work, with a description of the size and class of the apparatus. In the event of an order covering details for which drawings are already in existence, a drawing list should be issued by the Drawing Office. It would really be a good plan to issue a drawing list even in connection with a special class of manufacture, for this would enable the progress-man to check off the drawings as they are received, and so see at a glance exactly what drawings are outstanding at any time.

All drawings in connection with the order (or in connection with any complete section of the unit) should be in the shops before the issue of the specification or detail list, and the Drawing Office should co-operate with the Progress Department with a view to facilitating the issue of these drawings.

The specification list, which is really the shop order, is usually compiled by a specification clerk, and blue print, or type-written, copies are issued to every department interested, including a complete copy for the Progress Department. This list, which bears the order number of the job in question, contains all particulars of every detail required in connection with the order, including the quantity required, drawing number, material specification (with size and amount of bar required), source of supply, and a list of the departments through which the piece travels until it reaches its final stage. Every change from the original design is indicated by the issue of a revised, or an additional, specification list, and all suspension, release, and cancellation notices also emanate from the Drawing Office.

This sums up the connection of the Progress Department with the Drawing Office, and completes the first phase of the progress of the order; so from this we can turn to the duties of the Progress Department in connection with—

(*b*) *The Tool-drawing Office.*—This department, in many concerns, is a most exclusive and inaccessible department; but it is still one in which the progress man must actively interest himself. It is absolutely necessary that all tools, jigs, and fixings be ready at an early date, for nothing is more annoying to the management, and more calculated to upset delivery programmes, than belated knowledge of an uncompleted detail due to the fact that the necessary tools or jigs have not been made. It is imperative, therefore, that the progress-man gives due consideration to the early completion of these parts; and as they cannot be produced until the designs are in evidence, it is obvious that connections between the Progress Department and the Tool-drawing Office must be established.

An advance copy of the detail drawing should in all cases be issued to the Tool-drawing Office, to allow that department to determine what new tools, &c. (if any), are required, and the tool-drawing numbers should be entered on every copy of the detail drawing, showing for which detail each tool is required. Upon receipt of this information, the Progress Department should enter same on a progress sheet or a detail card, to enable it to be followed up, as circumstances demand. When a detail drawing is issued, and no new tools are required in connection with the same, a notice to this effect should be sent from the Tool-drawing Office, and a similar form could be used to notify the Progress Department when all the tool drawings for any specific detail are completed. Until such completion notice is received, therefore, the Progress Department has the responsibility of urging outstanding tool drawings, if these are at all likely to interfere with, or retard, the delivery of the detail for which they are required, and affect the delivery date of the complete unit.

It sometimes happens that the shop foreman has to order new or replace tools, a requisition covering the necessary particulars being sent to the Tool-drawing Office. It would be well for such requisitions to be made out in duplicate, and both copies sent by the foreman to the Progress Department. One copy would then be sent on to the Tool-drawing Office by the progress man, showing the degree of urgency of the tool required, and the other copy would be kept in the Progress Department until the necessary drawings are completed. If this procedure is adopted it will minimise to a great extent the large number of delays caused by the late completion of tools.

It has been mentioned that the Tool-drawing Office is an exclusive and an inaccessible department, and, without a doubt, the members of that department do resent the progress man's activities in their direction. The progress man has no desire to dictate to the draughtsman as to the length of time necessary for the completion of any specific drawing, any more than he desires to perform the same kind office for any of the shop foremen; but he has the same right to guard against any unnecessary delay in the Tool-drawing Office as in the shops. The draughtsman must realise that it is useless for the progress man to take every precaution to guard against delays in the shops, if the same precautions are not taken in those departments responsible for the preliminary work. It is not fair to penalise the shops for the delinquencies of the Tool-drawing Office, and to endeavour to force them to make good the delay occasioned by the late issue of the tool drawing. If the tool draughtsman does not desire the acquaintance of the progress man (professionally, of course) there is an obvious way of accomplishing this; but perhaps in a little while the Tool-drawing Office will become more democratic, and then the draughtsman will welcome the progress man as a fellow-worker, and not as an interfering inferior.

THE RATING OF MOTOR STARTERS.

By PERCY H. JACKSON.

Users of electrical starting apparatus will be well advised to become more conversant with standard ratings, a careful study of which will enable them to effect considerable economy.

Let us consider the rating of an ordinary duty D.C. motor-starter. The standard recommended, and since adopted by all reputable starter manufacturers, is as follows:—

The starting period of the motor, from rest to full speed, shall be 5 seconds, plus half a second for each 1 H.P. of the starter rating. For example, if the maximum rating of the starter is 50 H.P., then the starting period shall not exceed $5 + 50 \times 0{\cdot}5 = 30$ seconds.

It should be noted that the foregoing only refers to "ordinary" duty starters. For "heavy" duty starters the adopted rating allows a maximum starting period of 60 seconds. It is obvious, therefore, that if a 50-H.P. motor takes more than 30, but not more than 60 seconds to start, an ordinary duty starter will not suffice. Should the motor

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take more than 60 seconds to start, a special starter must be installed. If burnt-out resistances are to be avoided, these figures must be borne in mind.

Just as important, however, is the consideration of the current value at starting. The foregoing ratings are based on the assumption that the starting current is equal to full-load running current, and prospective purchasers may economise by remembering this. It often happens that motors are started under light load, as when driving shafting provided with loose pulleys, in which event the starting current may be equal to only 50 per cent. of the full-load running current. Again assuming the motor to be of 50-H.P. capacity, a 25-H.P. starter will not only produce better starting and more even acceleration, but will be much cheaper. It will be appreciated that the "full-on" contact must be capable of carrying continuously the full-load current, but no difficulty will be experienced in this direction, for even though a special contact has to be fitted, the purchaser will still realise a saving of money.

For starters above 100-H.P. capacity it is of really great importance that the starting conditions be considered, because above this size a multiple-switch starter is usually recommended, the cost of which is much in excess of that of the face-plate type. A 200-H.P. motor, starting under 50 per cent. of full load, will be satisfactorily controlled by a face-plate starter with an interlocked short-circuiting switch to carry the full-load current. If starting conditions are not mentioned in the inquiry to the starter manufacturer, full-load starting will be assumed, with the result that much money will be wasted and the motor will be subjected to nasty kicks at starting caused by the low resistance and incorrect grading. The same remarks apply to all resistance starters, contactors, face-plate, or drum controllers.

Referring now to A.C. gear, the method of starting by means of a compensator or auto-transformer calls for similar consideration. Unfortunately, the rating of these starters is not yet standardised, with the result that different manufacturers have different ratings. The most suitable allows a starting period of 1½ minutes with a period of rest between each successive start equal to 10 times the starting period. The starter may, therefore, be used once every 16½ minutes. If the starting operation occupies 1 minute, then the rest period need be only 10 minutes. It often happens that the motor necessitates the starter being retained in the starting position from 1 to 1½ minutes; obviously then, a lighter-rated starter (and there are several makes rated for less than 1 minute) would soon burn out. Such experiences are annoying to all concerned, apart from the accompanying waste of time and money.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

The following items are amongst the "Institution Notes" issued with No. 276 of the *Journal*:—

Certified Occupations.

The secretary of the Institution has been informed by the Ministry of National Service that, as a temporary measure, instructions have been given to the Regional Officers of the Ministry not to call up for medical examination men of the new military age who are engaged in one of the occupations named below, provided they were engaged in the same occupation (not necessarily with the same employer) on or before August 15th, 1915:—

Electrical Engineering—

Foreman.

Turner; fitter; erector; electrician or other skilled workman.

Wireman.

Radiography Joint Committee.

In collaboration with the British Association for Radiography and Physio-Therapy, the Council of the Institution has nominated the President (Mr. C. H. Wordingham), Mr. J. S. Highfield, Prof. T. Mather, and Mr. A. A. C. Swinton to serve on a Joint Committee of the two bodies, which has been appointed to prepare a scheme for ensuring that lay radiographers, &c., are properly qualified.

Board of Trade Reports on Electric Power Supply and Electrical Trades after the War.

The Council has appointed a Committee to report on the above. The following bodies have been invited to nominate two representatives each to serve on the Committee:—

Incorporated Municipal Electrical Association.
Association of Municipal Corporations.
Incorporated Association of Electric Power Companies.
Provincial Electric Supply Committee of the United Kingdom.
Conference of Chief Officials of the London Electric Supply Companies.
British Electrical and Allied Manufacturers' Association.
Cable-Makers' Association.
Tramways and Light Railways Association.
Municipal Tramways Association.
The Iron and Steel Institute.
British Electrical Federation.
Edmundsons' Electricity Corporation.
Federation of British Industries.

(The president and the four vice-presidents of the Institution are also members of the Committee.)

Maintenance Agreements for Secondary Batteries.

The Committee appointed by the Council to report on the above consists of:—

	Nominated by
C. H. Wordingham, C.B.E. Sir William Slingo. R. T. Smith. F. W. Crawter. R. A. Chattock.	The Institution.
D. P. Dunne. E. Jacob.	The B.E.A.M.A.
(*One representative to be nominated*)	The I.M.E.A.
J. S. Highfield.	The Incorporated Association of Electric Power Companies.

Local Sections.

A Committee was appointed by the Council in March, 1918, to review the position of the Local Sections and to make suggestions as regards increasing their usefulness. The report of this Committee was recently considered by the Council, and as a result it has been agreed:—

(1) That the Local Sections be known in future as "Centres," their names being altered as follows:—

New Name.	*Present Name.*
North-Western Centre.	Manchester Local Section.
North-Midland ,,	Yorkshire ,, ,,
South-Midland ,,	Birmingham ,, ,,
North-Eastern ,,	Newcastle ,, ,,
Western ,,	Western ,, ,,
Scottish ,,	Scottish ,, ,,
Irish ,,	Dublin ,, ,,

The Irish Centre to include the whole of Ireland.

(2) To empower the Territorial Centre Committees to represent the Institution on other bodies, such as Chambers of Commerce, Technical Library Committees, Education Authorities, kindred Engineering Societies, and so forth, subject to the approval of the Council in each case.

(3) To delegate certain branches of research to some of the Territorial Centres by the formation of local Research Sub-Committees: such Sub-Committees to be appointed by the Council at the instance of the Territorial Centre Committees. It will be the duty of each Sub-Committee to report to the Research Committee and to keep the Territorial Centre Committee informed of the progress of the particular research.

(4) To invite other bodies to co-operate through their local Associations in regard to forming local Engineers' Clubs.

Engineering Training Organisation.

The Council has sanctioned, on behalf of the Institution, a contribution of £250 towards the expenses of the above organisation for 1918.

Commercial Electrical Development Committee.

The Committee appointed by the Council to consider the formation of an Electrical Cooking and Heating Association having completed its preliminary work, a new Committee, with the above title, has been formed.

The new body, which is a separate organisation independent of any institution or association, will immediately consider the question of the development of electrical cooking and heating.

Benevolent Fund.

The report of the Committee of Management of the Benevolent Fund, adopted at the annual general meeting, stated that the total receipts in 1917 amounted to £430; the capital account stood at £4,642, and the accumulated unexpended income at £2,063. Fifteen applications for assistance were received, and the Committee made grants in 14 cases, amounting to £198. The capital account of the Wilde Benevolent Fund stood at £1,846, and the balance to the credit of the income account was £584. No grant was made from this fund.

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MOTOR PROBLEMS.

At the end of our leading article on the above subject on August 23rd, we outlined the ideal motor controller in the following words:—"What is needed is the simplicity of the tramway controller—one operating handle only, capable of being moved forward as quickly as safe loading of the motor will permit, and backward as quickly or as slowly as the needs of the machinery require, and, above all, cheap and reliable."

The Igranic Electric Co., Ltd., have sent us illustrations and a description of a standard controller which, they claim, fulfils all the conditions that we laid down.

This controller, which is principally applied to electrically-driven machine tools, consists of two parts: (1) A self-acting panel, as fig. 1, and (2) a drum or tramway-type starting and speed-regulating switch, as fig. 2, and it is designed to control a variable-speed shunt-wound motor. The self-acting panel (fig. 1) consists of a number of clapper switches, mounted on a slate slab, which is supported on an iron box

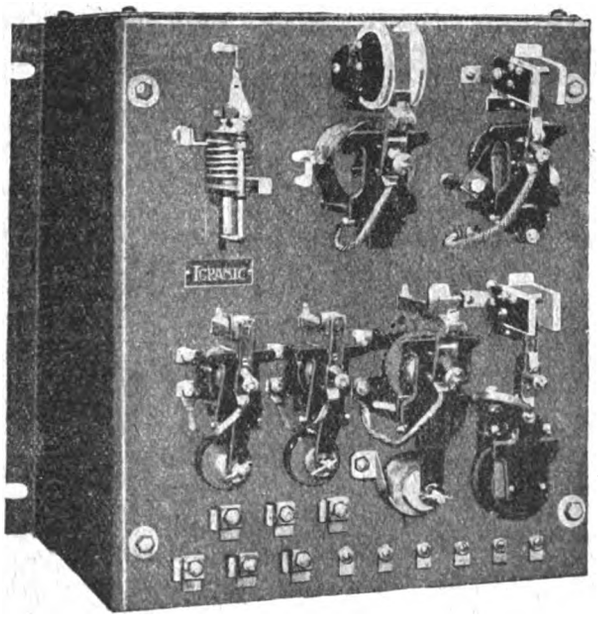

Fig. 1.—Igranic Self-acting Panel.

containing the starting resistances. In addition, there is mounted on the slate slab one, or if needed two, vibrating relays. One of the clapper switches is used as a main switch to open and close the motor circuit, and the others, which are of the lock-out type, control the acceleration of the motor to normal speed by short-circuiting, in succession, the various sections of starting resistance in series with the armature. The acceleration of the motor above normal speed, by shunt field regulation, and deceleration by the same means, is taken care of by the vibrating relays in conjunction with the drum-type master switch (fig. 2). The function of the latter is to open and close the coil circuit of the main clapper switch, and to select the desired speed by the insertion of more or less resistance in the shunt field circuit. The master drum is the only piece that the machine attendant has to handle, and, being small, it can generally be mounted in a convenient position on the machine that it controls. Sometimes it is mounted at the base of the machine and operated by a movable hand-wheel which is geared to it, and so placed as to follow the tool. The self-acting panel can be mounted on any conveniently adjacent wall or pillar.

Taking our demands seriatim, the Igranic Co. remark:—

1. The starting, stopping, and speed regulating switch is, in form and construction, exactly like a tramway controller, with the additional advantage that it is small in size, and therefore easy to find a place for on the machine.

2. It has only one handle, by which every function of control is performed.

3. The handle may be moved either forward or backward as quickly as the operator likes without any untoward result.

This is because the clapper switches, which control the acceleration of the motor to normal speed, are of the lock-out type, and automatically prevent too rapid short-circuiting of the starting resistances, while the vibrating relays automatically prevent too rapid insertion, or too rapid short-circuiting, of the field-regulating resistances.

Igranic lock-out switches have each two coils, one (called the closing coil) tending to close the switch, and the other (called the lock-out coil) tending to prevent it closing.

So long as the motor current exceeds a predetermined value the lock-out coil exerts a greater pull than the closing coil, and therefore prevents the switch from closing.

As soon as the current falls (through the acceleration of the motor) to the predetermined safe value, the closing coil becomes the stronger and closes the switch, thereby short-circuiting a section of the starting resistance.

When the switch closes, it short-circuits its own lock-out coil, and thereby prevents it any longer opposing the pull of the closing coil.

It will be seen that a series of such switches, used for the removal of starting resistance from the armature circuit of a motor, constitutes a self-governing, current-limit acceleration control.

One of the vibrating relays is called an accelerating relay, because its function is to prevent too rapid acceleration by field regulation.

Its operating winding is connected in series with the motor armature, and it is adapted, when the current passing through that winding exceeds a predetermined and adjustable value, to short-circuit the field regulating rheostat, thus restoring the motor-field to full strength.

As soon as the current passing through the motor armature falls to less than a predetermined value, this short-circuit around the field-regulating rheostat is removed and the resistance is reinserted, the result of such reinsertion being a tendency on the part of the motor to speed up rapidly and take more current from the line.

The increase in current through the operating winding causes the short-circuit to be re-established, and this relay continues alternately to short-circuit and re-insert the field resistance, vibrating in this manner until such time as the motor speed has been brought up to that for which the field adjusting rheostat is set.

The second vibrating relay is called a slow-down relay, and its function is to prevent the too rapid strengthening of the shunt field when reducing speed or stopping the motor. The action of this slow-down relay is quite similar to that of the accelerating relay, except that it must be arranged to insert

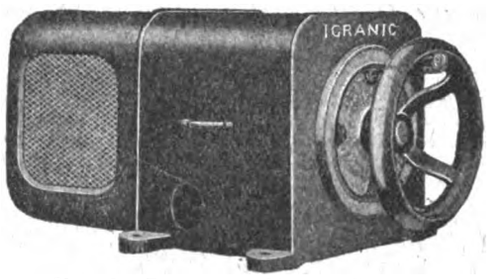

Fig. 2.—Drum-type Master Switch.

all field resistance on passage of an excessive current through its winding, instead of short-circuiting the field resistance, as the accelerating relay does. As the requirements for accelerating and slow-down relays are diametrically opposed, one being called upon to short-circuit the field resistance when the armature current exceeds a predetermined value, the other to insert it under the same conditions, it is obvious that the accelerating relay must be rendered inoperative when the motor is being slowed down, and, *vice versa*, the slowing-down relay must be rendered inoperative when the motor is being accelerated. This feature has been worked out in a thorough and effective manner, and interference between these devices is thoroughly guarded against.

4. Cheapness, the Igranic Co. remark, is a relative term, and a controller which effectually protects the motor from injury, as this one does, is surely cheaper than others which fail to do so, even if the latter could be purchased for only half as much. But the controller described is so simple in construction, and so few in its parts, that it can be produced at a price which is no obstacle to its sale.

5. Reliability is a question of experience, and the makers say they can point to numerous controllers of this type which have been in continual use for years in busy workshops and are still giving satisfaction.

Aluminium in Electric Machinery in Germany.—The Standardising Committee of the *Verband Deutscher Elektrotechniker* publishes modifications of its previous regulations concerning the use of aluminium in electric machinery. The previous regulations concerned machines, and they are now extended to transformers, for which the use of aluminium is now permitted, instead of zinc, that was previouly used as a substitute metal. The windings of transformers are generally made of aluminium, but copper may be used if the ratio of the power of the transformer in K.V.A. to the voltage of the windings in KV. does not exceed 0·5 for three-phase or 0·3 for single-phase currents. Brake magnets are to be wound with aluminium, and choking coils with iron cores are to be treated on the same lines as transformers. Choking coils without iron cores should generally be constructed of aluminium. In exceptional cases copper may be used for various parts of electrical machines—for instance, in the armatures of commutator machines destined for uses in which their temporary breakdown would endanger human life, or for very important installations, such as rolling mills, in which their failure would cause loss of material, in the armatures of commutator machines that are exposed to particularly violent variations of load, for machines in which the dissipation of heat is particularly difficult, such as in enclosed motors above 5 KW., and for machines in installations in which chemical action on aluminium is to be feared.—*E.T.Z.* July 4

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FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

ITALY.—The Commercial Treaties or Agreements between Italy and France, Brazil, Greece, Japan, Roumania, Serbia, Spain, and Switzerland, which were determined by the Italian Government last year (see the ELECTRICAL REVIEW of October 19th), have been prolonged to the end of 1918, so that the "Conventional" Tariff rates of duty will remain in operation for that period.

NEW CALEDONIA.—By virtue of a Presidential Decree of December 23rd a duty of 3 per cent. *ad val.* is levied on the export of locally-produced ores, and 4 per cent. *ad val.* on the products of the treatment of such ores. The tax is collected by the Customs at the port of export.

PARAGUAY.—Under the Paraguayan Budget Law for the year ended June 30th, 1918, all goods other than those specially enumerated and duty-free goods are subject to an import duty of 42 per cent. Goods specially enumerated (other than those on the Free List) are subject either to percentage rates of duty (ranging from 9 per cent. in the case of iron, steel, and copper in sheets, bars and ingots, &c., to 89 per cent. in the case of spirits), or to specific rates of duty (the articles in this case consist almost entirely of foodstuffs). All dutiable merchandise is subject to an *additional* duty of 1½ per cent. The Law also specifies the taxes payable in respect of wharfage dues for imported goods, and the fees payable for storage charges for goods deposited in Customs warehouses. The text of the Law can be consulted at the Department of Overseas Trade (Development and Intelligence).

SOUTHERN RHODESIA.—According to recent official decisions, the import duty leviable on corning conahones (parts of electric or gas lamps, not hand), electric motor tire pumps, electromagnets (part of crane), and patent quarzarc electrodes is 3 per cent. *ad val.* under the General Tariff, goods the produce or manufacture of the United Kingdom and reciprocating British Possessions being admitted free of duty.

UNITED STATES OF AMERICA.—Collectors of Customs at United States ports are now authorised to issue export licences in respect of goods on the American prohibited export list originating in and shipped from the United Kingdom, France, or Italy, or their colonies, when dispatched *viâ* a United States port to such countries or their colonies, on presentation of a copy of the manifest covering the goods. Similarly, goods from Canada (by rail) in transit for the United Kingdom, France, or Italy, or their colonies, will also be licensed by Collectors.

UNITED STATES (PANAMA CANAL ZONE).—Official announcement has been made that all goods exported from canal zone ports must be licensed. Shippers should note that this applies not only to cargo originating in the zone, but to all cargo shipped from canal zone ports, irrespective of its origin.

FRANCE.—By a Ministerial Decree dated November 19th, the provisions of the Decree of February 12th, 1915, by which carbons for electrical purposes were allowed to be exported from France without special authorisation when destined for the United Kingdom, the British Dominions, &c., and certain foreign countries, have been abrogated. The exportation of these carbons is therefore now prohibited except under licence.

BAHAMAS.—By Act No. 10 of 1917 the surtax of 10 per cent. imposed in 1915 on all goods subject to *ad valorem* duties on their importation into the Colony is continued in force for a period of one year, and from thence to the end of the next Session of the Legislature.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

13,868. "Sparking plugs for internal-combustion engines." V. PERRETT. August 26th.

13,869. "Commutators for use on internal-combustion engines." F. G. HAYWARD. August 26th.

13,870. "Means for receiving impulses and ascertaining their direction." R. A. FESSENDEN. August 26th. (U.S.A., August 16th, 1917.)

13,880. "Submarine signalling." R. A. FESSENDEN. August 26th. (U.S.A., July 20th, 1917.)

13,885. "Process for sheardising." S. O. COWPER-COLES. August 27th.

13,898. "Resistance." A. E. VICK. August 27th.

13,907. "Electric cigar or pipe-lighter." A. J. ROBERTS. August 27th.

13,922/3. "Electric transformers." S. Z. DE FERRANTI. August 27th.

13,931. "Sparking plugs for internal-combustion engines." H. R. RICARDO. August 27th.

13,934. "Standards for supports for electric lamps." A. E. WILSON. August 27th.

13,936. "Means for supporting electrical conductors." A. E. WILSON. August 27th.

13,940. "Magneto motor." D. SUCHOSTAWER. August 27th.

13,961. "Motor-starters, rheostats, &c." L. K. VIBE. August 28th.

13,975. "Trolley heads of electrically-propelled vehicles." H. DOWDEN & J. J. SAMPSON. August 28th.

13,984. "Manufacture of natural graphite electrodes." E. RIDONI & Soc. TALCO & GRAFITI VAL CHISONE. August 28th. (Italy, March 6th.)

13,986. "Electric switches." C. R. C. LYSTER, NEWTON & WRIGHT AND S. RUSS. August 28th.

14,014. "Apparatus for moistening and treating air in connection with electric heater." H. C. GOVER. August 29th.

14,020. "Reflector and heat-accumulator for gas and electric lighting and heating." H. LEVI. August 29th.

14,040. "Electric cut-outs." C. C. GERRARD, A. H. RAILING & W. E. WILSON. August 29th.

14,043/4. "Electric signalling lamps." W. H. EGGINTON & H. LUCAS. August 29th.

14,045. "Electric switches." W. H. EDWARDS & H. LUCAS. August 29th.

14,078. "Dynamo-electric machines." BRITISH THOMSON-HOUSTON CO. AND H. W. TAYLOR. August 30th.

14,079. "Electric furnaces." A. D. KEENE. August 30th. (U.S.A., September 5th, 1917.)

14,106. "Primary galvanic batteries with unalterable electrolyte." E. W. JUNGNER. August 30th. (Sweden, September 4th, 1917.)

14,114. "Plug-and-socket connections for electric circuits." W. H. EDWARDS & H. LUCAS. August 30th.

14,144. "Utilisation of the currents produced in the earth as source of electrical energy." W. A. RUNDLE & L. S. WALTON. August 31st.

14,148. "Electric lampholders." W. L. BODMAN. August 31st.

14,154. "Controlling switches of combined ammeters and voltmeters." B. BROOKS & W. HOLT. August 31st.

14,155. "Appliance for engaging overhead conductor with trolley-sheave of electrically-propelled cars." W. H. SIMMONDS. August 31st.

14,160. "Electrical apparatus for detecting, &c., presence of high-tension of extra-high-tension sparks or discharges." N. STELL. August 31st.

14,165. "Safety gaps of ignition magnetos for internal-combustion engines." M-L. MAGNETO SYNDICATE & E. A. WATSON. August 31st.

14,184. "Variable-speed alternating-current motors." J. D. LEWIS. August 31st.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

8,166. ELECTRIC TRACTION SYSTEMS. Ateliers de Constructions Electriques du Nord et de l'Est. December 21st, 1915. (102,923.)

1917.

4,666. ELECTRIC BATTERY INDICATING DEVICES. A. E. White (Domestic Engineering Co., U.S.A.). March 30th, 1917. (117,906.)

11,109. CEILING ROSES AND LIKE ELECTRICAL FITTINGS. J. C. White. August 2nd, 1917. (117,931.)

11,222. DYNAMO-ELECTRIC MACHINES. Crompton & Co. and N. Pensabene. August 3rd, 1917. (117,934.)

11,235. IGNITION DYNAMOS. C. T. Mason. September 15th, 1916. (109,793.)

11,298. MEANS FOR SUPPORTING ELECTRODES IN IONIC TUBES FOR USE MORE PARTICULARLY IN WIRELESS TELEGRAPHY. Osram-Robertson Lamp Works & F. P. Driver. August 4th, 1917. (117,939.)

11,505. ELECTRICAL INDUCTION APPARATUS. British Thomson-Houston Co. (General Electric Co., U.S.A.) August 10th, 1917. (117,953.)

11,667. AUTOMATIC DECELERATING DEVICES. British Thomson-Houston Co. (General Electric Co., U.S.A.) August 14th, 1917. (117,959.)

11,864. TELEPHONE RECEIVERS. A. Marr. August 18th, 1917. (Cognate application, 16,231/17.) (117,967.)

11,909. ELECTRIC SIGNALLING SYSTEMS, MORE PARTICULARLY FOR USE IN MINES. Automatic Telephone Manufacturing Co. & H. Green. August 20th, 1917. (117,969.)

12,357. GALVANIC BATTERIES. G. Oldham & J. Oldham. August 28th, 1917. (117,981.)

12,469. PHASE ADVANCERS FOR DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. & N. Shuttleworth. August 30th, 1917. (117,986.)

13,221. ELECTRIC OVENS. K. Mjelva. September 14th, 1917. (117,996.)

13,780. METHODS FOR MELTING REFRACTORY SUBSTANCES BY ELECTRIC ARCS. J. G. Webb. March 6th, 1917. (115,017.)

14,814. ELECTRIC CONDENSERS. F. R. Simms & Simms Motor Units, Ltd October 12th, 1917. (118,009.)

15,010. SPARKING PLUGS. J. E. Barrows. October 17th, 1917. (118,012.)

15,855. ELECTRIC COOKING STOVES. P. Watson. October 31st, 1917. (118,018.)

16,039. MEANS FOR COMPLETING AN ELECTRIC CIRCUIT, SPECIALLY APPLICABLE TO ALARM CLOCKS. H. O. Farrell & A. Ward. November 3rd, 1917. (118,020.)

16,321. DEVICE FOR CLOSING THE ORIFICES IN THE ROOF AND WALLS OF AN ELECTRIC FURNACE THROUGH WHICH THE ELECTRODES PASS. C. H. Watson and Co. & W. Travis. November 8th, 1917. (118,023.)

16,933. ELECTRICALLY-OPERATED OVERHEAD LIFTING GEAR. W. H. Vaughan, F. Wood & N. Baguley. November 17th, 1917. (118,031.)

17,162. IMPULSE TRANSMITTERS FOR AUTOMATIC TELEPHONES. H. Wilson. November 21st, 1917. (118,034.)

19,322. ELECTRIC HEATING APPARATUS. W. J. Mellersh-Jackson (L. V. Leonard and A. J. Allen). December 31st, 1917. (118,048.)

1918.

617. ELECTRIC STARTING APPARATUS FOR MOTOR-VEHICLE ENGINES. H. Lucas and C. L. Breeden. January 10th, 1918. (118,050.)

2,907. ELECTRIC RELAYS, PARTICULARLY FOR TRAFFIC-CONTROLLING APPARATUS. McKenzie Holland & Westinghouse Power Signal Co. February 20th, 1917. (113,615.)

3,414. ELECTRIC ACCUMULATORS. H. Dean & Chloride Electrical Storage Co. February 26th, 1918. (Addition to 15,815/17.) (118,063.)

4,098. CARRIERS FOR CABLE-WAY SYSTEMS. H. Thorne. March 8th, 1918. (118,065.)

An E.T.U. Treasurer Charged.—At Barrow-in-Furness Police Court, last week, Francis Furness (36), the treasurer of the Barrow branch of the Electrical Trades Union, was charged on remand with falsifying the branch's Post Office Savings Bank pass book, with embezzling certain sums of money, and with forging the initials of a postmistress and the date stamp of the branch post office in Rawlinson Street, Barrow. Accused, when asked whether he had anything to say, replied :—"Just to plead not guilty, sir, that is all." The Bench decided to commit him for trial at the next Lancaster Assizes. Bail was granted in one surety of £300, or two of £150.

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THE

ELECTRICAL REVIEW.

VOL. LXXXIII. SEPTEMBER 20, 1918. No. 2,130.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

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NOTICE TO READERS.

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INDUSTRIAL PROBLEMS.

SIMULTANEOUSLY with the move forward of the vast military organisation of the Allies with better prospects of more speedily crushing out of the Enemy terms of Peace which will ensure security for the future, there is again heard in many directions at Home the grating of the machinery of Labour organisation. The Premier is able to assure us that "the Worst is Over" in a Military Sense, but our satisfaction with that assurance is modified somewhat by new demands from workers in many departments of activity which indicate that the same phrase cannot be applied to the Home Front. The most deplorable feature of the industrial unrest which is present amongst us just now is that it is not by any means all or most of it the immediate consequence of the hardships of war conditions.

Among the latest demands or strike threats there have been the following:—A demand for non-employment of non-Union labour; attempts to compel men of certain classes to join particular unions; a demand for women to have the same rate of war bonus as men; a demand for war bonus payments to be converted into a slightly reduced permanent advance in the normal wage; a demand for the recognition of a Union, increased leave, and eight-hour shifts "after the war"; increase in overtime rates because wage increases have produced the anomalous state of things that makes overtime rates less than ordinary wage rates. These are a few of the points that occur to us as suggesting that the workers in at least some departments of labour are intent on securing, while the war is still in progress, improved or altered conditions for after the war. Probably there lies at the root of it all the widespread uncertainty concerning what is going to happen in regard to the cost of living after the war. Everybody, we suppose, welcomes the improved prospects of Peace, but none knows what that Peace will bring to millions of workers; therefore, the policy favoured at the moment seems to be: Get what you can while you can! And, unfortunately, the "strike" habit seems to be stronger than at any previous period of our history.

The determination on the part of employés of State and municipal undertakings to secure future benefit *now* is supported by the knowledge that their earnings are not regulated by industrial profits. The State Exchequer and the ratepayers will have to pay. But what of industrial workers who cannot draw more than industry will yield? We may fix the prices of war requirements according to the demands of labour and the exceptional prices of material, because we are spending out of Capital to win the war. The time is coming when that state of things cannot continue. We observe that Mr. G. N. Barnes, M.P., has been asking what we are going to do in the post-war period to safeguard and maintain the high standard of living that has come to most of the working people during the war. Personally, he believes the Whitley Report to represent a great idea which is capable of great expansion; but the A.S.E., the Union for which he fought long years ago, certainly does not see eye to eye with him in this. According to its spokesmen that Union, which he did so much to build up, feels strong enough to go alone. It can make its claims and back them up, and needs none of the Whitley conciliation spirit. What the A.S.E. is out for ultimately is control. It makes no secret of that ambition. What has Mr. Barnes to say on this point? We observe that he expresses the hope that the national factories put down during the war will not be allowed to be transferred to private owners; he wants them to be retained as national factories, and by that means to lessen the National Debt. He cannot, we suppose, say what they will produce, nor whether they will pay the present high wages at the same time as they presumably enter into competition with private industry, but he evidently approves of the idea of "control" to the

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extent that Government ownership will give it. Our impression is that Government ownership will really mean, in the long run, "control" by the workers. Mr. Barnes would run our industries in such a way that they would produce the greatest possible output of goods, under the most scientific conditions of labour, in order to get the largest possible wages and the best conditions of life in those industries. We do not pretend to regard these general aspirations as new; indeed, they have become almost platitudes to-day. What they need is a little more elaboration, so that we may understand exactly what it is that our national leaders propose for assisting the situation with which shortly we may be faced. As a matter of fact, we confess that the whole outlook industrially, so far as wages and conditions are concerned, seems to be about as confused as it has been at any time during the past four years. We are continually feeling our way through periods of industrial unrest without any actual remedy emerging, and sometimes it appears as though we shall be able to do little, except try to create "an atmosphere," until all the new difficulties that are now accumulating crowd upon us. We do not wish to minimise the value of the work that has been done in setting up Industrial Councils. We hope that much good will result from the series of district conferences that the National Alliance of Employers and Employed is holding in different parts of the country this autumn to promote industrial unity, and from events of a similar kind that the Industrial Reconstruction Council is holding in London, but the issuance of the manifesto by the Alliance seems to us to show pretty plainly that there is a strong representative opinion that something more than conferences, discussions, and pamphleteering is needed, and that without any further delay.

The Alliance has been considering the increasingly serious industrial unrest in the country, and the "tendencies which it reveals." It sees the great danger that exists through disputes being allowed to drift until the workers are forced to the conclusion that the "strike" is the only means by which they can establish their claims. It holds that the stage has been reached when "it is a question not so much of the long-standing and gradually accumulating causes of unrest as of the methods by means of which the whole industrial situation is to be handled." The want of co-ordination of Government industrial policy is creating a spirit of alienation and distrust between employers and workpeople on the one side, and the forces with which they should co-operate, on the other. Such a situation it is considered is "full of perilous possibilities." This being so, there should be "a definite and consistent Government policy—a policy not of drift but of prevention," and inasmuch as "Industrial peace cannot be secured by legal enactment, but in industry there can be peace by negotiation," the Alliance calls upon the Government to summon a round table conference of employers and employed and representatives of Government Departments concerned. The suggestion is made with a view to securing that "employers and employed are brought together on terms of equality to formulate and give effect to an industrial reconstruction policy in conjunction with the State."

This demand of the Alliance comes from a representative organisation of industrial authorities acting in conjunction with certain Labour leaders, and as its fears appear to coincide fairly approximately with our own concerning the result that has so far attended our efforts at industrial conciliation, it has our support.

The Prime Minister, in his Manchester speech, has indicated that his heart is with the people in their struggles, but he is not swayed merely by sentiment. "Comfort is the surest preventative of anarchy, but comfort involves plenty. You can ensure plenty by ensuring the best conditions for production. If abundance is not there you cannot distribute it. . . . The State must help to promote and encourage production. It must remove hindrances to production, and ensure confidence and serenity, which are essential to production." Mr. Lloyd George holds that it would be a mistake, indeed impossible, to attempt a statement of detailed plans in this hour, crowded as it is with other and more important concerns. Experts are studying the problems of reconstruction so that when the war is over the nation will not lose time in setting its house in order. The moment the struggle is over the work of reconstruction must begin—it must proceed while the national limbs are supple with endeavour, under the influence of patriotism and sacrifice, and with the momentum of victory behind it. The Premier's sentiments were characteristically strong and earnest, and we believe that ultimately he will, to the confusion of his opponents and critics who have been watching for an opportunity to "entangle him in his talk," be able to lead the nation sanely on to safer, surer ground for the future, but, busily engaged as the Government is upon matters of momentous concern, we believe that it would do well to pay heed to the suggestion of the Alliance. We have to win the war at all costs, but the ultimate good of the nation will assuredly be imperilled if we are only able to temporarily maintain our Home Front firm by facilitating "the rake's progress."

Power House Operation and Maintenance.

In these days of general retrenchment and national economy, a question of the first importance is that of turbine and boiler-house operation and maintenance. There is no doubt that many improvements and material economies have been effected within the last few years, and that efforts are still being directed to that end. In this connection valuable assistance can be gained from the experience of other engineers, and we commend to the notice of our readers the recent paper by Messrs. T. G. Otley and V. Pickles, on turbine-house plant operation (abstracted in our issues of August 30th and September 6th, 1918). Our readers will also remember a former paper by the same authors on boiler-house operation and maintenance (abstracted in the Electrical Review of February 9th, 16th, and 23rd, 1917). These papers furnish ample food for thought; the matter contained in them is worthy of careful reading and consideration by all who are interested in power house operation.

It is to be feared that in many undertakings there is not sufficient co-operation between the turbine-house staff and the boiler-house staff; each works more or less as a separate unit, independently of the other, whereas to obtain the best running conditions and the highest efficiencies the turbine and boiler should be regarded and operated as one unit. At one station that we have in mind, which takes up the large load variations of the system with which it is associated, the switchboard staff is in direct communication with the boiler-house staff by a code of signals. By this means the two staffs are able to co-operate and adjust their operations to suit one another's requirements.

The most important factors affecting boiler efficiency are the varying character, energy value, and size of the coal burnt. It has often been stated that it is possible to obtain the same efficiency with low as with high-value coal. In commercial working this is impossible, even with the same CO_2 and uptake temperatures. Load factor has a considerable effect on the efficiency of operation, but "utility" factor has also a powerful influence. For instance, a 100,000-kw. station, which has to be prepared to supply that load if required, though it is never actually called upon to do so, may have a load factor of 80 per cent., even though the maximum load called for is only, say, 50,000 kw. The utility factor is relatively low, although the load factor is high. Boiler maintenance is of equal importance to boiler operation in obtaining high efficiencies. It has been proved by experiment that the thermal resistance of the gas film accounts for between 95 and 98 per cent. of the total temperature drop from the furnace to the water. It is evident, therefore, that the external cleanliness of the tubes plays a very important part in boiler efficiency, indeed, much more so than a layer of scale of any reasonable thickness on the inside of the tubes. Again, the provision for dealing with ashes is often a minor factor in station design, but the efficient handling of ashes is a matter of the first importance at a power station running at a high load factor and burning any considerable tonnage of coal, especially when the coal contains a high percentage of ash, as at present.

There are many sources of waste which are avoidable; to facilitate their detection, full use should be made

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of recorders, gauges, and meters. Coal-weighing leads to many direct and indirect economies. To maintain efficiency, continual records of performance must be kept, especially as every condition of operation is variable. The heating surfaces demand very frequent and careful attention if maximum efficiency is to be obtained. The superheaters are specially important, because every 10° F. superheat lowers the steam consumption of turbines about 1 per cent. Observations showing the distribution of draught often give valuable information concerning defects or unfavourable conditions. After ensuring that as much as possible of the thermal value of the coal gets into the steam, it is desirable that losses in other parts of the installation—*e.g.*, the condenser—be kept as low as possible. It cannot be too strongly emphasised that the performances of boiler and furnace are distinct phenomena ; the furnace produces heat, and the boiler utilises it. Continual vigilance is needed to maintain efficiency, and everything depends ultimately upon the personal factor and upon "team work." The importance of this matter is such that the U.S.A. Government is taking steps to ascertain the efficiency of power plant with a view to eliminating wasteful plant and giving preference in coal supply to the most efficient installations.

Turning to the second and more recent paper to which we have referred above, in which the authors discuss some of the salient points connected with the efficient operation of turbine plant and its attendant auxiliaries, it may be said that the modern turbine has been developed to such a point that little can be done to increase its economy.

Within the range over which a turbine is commercially operated, its efficiency rises with the load it carries, but it does not follow that it is most economically loaded at its normal full rated capacity. Maximum economy is reached, according to the authors, when the product of turbine and steam efficiencies is greatest ; and as the steam efficiency falls with a rising load, this product may be greatest at some point below its full rated capacity. In general, however, we may assume that it pays to run with as high a plant load factor as possible. Steam efficiency is the variable which has to be given the greatest attention. This is dependent on boiler-house operation and the efficiency and maintenance of the condensing plant. It has been found by test that the over-all efficiency is affected to the extent of 1 per cent. by a change of one atmosphere in the steam pressure. Further, it has been shown—again by test—that if the initial temperature of the steam is increased by 7° C., another 1 per cent. in over-all efficiency results. We quote the results of these tests as confirmation of the importance of supplying turbines with steam at as high a pressure, and especially at as high a temperature, as possible.

Special attention should be given to condensing auxiliaries. and care should always be taken to get the best possible service out of the plant ; it should be run at all times at as high a speed as possible. Some time ago the authors of the paper referred to went very closely into the performance of their condensers, and a number of experiments were made to ascertain whether the efficiency of the plant supplied could be improved. It was found that improvements could undoubtedly be made, but once a plant of this kind has left the factory it is too late to make radical alterations with a view to improving its design or construction.

Efficiency in the operation of any station can only be attained by close supervision. Although the same supervision cannot be exercised in commercial operation as in a test, the operating data recorded should be sufficient and accurate enough to enable a reliable opinion of the performance of the plant to be formed. The steam used in the turbines is the most difficult thing to measure. It is stated that none of the ordinary forms of water meter that have been tried in South African stations gave sufficiently accurate or constant figures, and special apparatus had to be evolved, which again shows that improvements can be made if set about in the right manner.

In times of stress like the present the Government calls to its aid the entire engineering strength of the country. There is no stinting of public money for experimental work in connection with the war, and it is now realised that the work of the engineer is one of the principal factors in the conflict. National greatness and strength in war are dependent on the energies of a people in peace time, and, as is the case to-day, so also in normal times it is the engineer, using the term in its broadest sense, who plays the principal part in national greatness. This leads to the conclusion which the authors have come to, that while to one man or one firm of manufacturers, the decision whether he will risk his reputation or they their financial position by a radical change in engineering practice is a very great undertaking, to a Government such a burden is a light one. They submit, therefore, that pioneer work of this description, when endorsed by a representative Institution or Committee, should cheerfully be undertaken by the Government as a national obligation. We trust that the Fuel Research Board established by the Scientific and Industrial Research Department will translate this thought into action, and that its investigations will be productive of many improvements both in apparatus and in operation, to the great advantage of the State and of the individual.

Electricity and Steel Testing.

It is a commonplace that electricity is playing a prominent part in almost every field of industrial activity nowadays ; it may not, however, be so generally realised that its capabilities are being continually extended in quite unexpected directions, and that it is, in fact, a sort of Admirable Crichton, of infinite resourcefulness and inexhaustible possibilities.

In our issue of October 19th, 1917, we described a new method of testing steel which had been evolved in the United States, depending on the fact that the magnetic and mechanical properties of a certain grade of steel were definitely correlated, so that one might be taken as a criterion of the other. The special virtue of this method was that it did not involve the slightest interference with the article under test, an important consideration, and one which is shared by no other mode of testing. The method can also, therefore, be applied from time to time to the articles in service, to determine their condition, thus avoiding the premature renewal of parts which are perfectly sound, or, on the other hand, preventing disaster through their unduly early deterioration. Further examples of the uses of electrical tests were brought forward at the meeting of the Iron and Steel Institute last week, in papers read by Mr. Kôtaro Honda and Mr. E. D. Campbell. The remarkable change in the molecular constitution of steel at the temperature of recalescence, with a simultaneous loss of its magnetic properties, has for some years been utilised in connection with the hardening of steel, and is the basis of the Wild-Barfield electric hardening furnace, which ingeniously utilises the disappearance of the magnetism to indicate the attainment of this critical temperature ; Mr. Honda has further developed the application of this principle, by determining the critical points and transformation points of various constituents of steels, and finds it possible to conduct a magnetic analysis of steel and to trace the changes in its structure which accompany changes in temperature. No doubt the method has its limitations, but it will prove a most valuable supplement to photomicrographic examination and chemical analysis, and who can tell to what the system may lead ? Congratulations are due to the author and his colleagues, who have carried out an arduous and extremely detailed investigation with notable success.

Mr. Campbell's paper related to the electrical resistance of hardened steel, a subject which has engaged the attention of metallurgical chemists for many years, and forms part of a prolonged series of investigations on the resistivity of steels ; it deals with the rate of change of the resistivity at 100° C. and at ordinary temperatures, due to the reaction which takes place in the unstable solid solutions which constitute hardened steels. At 100° C. changes are observed in the course of a few hours far greater than take place at room temperature in as many months. Such researches continually add to our knowledge of the structure of steel—a matter of immense importance, in view of the part that class of alloys plays in every department of engineering and industry.

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NOTES ON THE ACTION OF AUTOMATIC PROTECTIVE GEAR ON A LARGE A.C. NETWORK.

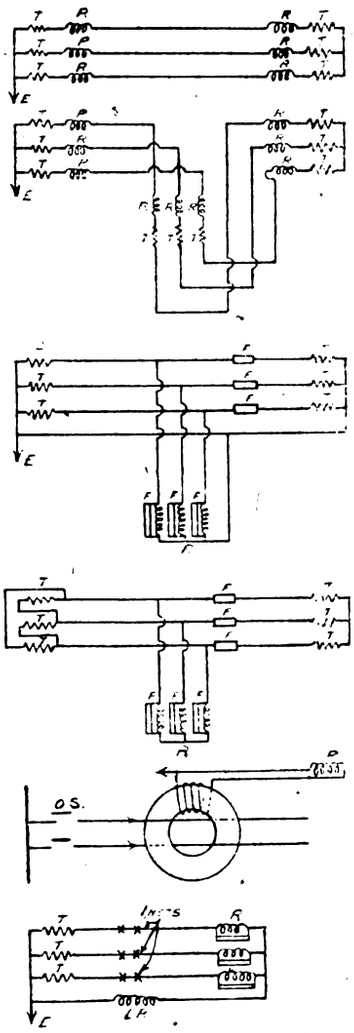
By C. W. MARSHALL.

The maintenance of continuity of supply on large electricity supply systems is at all times of vital importance, and the estimated financial loss due to interruption of supply on the network referred to in this article is in the region of £600 per minute. This loss is based on the assumption that a general shut-down occurs during factory working hours. It does not include any of the great material losses which sometimes occur in gun factories, paper works, &c. This consideration has led broad-minded managers of supply undertakings to be willing, in normal times, to risk sacrificing their own machines, if necessary, in order to obtain a high degree of continuity.

At the present time it is necessary to preserve continuity with the minimum of danger to plant of all kinds, and accordingly a compromise between stability and sensitiveness of the protective devices must be made.

These notes are based on the results of some years' working, and the various classes of plant are treated separately, beginning with the source of supply. The alternators, which vary in capacity from 4,000 K.V.A. to 7,000 K.V.A., are all protected on the Merz-Price circulating-current system, and the gear has been tested on several occasions under both internal and external fault conditions. The relays originally fitted were of low impedance, and although the transformers were very well balanced, it was found impossible to prevent the machines from being tripped out under heavy external short circuits without using fuses in parallel with each relay element. Later on, new relays of high impedance were substituted for the original equipment, and the machines are now running with settings of from 10 per cent. to 20 per cent. of full-load current, with very satisfactory results.

It must be noted, however, that although the machines have come through many severe external faults, it is by no means certain that they would not come off the bus-bars if a fault were to develop in the immediate neighbourhood of the power stations. Experience has shown that with a setting of 50 per cent. and a time lag of about ½ second, a faulty machine could be disconnected from the bus-bars without great disturbance, but that the damage done to the windings was such as to necessitate complete renewal of both stator and rotor windings. In the cases mentioned no automatic field-breaking device was fitted. With an instantaneous setting of 10 per cent. a faulty alternator has been cut off without causing the slightest trouble, and the damage to the machine was confined to one stator coil. Here again the field circuit was merely broken by hand. The general conclusions drawn are that while Merz-Price gear gives a satisfactory degree of protection from the standpoint of sensitiveness, it leaves much to be desired in stability, and, wherever practicable, one of the more recent developments, such as the self-balance gear, as used by Beard, or the lately patented method of A. E. McColl, should be adopted. This latter method is of very general application, and fault settings of 5 per cent., and even less, can be used, without any danger of instability; with these sensitive settings it ought to be quite satisfactory to use field-breaking devices on the exciter alone, thus effecting very considerable economies in the first cost of the gear.



No.	System.	Current transformer.	Relays.	Remarks.
1.	Merz-Price feeders. Voltage balance.	Single air-gap type 400/1 B.T.H. 590/1 Reyrolle.	Moving iron, 0·1 amp.	Approximate fault current, 100-200 amps. Liable to trip sound sections if fault currents are great.
2.	Merz-Price T's.	Do.	Do.	Do. Pilots 3/20
3.	Merz-Price circulating current protection for generator and Y/Y transformers.	Ordinary instrument type. 5 A. secondary.	Do. 3-12 A. transformers, 0·05 A. generators.	Pilots 7/21½ 4-core. Series fuses for transformers only.
4.	Circulating current protection for Δ/Y transformers.	Ordinary instrument type, secondary Δ 2·89 A. Y 5 A.	Do.	Do.
5.	Merz-Hunter split conductor.	Special double primary.	Moving iron, 0·05 A.	Fault current 10 A. Note split switch.
6.	Wedmore core balance.	Ordinary instrument type. 5 A. secondary.	Do.	For tail ends only.

T = Transformer secondary.
R = Relay operating coil.
F = Fuse.
Secondary conductor only shown, except in 5.
O.S. = Oil switch. One phase only shown.

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In protecting feeders Merz-Price balanced voltage gear has done quite good work, but it is somewhat deficient both in sensitiveness and stability. The general experience has been to the effect that Merz-Price gear on cables cannot be depended upon to cut out a defective cable before a short circuit between phases has developed, and that the rush of current to the fault is often sufficient to disconnect sound sections protected on the same system. Split-conductor protection, both with split-concentric and six-core cables, has proved to be extremely satisfactory in both the above respects. So far as rather limited experience shows, faulty sections can be cleared without causing the slightest disturbance, and there is no danger of the relays operating under even the severest straight-through faults. Where existing cables are grouped to form split conductors, it is very difficult to obtain exact balance, and biased relays are desirable. It is worthy of note that all cable faults occurring at distances corresponding to ohmic resistances of 0·2 ohm and over (from the power stations) have been cleared without damaging the oil switches to any serious extent. This fact, taken in conjunction with the amount of plant running at the time of the fault, usually about 40,000 kw., and the inherent reactance of the machines, about 5 per cent., gives a valuable guide to the size of the zones into which the system ought to be subdivided in order to ensure faults being cleared without destroying the oil switches. Another noteworthy fact connected with faults beyond the 0·2-ohm limit is that they have invariably been cleared without disturbing the running of the synchronous machinery, even though the minimum time in which the relays could operate was in some cases 0·8 second.

Transformers protected on the circulating-current system have necessarily parallel fuses for use in conjunction with the relays, and although the degree of protection is fairly high, the writer is of opinion that it would be advisable to discard the system entirely in favour of McColl's. The most important practical point experienced by the writer is that the best method of dealing with the well-known connection troubles in delta/star jobs, is to fix rigidly the standard connections, mark the polarity of all current transformers, and use coloured wiring. Any error on the part of wiremen should then be distinguished without difficulty.

Leakage Protection, fig. 1 (6), has proved very useful. Although it was found necessary to standardise 100 per cent. fault setting, the extremely rapid action of the relays is generally sufficient to clear faulty apparatus without doing much damage, or disturbing the running of the sound parts of the system. The application of leakage to H.T. motor windings should not be relied on too much, as quite recently two cases occurred in which large motors developed faults between phases. Due to the fact that there was no earth in either case, the leakage relays did not act. The machines were cleared by comparatively slow acting overload devices, causing very severe shocks to the system and great damage to the windings.

Taken as a whole, it appears that the conventional devices, as outlined above, are a very sound investment. It seems to the writer that far more should be done to encourage the adoption of less known schemes, even though they involve considerable expenditure of capital. For instance, the sheath system proposed by the late F. B. Whitaker, if properly developed, would give complete protection to the bus-bars as well as the cables, with almost no possibility of dead short circuits occurring.

In order to ensure that protective gear gets a fair chance of operating to the best advantage, it should be the aim of the managements of supply companies to enlist the active co-operation of all members of their staffs. The writer suggests that it would be advantageous to withdraw the keener shift engineers from their routine work for, say, one or two months each year, and employ them on erection and testing connected with the various types of gear. It is contended that this would stimulate their interest in the apparatus, and would also prove an interesting relief from what is generally acknowledged to be an extremely dull and initiative-destroying form of employment.

Diagram 1 gives the essential connections of the systems referred to in the paper.

In conclusion, it would be invaluable to those interested in the maintenance of continuous supply if electricity supply companies and municipalities would publish annually a statement of all faults occurring on their systems. This aspect of their work is almost as important as the financial side, and it would be extremely beneficial if there was healthy rivalry between authorities as to which area should have the best record of immunity from shut-downs.

THE ELECTRICAL INDUSTRY IN RUSSIA.

By ALLAN MONKHOUSE, Jun., A.M.I.E.E., A.Am.I.E.E.

At the present moment industry in Russia is at a complete standstill; nevertheless, it may be of interest to review briefly the advance made in the electrical industry in that country up to a few months ago, when civil war and anarchy caused the temporary closing down of the works. The re-opening of these works is merely a matter of time, and once law and order are restored in Russia the possibilities for electrical development in such a vast country, abounding with natural resources, will be enormous.

Heavy Machinery, Motors, &c.

There are four large works in Russia engaged on the manufacture of heavy electrical plant.

(*a*) The Russian A.E.G. Co.'s works, previously at Riga, and now evacuated to Kharkoff. Before the war this firm, like the Russian Siemens-Schuckert Co. and the Russian Siemens-Halske Co., was in actual fact more like a department of the Berlin firm of the same name. Most of the designing and technical work was done in Berlin, and nothing but the simplest machines were built in Russia. The Russian A.E.G. Co., in fact, used to employ its Riga works very largely as an assembling shop for Berlin-made machines. In this way, besides avoiding the heavy Customs duties on finished machinery, it was enabled to make a selling point by stating that its machines were Russian built. At the outbreak of the war, this firm, together with the other two mentioned, wasted no time in denouncing all connection with the Berlin firm and publicly advertising that its shares were held entirely by Russian subjects, and that it was associated with the G.E.C. of America. The evacuation of Riga practically shut down the works for a time; however, the works were reopened in 1915, in Kharkoff, where the firm has erected extensive new works capable of employing 10,000 men, and designed to build all classes of electrical machinery. A new shop is under construction for the manufacture of turbo-alternator sets complete. This firm has had great difficulty in living down its previous connection with Berlin, and as lately as last year the managing director of the works was reported as having been arrested on a charge of being an enemy alien.

(*b*) The "Volta" company at Reval has a modern, well-equipped plant. This firm was chiefly engaged on large Admiralty work, and enjoyed a good reputation. The works have the advantage of being situated in Esthonia, where the quality of the labour obtainable is very considerably superior to that obtainable in Russia proper. Although a Russian-owned concern, the organisation of the works is based on German lines, and, in fact, the internal correspondence, drawings, and works specifications are all couched in the German language.

(*c*) The Russian Siemens-Schuckert Co. has a works in Petrograd which were previously chiefly employed in assembling and building traction equipments and small motors. Since the outbreak of war, the works have been considerably enlarged for dealing with larger work.

(*d*) The Russian Electrical Co. "Dynamo" is a firm founded in 1912 with purely Russian capital and incorporating the business of the N. Glehoff Co., whose works were destroyed by fire in 1911, and Messrs. M. M. Podobedoff & Co.'s contracting department. This firm bought up the works of the Russian Westinghouse Co. in Moscow, which it considerably enlarged, and commenced the manufacture of all classes of heavy electrical machinery. A special traction department was laid down to manufacture

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railway equipment to the designs of Messrs. Dick, Kerr and Co. The "Dynamo" Co. later became the sole agents for Russia for the British Westinghouse Electric and Manufacturing Co., and the Westinghouse Companies of Italy and America. After the outbreak of war the company made enormous developments to its works. New works were built for making oil switches and switchgear of all kinds, lamp fittings, and porcelain insulators. The firm also put down two large shell works, and a department for making wire cutters and other military requirements. In 1915 the firm built several 600-kw., 1,500-volt direct-current generators for railway work, an accomplishment which was considered a distinct advance in Russian electrical manufacturing. The Moscow works include a large oil engine department, making a good engine of the Hornsby type.

Amongst other firms which, although not having works in Russia, did considerable trade with that country, and are, consequently, well known to the Russian buyers, may be mentioned Bergmann Co., Dick, Kerr & Co. (for traction equipments, &c.), Brown, Boveri & Co., Oerlikon Co., and the Swedish General Electric Co. (A.S.E.A.).

Cable-Making.

The cable-making industry had advanced probably further than any other branch of electrical work in Russia. The Russian Cable and Metal Rolling Co.'s works in Moscow started operations in 1912, and is associated with the "Dynamo" Co. This firm was a joint development of the M. M. Podobedoff Co., which had been manufacturing light insulated wire for some years, and of the British Insulated and Helsby Cable Co. The firm made enormous developments during the early part of the war, and, finding itself hampered by the impossibility of obtaining machinery, it undauntedly put down a small workshop, and a few weeks from the commencement of hostilities it was itself constructing all the plant necessary for drawing, stranding, and insulating field telephone wire. Eventually the plant was turning out 1,000 verts of this wire per day. Plant was also laid down for manufacturing enamelled wire, and, just prior to the revolution, a large reverberatory furnace department was added to the works for treating copper scrap. The firm has a large department for making heavy paper-insulated power cables and telephone cables. In 1913 the firm completed orders for 1,100 pair paper-insulated, lead-covered telephone cable, thus creating a record for large telephone cables in Russia. Other cable and wire manufacturers of equal importance are Veshnakoff, Shaamshin, & Alexieff, in Moscow, the Kolchugin Co., near Moscow, and the United Cable works in Petrograd.

All the cable makers were formed into a combine operating under the name of "Electroprovod," which combine controlled the whole cable-making industry. All orders were placed through it, and were divided out between the works in accordance with a definite agreement.

Electrical Instruments and Small Apparatus.

Previously to the war the German manufacturers held this field almost completely in their hands. It was an exception to find anything but German switchboard apparatus anywhere except on a number of installations made by the Russian Westinghouse Co., where British and American instruments were used. For laboratory work Weston instruments are, and always have been, regarded as the standard.

The A.E.G. Co., Siemens & Halske, Hartmann and Braun, Kaiserwetter, and Paul Meyer may be mentioned amongst those firms which had an enormous trade with Russia. The latter three firms had no works in Russia, but had most energetic agents all over the country. These firms produced attractive catalogues, and not infrequently altered their designs to suit Russian conditions—a procedure which, it is regrettable to say, it was found, generally speaking, British manufacturers were very unwilling to follow. Messrs. Siemens & Halske commenced assembling measuring instruments in Petrograd to comply with the Russian Admiralty injuction that, wherever possible, the Naval Departments should give preference to Russian-made materials in placing orders. A firm under the name of Engineer Petch in Warsaw commenced instrument making, but apparently abandoned the attempt after the outbreak of war. The Bureau of Electrical Measuring Instruments in Petrograd also commenced the manufacture of instruments in 1915, but its efforts were not crowned with great success. The most serious attempt to manufacture this kind of apparatus in Russia was made by a British firm in Moscow, which had succeeded in putting the manufacture of moving iron instruments and small switchgear on a thoroughly good basis. This firm's plant was being extended to manufacture special switchgear and auxiliary apparatus for naval requirements when the works were shut down in March last, on the British Colony being instructed to leave Moscow.

Telegraphic Apparatus.

The telegraph apparatus business in Russia was largely in the hands of Messrs. Siemens & Halske. The chief buyers of this kind of apparatus were the Government Telegraph Departments and the railways. The Russian Siemens & Halske Co. has, since the war, put down a large new, well-equipped works at Nijni Novgorod for the manufacture of telegraph and telephone apparatus. The works were hardly in full operation when the reign of anarchy began. The Moscow Telephone Manufacturing Co. had also just equipped works in Moscow for the manufacture of telegraph and telephone apparatus, but as it was at these very works that the Bolshevik Red Guards were first formed for the *coup d'état* of November last, it is hardly probable that much remains of the works organisation.

Telephone Apparatus.

The telephone business in Russia is almost entirely in Swedish hands, through the Ericsson companies, which had a very large works in Petrograd, and which also controlled the telephone stations of Petrograd and Moscow, and other large towns. The Moscow telephone system was unquestionably one of the finest in the world, and until January, 1917, it was controlled and managed by Swedish engineers. During the Bolshevik bombardment in November last the entire system was "burnt out" by someone maliciously connecting the 220-volt A.C. mains on to the operating boards.

Accumulators and Dry Cells.

There were several firms engaged in the manufacture of accumulators, but unquestionably the Tudor Co. was the most important. After the outbreak of war, five or six small works were started in the Moscow district, exclusively directed to manufacturing dry cells for pocket lamps—a soldier's commodity for which there was a very large demand. It should be said that the majority of these cells were hardly satisfactory in operation, rarely "holding up" for any reasonable period.

Lamps.

Several firms in the Moscow district were engaged on the manufacture of lamps, chief amongst which the works of Engineer Kalmanok may be mentioned. The lamps manufactured and the smallness of the output, however, were such that these works could hardly be expected to compete with foreign manufacturers under anything but war conditions.

Electromedical Apparatus.

Previously to the war, no attempt was made to make electromedical apparatus in Russia, but the enormous requirements of the war led to a start being made by several firms. Messrs. Russian Siemens & Halske Co., Mr. Vertsalnik, of Moscow, and Mr. H. Ledward, whose workshops and laboratory are in Moscow may be mentioned amongst those who were developing this work rapidly. The last-named had also started the manufacture of X-ray screens with highly satisfactory results. X-ray tubes were being made by Engineer Fedeoroffski's works in Petrograd.

Insulation Materials.

In the manufacture of porcelain ware and insulators the "Isolator" Works in Moscow and the "Dynamo" Co.'s Works were producing articles which were equally as good as any foreign products, and, moreover, the cost of manufacturing was so low that, were proper trade channels open,

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these works could most effectively compete with British makers, especially for the simpler kinds of insulators.

Although Russia has a very large firm engaged in rubber manufacturing, its products have never proved successful from an electrical point of view. This, however, may be attributed to the technical personnel of the works being hardly acquainted with what is required for a good dielectric insulation, since there is no question that the splendid modern equipment of the works should be able to produce the article required.

Recently an attempt was made to manufacture a product similar to "Bakelite," under the name of "Carbolite." This was a moderately good substitute, but rather brittle. The Russian A.E.G. Co. also makes an insulation under the name of "Rigolite," which it is trying to substitute for "Stabilit."

Experiments have also been made with Siberian mica splittings. This mica is of good quality, and there is no doubt that, with proper equipment and experienced supervision, a good grade of micanite could be made in Russia from local mica.

From the above summary of the state of the electrical industry in Russia, it will be seen that the war had a great stimulating effect in the development of new industries. Before the war the German manufacturers, with their splendid selling organisation, good catalogues in the Russian language, rapid deliveries from stock, and their system of long credits, had practically monopolised the electrical trade in Russia. When Russia found herself suddenly cut off from her supplies, British, Swedish, and American firms began to fill the place left by the Germans, but the difficulties of shipment and in obtaining valuta made business so difficult, that the Russian manufacturers were everywhere tempted to risk the new developments.

The greatest difficulty was in obtaining the necessary skilled labour and supervision. The Russian workman can seldom be sufficiently trusted to be left without the closest supervision. For instance, in armature winding it is a matter of the greatest difficulty to teach men to have even an inkling of what purpose insulation is intended to serve. It was quite a common occurrence to find men driving former-wound coils into armature slots with a fitter's hammer, fondly imagining that so long as the Leatheroid packing piece covered up the obviously-damaged insulation of the coil they would escape detection. For the finer work, however, excellent labour was found by employing silversmiths, who could be obtained easily since their own trade had been hard hit by the war, and the men were very glad to find employment, especially on war work, where they could secure exemptions. Female labour is fairly good, and for winding and fine work is unquestionably superior to male labour. Some works tried to employ Letts and Esthonians on the more delicate and difficult work, but this was an arrangement that always resulted in serious quarrels with the Russian workers. Generally speaking, however, there is no question that excellent semi-skilled labour is obtainable in Russia, but such labour requires the closest supervision.

Some difficulty had been experienced during the war in obtaining raw materials, especially armature iron and insulation materials. The various Ural ironworks have, however, now managed to produce an iron which, when tested at the Moscow Municipal Testing Station, showed most excellent results in comparison with the best British makes. Cast-steel for traction motor frames was another great difficulty, and as nothing could be obtained to equal the products of Sheffield and Middlesbrough makers, it was found necessary to thicken up the frames to obtain the required results with Russian steels.

Drop forgings were almost impossible to obtain, and as there are only two works in Russia making a speciality of the manufacture of malleable iron castings, it was very frequently found necessary to alter designs to employ cast brass and thicker cast-iron parts where malleable iron would otherwise have been used. Latterly one works was casting a cast-iron with 30—35 per cent. old wrought-iron scrap in it for use instead of malleable iron.

At the present moment almost all the works named are shut down, due to want of materials, fuel, supervision, or for financial reasons, and it is difficult to say when they may be reopened, but there is no question about it that when Russia does outgrow the present period of adolescence through which she is passing, and takes her place among the nations, there are unlimited possibilities for industrial development to be found in that country.

The one thing Russia lacks is *practical* technical education—the very trait strongest amongst British engineers. Up till now it is a fact that wherever British engineers and technical men have been in charge of industry in Russia their efforts have been crowned with success. The textile industry in Russia is in itself sufficient proof of this statement.

Germany as a nation is not interested in developing Russia industrially, since, having no Colonies of her own, she wishes to keep Russia as a "colony" for her export trade. The terms of the Brest-Litovsk treaty clearly proved this fact. It is questionable if Russia can reorganise her industry without outside assistance, and it is to be hoped that British capital and British engineers may realise this when the present state of anarchy passes, and thus help to prevent Russia again becoming a dumping ground for German goods.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Electric Crane Tractor.

We learn from the Electric Vehicle Section of the National Electric Light Association, New York, that a Chicago manufacturer of electric vehicles recently placed on the market an electric tractor equipped with a 2-ton capacity crane, also operated electrically, and supplied with energy from the same storage battery as was used to propel the vehicle. The demand for this mobile electric tractor crane was created principally through war conditions, and although it has not as high a lifting capacity as many locomotive and overhead cranes, it has the advantage of being more flexible in its radius of action. Recently one of these electric crane tractors was observed unloading a freight car at a well-known terminal. It was handling large crates of army kitchen equipment weighing approximately 3,700 lb. After lifting the cases off the freight car, it backed away, and running across the pier under its own power, deposited its load. While this is a somewhat larger load than the vehicle was designed to carry while in motion (the manufacturers would prefer loads to be limited to 2,000 or 3,000 lb. in such instances, the ordinary stationary crane having only a maximum capacity of 4,000 lb.), the tractor performed its duty easily. The boom of the crane swings through 180°, so that after material is lifted it can be deposited easily on the ground or on a trailer for transportation elsewhere. It can be readily realised that speed in handling material is of importance under present conditions. Locomotive or overhead cranes are not always available at just the place where it is necessary to handle material at a given time, and even if available, they cannot always be transported quickly from one point to another as can an electric crane tractor of this type. The electric crane tractor is equipped with a spring draw-bar coupler at the rear of the frame. It is possible, therefore, to load trailers by means of the electric crane, and then haul these trailers electrically to another point and unload them. As a tractor it can haul a gross trailing load of 15 tons. Electric tractors of this

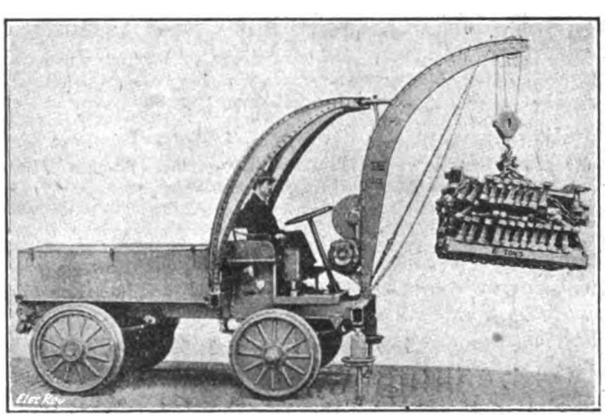

Fig. 1.—Electric Crane Tractor.

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type have been used in many instances to "spot" loaded freight cars, either pulling or pushing them. This electric crane tractor is another member of the electric vehicle family, which contributes no small part in successful war operations, not only expediting the rapid and economic movement of material and munitions, but also releasing numbers of men otherwise needed. Many of these electric transportation units are being operated successfully by women.

A Trolley-head Adjuster.

We are informed that an appliance has been invented by Mr. W. H. Simmonds, of 31, Chancellor Road, West Dulwich, S.E. 21, whereby it is stated a considerable waste of time and labour can be saved in re-establishing the engagement of an overhead conductor with the trolley-sheave of electrically-propelled cars. To accomplish this object the contact sheave on the end of the trolley pole is provided with an adjuster pivotally supported on the spindle on which the contact-making sheave is mounted. This adjuster is constructed with a pair of horn-strips which diverge from one another in an outwardly radial direction from the central plane of the sheave. The adjuster is also provided with an arm extending approximately radially opposite to the horns, and to the extremity of the arm the usual rope is secured for disconnecting the trolley-sheave with its pole from the overhead conductor, allowing same to rise and make contact with the conductor.

To disconnect the trolley-sheave with its pole a downward pull is given on the rope which rocks the adjuster, bringing the horns of the latter into a more or less vertical position. Should, on swinging the pole round from one end of the car to the other, the pulley-sheave not register in a plane coinciding with the line of the overhead-conductor, by simply slackening the rope and allowing the pole to rise, the horns will either on one side or the other encounter the overhead conductor, causing the adjuster with its pulley sheave to rotate, thereby bringing it into true alignment with the conductor, and with a simultaneous slackening of the rope the pulley sheave groove will engage with the conductor and at the same time the conductor will force the adjuster backwards into its out-of-action position by means of a crossbar situated at the rear, which comes in contact with the under side of the conductor.

It is claimed that with such a device the trolley pole with its sheave can be instantly re-engaged with the conductor under any unfavourable conditions in the minimum amount of time.

The Davis Brazing Table.

We understand that the Davis Furnace Co., Diamond Foundry, Luton, Beds., is placing on the market a new form of self-contained gas-fired brazing table, which is especially suitable for certain toolmaker's work. The use of an outfit of this description, operating upon such an extremely convenient and cleanly fuel as gas, gives, it is claimed, certain advantages, amongst which we may mention: ease of manipulation, as the apparatus is ready for work immediately the work is laid on the table; exact control of temperature and the area to be heated; cleanliness, and consequently improved quality of work turned out; the work is also in clear view during the time the operation is in progress. Apart from the brazing of pipes, tubes, and similar work, the apparatus is very suitable for brazing tips on tools. The firebrick table is mounted upon a very strong cast-iron stand, provided with a lower or bracing shelf, a high-pressure blower being fixed upon the latter, complete with fast and loose pulleys, or alternatively a small electrically-driven machine for providing the air-blast required by the blowpipes. Each blowpipe is swivel-mounted on a pillar with suitable adjustment for height. Instantaneous lateral adjustment is provided by the vertical supporting pillars sliding on a machined bar of square section, fixed horizontally along the front of the table. Flexible metallic tubing, complete with separate main control cocks, is provided for the air and gas supplies.

A PORTABLE AUTOMATIC COAL-TRIMMING CONVEYOR.

The process of "coaling ship," which consists not only in getting the coal on board, but in conveying it to and filling the various bunkers, termed trimming, is always an operation requiring a large amount of hand labour. Part of the operation consists in transferring the coal from barges or other craft, or from shore to the latter. The portable automatic trimming conveyor herein described has been designed with the purpose of handling the coal with the minimum of labour, trimming it into all the bunkering spaces provided in steamers, reducing the cost, and displacing the hand labour required in the present bunkering system.

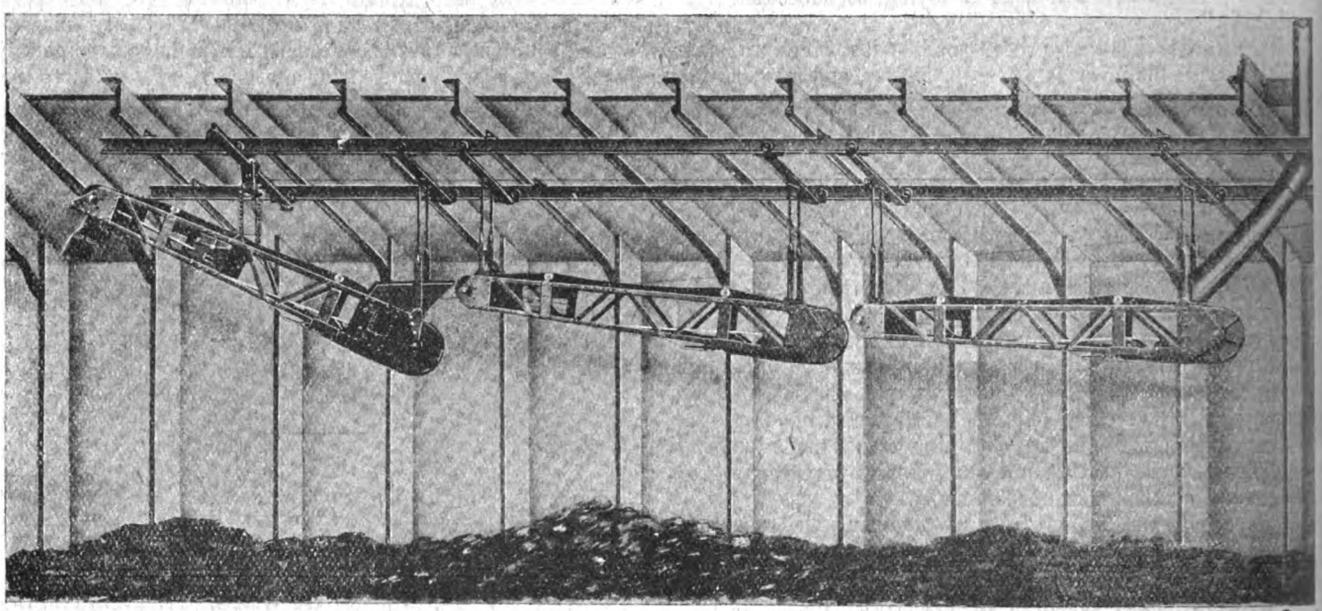

Fig. 1.—Portable Automatic Coal-Trimming Conveyor.

Fig. 1 illustrates the arrangement of the plant, which consists generally of a series of short self-contained conveyors, usually three in number, but depending upon the length of bunker, suspended from a pair of rails attached to the centre of the deck beams inside the bunker upon which the conveyors are free to travel longitudinally. The coal is delivered at one end of the series of conveyors by means of a shoot from the deck above, and is discharged at the other end by the trimming or front conveyor. This conveyor is provided with a lateral movement, so that the coal may be distributed over the whole width of the bunker, and is inclined sufficiently to throw the coal high enough to fill the bunker up to the top.

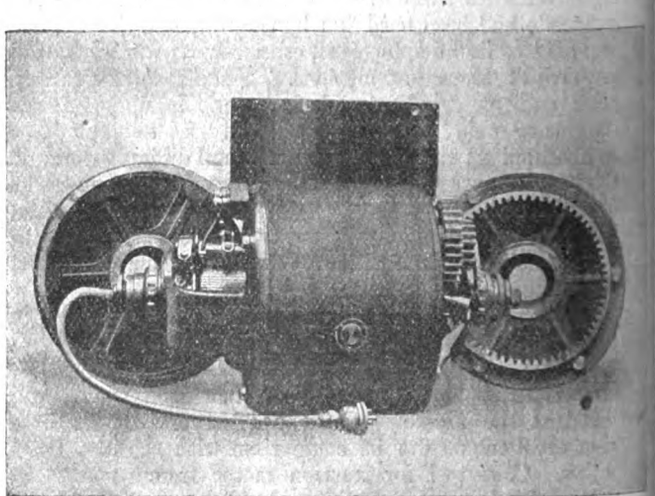

Fig. 2.—Driving Drum.

The conveyors are each driven by an electric motor situated inside, and forming part of, the end driving drum or terminal. The necessary lateral and longitudinal movements of the trimming conveyor are operated by mechanism from the driving motor, and both are automatic, the lateral movement being continuous, and the longitudinal movement being dependent upon the action of an ingenious device attached to the front of the conveyor, and consisting of a hanging plate

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or shield, which is caused to move by the action of the coal piling up, thereby making an electrical contact which sets in motion a drum, and winds back the train of conveyors. When the end or tail conveyor has been backed beyond the delivery shoot, and is no longer required, it can be removed and fixed in another position. Coaling can then commence in another bunker, or several trains can be fitted up from a central delivery shoot, and the whole of the coaling proceed at the same time. When both sides of the ship must simultaneously be coaled, conveyors can be laid across the decks, or slung from gantries or cranes to the delivery hatch. In fact, it is claimed they can be adapted in any direction where material has to be shovelled, wheeled, or carried.

Another type of portable conveyor of the same general design as the trimming conveyor is mounted on swivelling

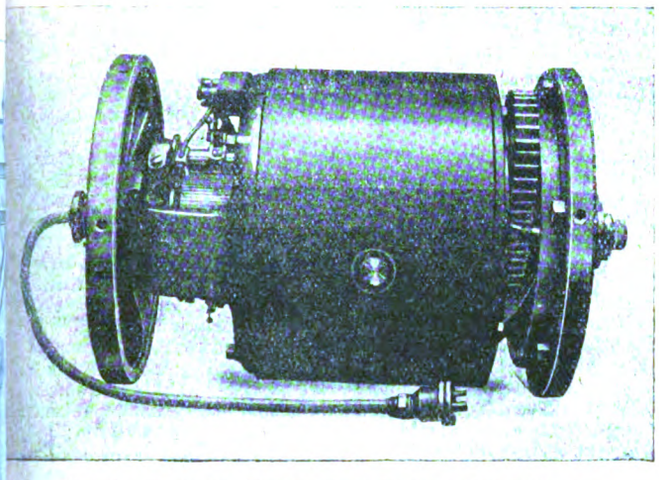

Fig. 3.—Driving Drum with Pulley Removed and End Brackets in Position.

castors for moving about the ship's deck, wharf, warehouse, or any other place where material has to be moved. These conveyors are also self-contained, and can be made in any desired length, and any number can be fitted up end to end, making a continuous train possibly several hundred feet in length.

The special feature of this conveying plant is the electric driving drum, of which the complete machine is illustrated in fig. 2. This driving drum consists of an electric motor of suitable horse-power, which can be wound for any commer-

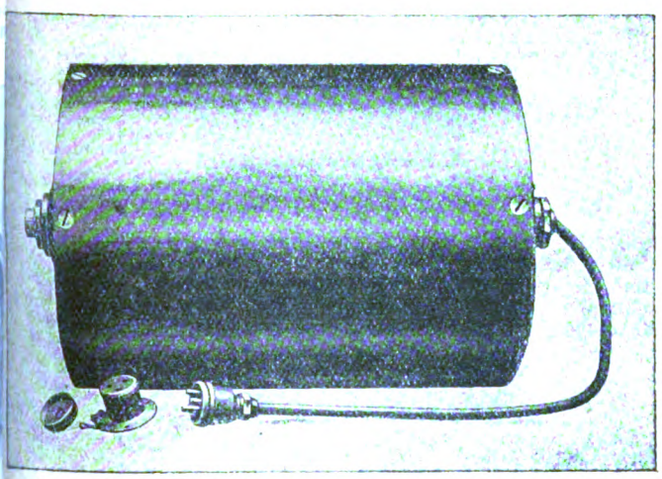

Fig. 4.—Motor Complete with Brackets, Pulley Removed. Removed.

cial voltage for either direct or alternating current. The whole of the outer drum which forms the belt pulley revolves and receives its power from an internal machine-cut gear wheel fixed to one of the end brackets that carry the drum, these brackets run on standard roller bearings. The internal gear wheel is connected by suitable spur and pinion with a pinion fixed on one end of the sleeve on which is also mounted the armature of the motor. The armature and driving pinion revolve on a hollow shaft to which is keyed the yoke and fields of the motor. The hollow shaft serves the double purpose of providing at one end a reservoir for the lubricant for the armature sleeve and gearing, and at the other a channel and protection for the cable connections. Both end brackets of the drum are solid, so that the machine becomes a totally enclosed motor protected from dust and damp, enabling it to be used under any weather conditions or in any situation.

Fig. 3 illustrates the driving drum with the pulley removed, the end brackets in position with the intermediate pinion, and the method of making the cable connections. Fig. 4 illustrates the parts of the driving drum showing the motor complete with both brackets and pulley removed, and making clear the whole design and construction of the machine.

The special self-contained motor and driving drum is adaptable for a great many purposes, such as elevators working in exposed positions, conveyors both above ground and underground in connection with coal mines, &c., portable stackers, loaders and pilers, and slat conveyors in connection with the mechanical handling of materials. It can also be used for haulage purposes, for driving winches, capstans, &c., replacing steam-driven machines working in exposed conditions.

The sole licensees and manufacturers of this labour-saving machine are Messrs. J. Martin Blair, 3-7, Southampton Street, Strand, W.C., and the motors are built for this firm by the Collins Electrical, Ltd., 115, Clerkenwell Road, E.C.

THE BRITISH SCIENTIFIC PRODUCTS EXHIBITION.

(*Concluded from p.* 248.)

Joseph Lucas, Ltd., Birmingham.—This firm's exhibit contained electric generating units for aircraft; a 12-volt aero electric engine starter weighing 10 lb.; a 12-volt tank starting and lighting equipment, the starter when fitted is geared to the engine fly-wheel. Three types of daylight signal-lamp outfits were included in the exhibit. In one type for use on patrol boats, aircraft, &c., the grip handle contains two spring triggers for operating the lamp, the lower one making contact with the battery, so long as it is pressed, and thus lighting the bulb. The upper trigger oscillates the mirror for the purpose of sending signals. This type of lamp is fitted with telescopic sight with adjustable eyepiece. In actual practice signals from this lamp have been read at a distance of 14 miles in daylight. A second type for use in maintaining and establishing communications in army zones where telepragh and telephone wires are cut by enemy fire, the signals are sent by means of the tapping key, which makes connection with the battery and lights up the bulb when depressed. A third lamp similar to the above, but somewhat larger, is fitted with a telescopic sight which has about two diameters magnification, and a total field of vision of about 4½ deg. The tube sight fitted to the side of the lamp is for night use, in case the telescopic sight becomes damaged. A narrow beam of light is projected for daylight signalling, and coast signals from this lamp have been read by battle-cruisers when twenty miles out at sea. This firm also had on view an interesting collection of electrically-heated articles of clothing such as a jacket, gloves, shoes, &c., for use on aircraft, together with a generating unit for heating the same. The dynamo is driven by an air screw, and switches are provided for operating the wireless apparatus, lamps, flares, Klaxon, and for heating the guns.

The Cleveland Magnesite & Refractory Co., Ltd., Normanby, Eston, Yorks.—The section devoted to ferrous metallurgy made the importance of the exhibition fairly obvious, for example, the exhibit of this firm contained samples of selica bricks and blocks for use for lining the interior and roofs of open-hearth steel furnaces, &c., and they are produced from high-quality ganister obtained from quarries in Weardale. An average analysis of the silica bricks produced by this firm is as follows:—Silica 95.12, alumina 1.60, lime 1.55, magneisa 0.27, iron peroxide 0.99, alkalis 0.34, loss on ignition 0.20. This company owns three brick works, two of which have been started since the war; women labour is largely employed, and the output is about 100,000 per week, in addition to magnesite bricks and cement.

Messrs. Ridge, Beedle & Co., Glasgow.—The usefulness of zirconia as a refractory material was illustrated by the exhibit of this firm of samples of zirconia brick for high temperature and resistance to chemical reaction. This is especially promising in connection with electric furnaces.

The National Physical Laboratory, Teddington.—These exhibits enabled the progress which has been made in certain directions to be measured with a reasonable approach to exactness. The metrology department exhibited various forms and types of gauges together with apparatus for testing and calibrating the same. The engineering department showed a mirror extensometer made at the N.P.L. This particular type has hitherto been made in Germany; it is an instrument of extreme sensitiveness and accuracy, can be adapted for all kinds of work where increases of length have to be measured, and is well suited for research work. From the metallurgy department came a set of samples of new light alloys of alluminium which have been developed and prepared at the N.P.L., including castings, ingots, and slabs suitable for rolling into bars and sheets; also spinnings and finished articles illustrating the adaptability of these alloys, their ready machining, and good finish. Samples of zirconium compounds prepared at, and largely by a new process worked out at, the N.P.L., were shown together with articles made from silicon carbide and

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also fireclay crucibles. An electric thermostat, developed at the N.P.L. by Messrs. Haughton & Hauson, was shown together with descriptive diagrams. This apparatus is used for prolonged heating of metallurgical specimens at an accurately controlled temperature. The instrument is capable of maintaining any desired temperature up to 1,000 deg. C. accurately to within 1 deg. C. for any desired length of time. The electrical measurements department contributed a model and photograph of Campbell's standard of mutual inductance calculable from the dimensions. The primary circuit of the ind ctance consists of two single-layer coils of bare wire wound in accurately measured screw cuts on a marble cylinder, the secondary being a coil of many turns and layers wound in a narrow channel on a marble ring. The two primary coils are connected in series, and the dimensions are so chosen as to make the magnetic field (due to the primary current) approximately zero over the space occupied by the channel winding. Thus the value of the mutual inductance depends chiefly upon the dimensions of the primary coils (which can be determined with high accuracy), and only slightly upon the dimensions and position of the ring coil, which cannot be found with the same precision.

The Duddell oscillograph (the actual instrument which belonged to the late Mr. W. Duddell, F.R.S., was on view), is for the purpose of finding the curve which a quickly varying current follows—for example, the wave form of an alternating current. The current passes through a loop of phosphor-bronze strip tightly stretched in a very narrow air gap between the roles of a powerful electro magnet. This loop is deflected by the current, and a minute mirror attached to the loop reflects a spot of light to a moving photographic plate, and so serves to record the motion of the loop, and thus gives a trace of the variation of the current. The electrical standards department exhibited Weston normal cells having mercury for the positive element, and an amalgam consisting preferably of 10 per cent. of cadmium and 90 per cent. of mercury for the negative element. The electrolyte is a saturated solution of cadmium sulphate in water. The depolariser consists of mercurous sulphate, and on the preparation of this the constancy and usefulness of the cell depend. Many cells prepared at the N.P.L. have remained constant in voltage within one hundred-thousandth of a volt for more than eight years. The H form is due to Lord Rayleigh (see *Phil. Trans. Roy. Soc.* 1908). This section also contains a Kelvin double bridge, the one shown was arranged for the measurement of a low resistance of 0.01 ohm. in terms of a 10, 1, and 0.1 ohm. standard (see Report of British Association, 1906). A platinum thermometry bridge for use when temperatures accurate within 0.001 deg. C. have to be measured, involving measurements of resistances within four parts in one million. The bridge that was shown enables platinum thermometers with potential leads to be used, and by means of changes in connections the resistance of the leads is eliminated from the measurements. The changes are effected by one movement of a reversing switch (see *Phil. Magazine*, October, 1912).

Henry Wiggin & Co., Ltd., Birmingham.—This firm's exhibits consisted mostly of pure nickel crucibles for laboratory use, and various compound metals. While not intended primarily for the electrical trade, the various examples of compound metals which the firm was showing, and which previously have not been produced in this country, should prove of interest to makers of cooking and heating aparatus. An investigation of these would no doubt show that advantageous use could be made of such compound metals as nickel on steel, copper on steel, nickel on copper, &c., for cooking utensils, ranges, and heaters.

Messrs. Vickers, Ltd., Westminster, S.W.1.—Among this firm's exhibits were various types of B.L.I.C. magnetos manufactured for use on internal-combustion engines. The S.H. type magneto and coil is made for 2- to 8-cylinder engines, varying from 250 to 2,000 h.p. The system of ignition is high-tension, the magneto being a low-tension generator working through a transformer coil, the current from which is distributed by the distributor attached to the magneto. The Williams-Janney variable-speed gear that was shown by this firm has been very aptly described by a leading ordnance expert as "a means for controlling the speed transmitted from an uncontrollable source of rotary power." For example, a simple shunt-wound electric motor may be taken as "an uncontrollable source of rotary power," as it rotates at a constant speed irrespective of the load within the limits of its rating.

The variable-speed gear renders it possible to use a constant-speed direct- or alternating-current motor for driving positively mechanism at any desired speed between the maximum in one direction and the maximum in a reverse direction. In addition to being a starting, stopping, infinite speed-controlling, and reversing device, it also acts as a gradual, but positive, brake, so that the driven shaft can be reversed at high speed almost instantaneously without shock. As an example of the wonderful range in speed control, it is only necessary to quote the result of observations taken of one of these machines installed in the turret of a battleship, in which the speed of the driven shaft was varied from 485 r.p.m. down to one revolution in 10 minutes. Another valuable feature of the variable-speed gear is the fact that the maximum b.h.p. of the driving motor, or oil engine, running at a constant speed can be utilised at a wide variation of speeds of the driven shaft, as a high torque can be given off at low speeds, falling away (if desired) at higher speeds, although, of course, the same torque can be taken off at all speeds, provided the motor is sufficiently powerful to drive the machine.

This firm was also showing the well-known aircraft light alloy duralumin, with a specific gravity of 2.8, and tensile strength up to 35 tons per sq. in., and also heavy drop forged stampings, sample test pieces and a number of engineer's tools made of various alloy steels. The Vicker's hardness comparator was shown. This is a pocket instrument for ascertaining the Brinell hardness of any article in steel or other metal without the aid of a microscope, vernier, or other measuring device. It is claimed that the instrument yields trustworthy results on large and small pieces, irrespective of their foundation or support, and the test may be carried out on surfaces at any angle.

The Quain Ozone Syndicate, Ltd., Westminster, S.W.1.—In apparatus used for the production of ozone from atmospheric air the brush discharge occurs and attacks the nitrogen, breaking much of it into nitrous compounds. Ozone as generally understood was for this reason considered dangerous to be used for therapeutic purposes. When prepared by the Quain Silica Ozoniser the ozone is free from nitrous gases, and in therapeutic doses can be inhaled with impunity. The Quain ozoniser as exhibited consists of a vacuum tube made from quartz silica, through which the energy of the ultra-violet rays passes freely, exuding an aurora about 1 mm. in radial depth, while the brush discharge that passes freely through other insulating media by this method is condensed into a non-sparking halo, permeating the ozone envelope formed round the tube, a condition herctofore not associated with ozone production.

Further, the atmospheric nitrogen becomes "ionised" in its passage through the ozoniser, and becomes a medium of conveying the important condition to the point of application with the ozone. Tests at Faraday House, London, proved that the Quain ozoniser does not produce nitrous compounds, a certificate to that effect has been given; the tests also showed a large increase of ozone produced by the silica tube compared with other methods with the same consumption of electricity. This type of Quain silica ozoniser is now in use in several British and French Red Cross hospitals. It is claimed that the apparatus has been used with success for treatment of tubercular and all diseases of the respiratory organs, also successfully applied in restoring and healing obstinate granulating wounds and sinuses which have in most cases resisted other forms of treatment.

The stand occupied by Messrs. Simplex Conduits, Ltd., Birmingham, dealt with their well-known conduits and fittings. There were several lengths of 2½-in. acetylene welded, and 1-in., ¾-in., and ½-in. butt-welded steel tube; also 2½-in.

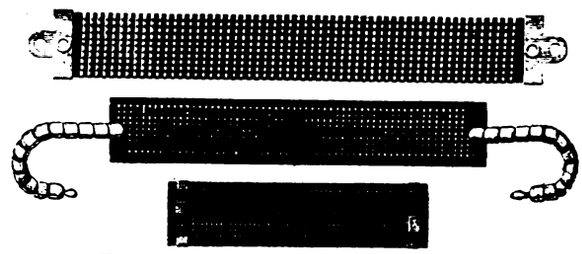

Fig. 9.—Simplex Heating Elements.

and ¾-in. inspection tee pieces, watertight lanterns, watertight switches, &c. The tubes and fittings are coated with a uniform deposit of pure zinc by electro-deposition. This method of protection against corrosion is specially designed to compete with the wasteful hot galvanising process hitherto

Fig. 10.—Electric Still.

in vogue. For a number of years the company has conducted experiments on the properties of enamel as a protective covering for conduits and fittings. As a result a large automatic electro-galvanising plant has been completed at

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Birmingham, operating on the "Zenex" process. This plant, we understand, is capable of dealing with many millions of feet of conduit per annum, together with some hundreds of fittings.

There was also shown an interesting set of resistance elements, such as are used on heating and cooking apparatus (fig. 9). The various war departments have so developed the use of electric heating that the manufacture of these elements has been greatly improved and accelerated. The elements are all machine made, and are designed to comply with the most stringent Admiralty demands. One of the elements shown (fig. 9) is rather a fine specimen of workmanship, it having a resistance of 6,000 ohms in a space of 5 in. by 1¼ in. The fineness of the material, and the accuracy of the winding make this element somewhat remarkable. The electric still that was shown by the same firm is a robust and complete piece of apparatus, and has been in great demand in that and the larger sizes, for laboratory use. The growth of industrial research has greatly increased the demand for this type of apparatus, and in the near future there should be very large business in electrically-heated stills, especially as there are practically no limits to size, and many have been supplied to provide distilled water for the batteries of central stations. Similar remarks apply to the electric steriliser that was shown; the demand for this apparatus for war service has been very heavy. Electricity is so cleanly, so convenient, and so efficient for the purpose of heating water for sterilising surgical instruments that there is little doubt that it will displace any other form of heating.

WAR ITEMS.

St. Dunstan's.—The employés of Accrington Corporation electricity department have contributed £9 to St. Dunstan's Hostel for Blinded Sailors and Soldiers.

Notification of Electric Motors in Germany.—A reminder to the owners of motors of low powers of the necessity for notifying the possession to the military authorities has again been issued by the General Command of the Seventh Army Corps. It is pointed out in connection with recent re-examinations that many proprietors of motors upon which an embargo has been placed, and which are notifiable, have failed to make a return on account of ignorance of the War Office notice of June 15th, 1917. This order rendered necessary the notification of all motors of 2 H.P. and upwards which are not regularly in use in establishments engaged on war work, exceptions being made in the cases of lift motors in ordinary use and motors used for auxiliary war work. The owners of motors which come under consideration are informed that a further opportunity is now afforded them to make a return, failing which they are threatened with the legal penalties provided for non-compliance.

Exemption Applications.—At Weybridge, on September 12th, H. W. Harrington (45), electrician, was, by consent, granted six months' exemption.

At Uppingham, three months' temporary exemption was granted to G. S. Manton (Grade 3), electrician at Uppingham School.

At Tonbridge, on September 10th, six months' exemption was conceded to S. Spencer (38), electrical engineer.

At Chelmsford, the Commandant at Haskard's Auxiliary Hospital, Ingatestone, appealed for the retention of E. W. Hynds (47, Grade 1), the only man capable of running the electric light plant. Captain D. S. Smith intimated that if exemption was granted to a Grade 1 man he would have to appeal. The Commandant remarked that if the Government was stupid enough to take the only man she would have to close the hospital, and she should tell the authorities the reason. The Chairman (Mr. H. G. N. Coynbeare, J.P.): You can get another man. The Commandant replied that it would be the most difficult thing in the world to replace him. The appeal was refused, with six weeks' grace, the man to be re-graded in the meantime with a view to exemption being given if the grade is lowered.

At Enfield, exemption was claimed for A. Williams (19, Grade 1), a skilled glass-bulb blower engaged at the works of the Edison Swan Electric Co., Ltd. Mr. A. Hart pointed out that it was well known that men in that particular occupation—even men from the Guards—were being brought back from France, and replaced in this special industry. Col. Bowles said that they should ventilate their view against the disturbing and taking away from work of such men as applicant. It was notorious that glass-blowers were very badly wanted. The National Service Representative remarked that the man had the red protection card, and that he would retain until he joined the Colours, or he would have nothing to produce to show why he was out of the Army. It transpired that applicant's position came within a Royal Proclamation of last June withdrawing all certificates of exemption on occupational grounds in the case of men up to 23 years of age. Colonel Bowles expressed the hope that the National Service Representative would take some notice of that kind of case, especially as they knew that skilled glass workers were very scarce, and applicant was now doing more valuable work than he would be doing in the Army. The Tribunal decided that it had no power to entertain the application.

At Canterbury, the Corporation applied for additional exemption for W. Strand (41) and E. Roberts (40, Grade 1), stokers at the dust destructor. The electrical engineer (Mr. Blascheck) said that the work was very hard, and he doubted whether a Grade 3 man or a discharged soldier could do it. Incompetent men would not effect any economy of fuel, so important to-day. These men were able to get more steam from coal for generating electricity, and so effected saving both in coal and time. Each was granted six months' exemption.

Barnstaple Tribunal has granted temporary exemption to December 1st to F. Bickford (30, Grade 3), electrical engineer and contractor, who said that he kept in repair more than three-fourths of the electrical power plants in the borough.

The Eccles (Lancs.) Tribunal has given exemption until the end of February to the electrical engineer at Barton workhouse (46, Grade 2).

LEGAL.

War Worker's Bonus.

In the City of London Court, on Tuesday, before his Honour Judge Atherley-Jones, K.C., the Western Union Telegraph Co., 22, Great Winchester Street, E.C., sued one of its former electricians, named F. Pinkerton, Sydenham, to recover £12 18s. 10d., a month's wages in lieu of notice. Mr. Cassie Holden, plaintiffs' counsel, said that the claim was brought as a question of principle, as it involved one of national importance. The plaintiffs were carrying out work of extreme national importance, as was recognised by the Ministry of National Service. To a large extent their work dealt with Government cables and important commercial work. The claim was made to establish the right of the company to compensation for the injury done to it by the defendant leaving without notice. If a cook left nowadays one telephoned to the Labour Exchange and got a substitute at three times the wages, but there were no men to take the defendant's place, and the rest of the staff were working at very high pressure. The rule of the service was a month's notice on either side. The company did not want to be vindictive, and it had not acted harshly. Defendant entered the service in 1909. He was 31 years of age, and was originally a junior electrician, but since then had been a wireless operator on the cable steamship *Lord Kelvin*. The company recognised the greatly increased cost of living amongst their employés, and it commenced to pay war bonuses in 1915. There were three systems in all, and they overlapped. One was paid half-yearly and was deferred, and the others were monthly. But the payments were gratuitous, and were not pensionable. Plaintiffs' assistant traffic manager, Paulin, was asked on June 21st to release defendant as from July 1st, and defendant asked if he could have his bonus, although it was not technically due if he resigned before July 1st. That was objected to, but the defendant had "downed tools," and left on June 29th, much to plaintiffs' inconvenience. His salary was paid on June 29th, as well as the bonus due on July 1st. He did not come again, and plaintiffs now demanded a month's salary as defendant gave no proper notice. Defendant was now suggesting that as there was a bonus in plaintiffs' hands, payment of which was deferred until next January, they had that as compensation for him leaving without notice. But that was not so, as defendant had forfeited it. Defendant said plaintiffs agreed to him going on June 29th as he had a better situation, and there was no contract with the plaintiffs for a month's notice. He could not live on the £150 a year and bonus, and the work was very hard. Judge Atherley-Jones said that the plaintiffs had behaved with great fairness to the defendant, but Paulin had given them away as he had waived the notice. There was an obligation on the defendant to give a month's notice, but it was waived. Judgment for the defendant, without costs. It would have been very difficult for the plaintiffs to have proved the amount of their damage.

Lighting Regulations Infringed.

According to a local paper, at the Bristol Police Court, Albert Edward Maggs, of Clifton, was fined £3 for using electric light for the purpose of advertisement or display when the premises were closed for customers. Defendant did not appear. It was pointed out that this was the first prosecution taken in Bristol. Superintendent Hazell said that the object of the Order was to economise light in every respect.

E.T.U.—We are informed that at a mass meeting of station engineers of the E.T.U., a resolution was passed agreeing that for the next month new candidates be admitted to membership of the Station Engineers' Section at the nominal entrance fee, and that after that date substantial increases be made.

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CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Wanted: A Book.

Your leaderette on the above subject in the issue of September 6th appeals to me very strongly, as on examining 300 books in our library, I cannot find any that really give lucid data of faults from the erector's point of view, and a series of books such as you suggest would be a very valuable addition to our library.

This Society has endeavoured since its foundation in March, 1914, to improve the efficiency of its members by arranging a series of technical papers each season, and I venture to suggest that the papers read and the debates which followed have been educational to both members and visitors.

Three useful papers on A.C. motors, two on D.C. motors, and many other subjects form a valuable asset for reference. Our members, however, are desirous during the ensuing season of hearing a paper on A.C. work on the lines you suggest—viz., from the erector's point of view.

I shall be glad to learn if any one of your subscribers is willing to read a paper on these lines before the Society; he would confer a benefit on our members, who comprise managers, supervisors, and foremen in the electrical trade, and such a paper might very well form part of a series of books such as you recommend.

I shall be glad to fix a suitable date and give all possible assistance to any prospective author.

Papers on electric welding, furnaces, and overhead work would be welcome.

Chas. J. Banister,
Hon. Secretary, National Association of Supervising Electricians.
50, Chipstead Street, Parsons Green, S.W.,
September 16th, 1918.

BUSINESS NOTES.

Merton's.—It was announced in the daily Press that a meeting of MESSRS. HENRY R. MERTON & CO., LTD., was to be held this week to consider a proposal to place the company in voluntary liquidation. It has since been reported that the meeting was held on Tuesday, but that no statement would be issued as the business was purely private and did not concern anyone but the shareholders. The *Financial Times* remarks that just over two years ago the £300,000 of shares formerly held by German firms were transferred to British subjects.

Increased Capital.—BOLCKOW, VAUGHAN & CO., LTD. are about to increase their share capital by £1,000,000 to £5,000,000.

Liquidations.—TELEPHONE DEVELOPMENT CO., LTD.—Meeting October 16th, 22-28, Broad Street Avenue, E.C. 2, to hear an account of the winding up from the liquidators, Messrs. J. E Kingsbury and A. Anns.

BRAZILIAN STREET RAILWAY CO., LTD.—Meeting October 17th at River Plate House, E.C., to hear an account of the winding up from the liquidator, Mr. H. Tattam.

UNITED VACUUM CLEANER CO., LTD.—This company is winding up voluntarily, with Mr. F. G. Fuke as liquidator.

Book Notices.—"Science Abstracts." Sections A and B Vol. XXI. Part VIII. August 31st, 1918. London: E. & F. N Spon, Ltd. Price 1s. 6d. net each.

"*Proceedings* of the Incorporated Municipal Electrical Association for 1918." London: Wyman & Sons, Ltd. Price 5s.

Beama Journal (Spanish edition). Vol. II. No. 3. September, 1918. London: King's House, Kingsway, W.C.

"Adelaide Municipal Tramways." Pp, 13, figs. 23. A full illustrated description of the undertaking, reprinted from the *Tramway and Railway World*. Vol. XLIII. June 13th, 1918.

"Incandescent Electric Lamp Handbook."—We have received from the BRITISH THOMSON-HOUSTON CO., LTD., a new edition of their excellent little handbook on standard incandescent electric lamps, called "Handbook No. 1A." The widespread demand for the first lamp handbook issued has caused the company to issue this second edition, giving the latest revised Association sale rules, terms and conditions, on incandescent electric lamps. The opportunity has been taken to make this edition a more complete one in respect of the definitions and terms used in the lamp trade and lighting industry. It contains an interesting and informing article on the "Lumen," the new unit of light-rating for electric lamps, and its method of application in solving illumination problems. There is also a very complete list of photometric units, standards, and definitions, setting forth the new units of illuminating engineering, and clearly defining and describing each. These new units of illuminating engineering should be familiar to all electrical engineers and contractors, as they are likely to become definite units of the lighting industry, just as the electrical units have become known to, and used by, the electrical trade. This handbook is issued for the use of the electrical trade and electrical engineers, and copies can be obtained from the Lamp and Wiring Supplies Department, at Mazda House, 77, Upper Thames Street, London, E.C. 4.

The Banks and Industrial Restoration After the War.—At the meeting of the London City and Midland Bank called to approve the agreement for the amalgamation with the London Joint-Stock Bank, Sir Edward Holden, in the course of an exhaustive speech, which industrial students would do well to read, said that bankers were confronted with the problem of restoring the industries of the country after the war to the condition which they previously occupied. The concerns which had been converted from peace production into munition factories would have to be reconverted to their original condition. In the case of a number of those branches of industry which had continued in their pre-war occupation, such as those producing for home consumption and for export, the plant and machinery had been allowed to run down, and it would be necessary to renovate them and bring them up to date, and even to a better condition than before the war. Large sums of money would have to be found for the purchase of raw material, and large sums would also be required to improve the trade position generally. It was estimated that no less than 300 millions sterling would be required for these purposes, and credit would in some way have to be created for that amount. Large and powerful banks were indispensable for the purpose. The second reason why these amalgamations had taken place was that every effort should be made to retain London as the financial centre of the world. One of our principal competitors in the future would be Germany, and just as the Germans made great preparations for the war by increasing their armies and supplying themselves with large amounts of gold and munitions of war, so they were at the present time making their preparations for after-war trade. These preparations took the form not only of a continuation of the Darlehnskassen, but also of enlarging and strengthening their joint-stock banks by amalgamations and by the opening of new branches. As a result of their amalgamations, it was estimated that the Deutsche Bank at the present time had over 300 millions sterling of deposits, the Disconto-Gesellschaft over 200 millions, and the Dresdner over 170 millions, in addition to which it must be remembered that each of these three banks was affiliated with a number of smaller banks, over which they exercised direct control, and also a number of banks with which they were indirectly connected. For example, the Deutsche Bank was at the head of, and directly controlled, a banking group consisting of 25 banks with total deposits of about 450 millions, while the group of the Disconto-Gesellschaft was made up of 14 banks with total deposits of over 300 millions. The Dresdner Bank also had a number of affiliations. These were the three principal German banks with which they would have to compete, and to do so successfully they must meet them on a fair equality of size. By the amalgamations which had taken place in this country our banks had grown at the present time, excluding affiliations, to a magnitude measured by 300 millions of deposits in the case of this bank when this arrangement was completed, 243 millons for Lloyds Bank, 230 millions for the London County and Westminster and Parr's Bank, 212 millions for Barclays, and 176 millions for the National Provincial and Union Bank of England. The bankers had been determined, notwithstanding strenuous opposition, that it should not be alleged against them that they had not made full preparations for meeting the international trade competition which would arise after the war, and that they had not done everything in their power to retain London as the financial centre of the world.

The Pulvermacher Belt: New Zealand Prohibits Import.—The *New Zealand Gazette* of June 27th contains copy of an Order in Council of June 18th, 1918, prohibiting the importation into New Zealand of electric or galvanic apparatus known as Pulvermacher's Electrical Body Battery, Pulvermacher's Galvanic Dry Combined Bands, Pulvermacher's No. 34 Electro-galvanic Deafness Chain, and of any electric or galvanic apparatus vended by, or on account of, the Electrological Institute (J. L. Pulvermacher & Co., Ltd.), 56, Ludgate Hill, London, E.C., and of all written or printed advertising matter relating solely or principally to such apparatus.—*Board of Trade Journal.*

For Sale.—Tynemouth Corporation has for disposal one three-wire balancer booster set by Siemens Bros. Particulars are given in our advertisement pages to-day.

Falk, Stadelmann & Co., Ltd.—With reference to the letter in our "Correspondence" columns, last week, from the Cable-makers' Association, we are informed by Messrs. Falk, Stadelmann & Co., Ltd., that the paragraph reprinted from *John Bull* contains statements which are not in accordance with facts, and which should be corrected. The business was established in this country in 1881 (37 years ago), and was incorporated as a company in 1887. It has always been reputably connected with the lighting industry, and had made considerable efforts in fostering British industries, as reference to pre-war catalogues shows. The company is, and always has been, a private one, practically the whole of the capital having, from its inception, been held by British subjects. A small proportion (and that principally in preference shares, which have no control whatever in the affairs of the company) was originally held by an enemy subject. After the outbreak of the war, the company desired to extinguish this interest, and these shares were accordingly vested by the Board of Trade in the Public Trustee, and subsequently acquired by the company under the Trading with the Enemy Act (1916), so that not only is the company "All British," but also its entire capital. We understand that Messrs. Falk, Stadelmann and Co., Ltd., are willing to give any member of the trade, including Mr. L. B. Atkinson or any other members of the Cable-makers' Association, any information they may desire with regard to the constitution of their company.

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South African Trade Report.—The report of H.M. Trade Commissioner in South Africa for 1917 was published yesterday.

Trade Announcement.—Mr. Leslie Miller announces that owing to increased business he has removed to larger manufacturing premises at 70, Sanderstead Road, South Croydon, Surrey. Telephone: No. 2117 Croydon.

Catalogue.—The General Electric Co., Ltd., Queen Victoria Street, London, E.C. 4.—Catalogue of 28 pp. (X Section, 1918 edition), relating to high-tension switchgear. Illustrations, descriptive notes, tabulated details and prices, and dimension drawings, appear relating to oil-break switches and switch panels, truck type switchgear, tension limiters and lightning arresters, limiting resistances, choking coils, isolating links, underground switch-boxes, relays, static leakage detectors, &c.

Competition in China After the War.—In the course of a lengthy speech to the shareholders of the Pekin Syndicate, Ltd., in London, on Monday, the chairman, Mr. T. A. Barson, made the following interesting remarks on the question of after-the-war competition in China:—

"There will be keener competition than ever after the war. Japan, whose industrial progress has been particularly favoured by the European war, will naturally fight hard to retain her position. France, with her go-ahead policy, is making, and will continue to make, big strides in industrial enterprises. America—particularly during the war—has had glaring proof of the demands of China for machinery, and the chances of obtaining raw materials from her. German influence has been checked somewhat, but she will endeavour to renew her efforts more vigorously than ever after peace is declared. It is to be hoped that our Government is fully awake to the possibilities for British trade over there, and will do everything possible to help to secure for Great Britain a share of the business of this wonderful country. I am not trying to pose as a European expert on China. I oft-times doubt whether there is one in existence, but I have had some experience of the people and customs, and I assure you that to a European both are full of surprises. There is a lot of work still to be done, but the possibilities and prospects are great. . . . Trust on the part of the Chinese has taken the place of suspicion, and they are now as anxious to accept our help in the development of their country as we are pleased to offer it."

Lantern Slides.—The Liverpool Electrical Engineering Co., 18, Vauxhall Road, Liverpool, desires the loan of lantern slides connected with any branch of the electrical industry for use at the evening classes for the apprentices and junior members of the firm.

Messrs. E. Bennis & Co., Ltd., 28, Victoria Street, S.W. 1, have a large number of lantern slides dealing with development and present practice in connection with automatic stokers, coal elevators, conveyors, &c., for loan for lecture purposes.

Patents and Alien Enemies.—Application has been made to the Board of Trade by Messrs. William Suckling & Sons, Birmingham, to avoid or suspend Patent No. 26,436/07 granted to Bosch for sparking plugs.

LIGHTING AND POWER NOTES.

Aberdeen.—Threatened Strike.—At a mass meeting of Corporation employés in connection with the strike of certain sections of municipal workers, the employés of the gas and electricity departments notified the Corporation that, unless an agreement was arrived at within a reasonable time, they would also strike. The gas workers' strike would be in sympathy with the other departments, but the workers in the electricity department demand an increase of 3s. 9d. per week to bring their bonus on a level with the £1 per week granted to the gas workers in March last. The Council has intimated its willingness to grant this increase as from the date of the men's application, August 17th.

Aberystwyth.—Hydro-electric Scheme.—The T.C. has again referred the question of a hydro-electric scheme to the Public Works Committee for a report. Dr. Harries informed the Council that there would not be the slightest difficulty in getting 1,000 or 2,000 H.P. from the weir, without storage.

Ammanford.—Electricity Charges.—The owner of the electricity works, Mr. W. Herbert, has given notice to the Council that, unless the price paid to him for energy is advanced by 25 per cent. for private lighting, and by 50 per cent. for public lighting and power, he wishes to terminate the agreement. The Council has sought legal opinion as to Mr. Herbert's powers to increase meter rents by 500 per cent.

Aston-under-Lyne.—National Electricity Supply.—The T.C. has adopted a resolution of the E.S. Committee protesting against the embodiment in legislation of the recommendations of the terms of purchase by the State of generating stations and transmission lines, as recommended by the Electric Power Supply Committee (B. of T.), on the ground that the terms would penalise prudently-managed undertakings and place a premium on undertakings which have failed to create depreciation and reserve funds (Clause 56 B), and also against the recommendation to confiscate sinking funds and then to require municipal authorities to discharge their loan obligations (Clause 56 F). In the event of such a Bill being introduced, the Parliamentary Committee of the Council is to be instructed to rigorously oppose it.

Barnsley.—Electricity Supply.—The T.C. has requested the acting borough electrical engineer to prepare a special report on the cost of supplies of electricity to new consumers, and increased supplies to existing ones.

Bradford.—Mains Extensions.—The Electricity Committee has authorised the extension of the mains to Bowling Iron Works, at a cost of £204, and at New Cross Street, at a cost of £420, including transformer equipment.

Bury St. Edmunds.—Year's Working.—In his report for the past year, the borough electrical engineer states that the stand-by margin of plant is insufficient, and that after the war the works will probably be unable to meet the demand. He recommends that the mains be extended to the Northgate district without delay; with the necessary switchgear this is estimated to cost £2,500. The price at present paid for coal is 31s. per ton, against 26s. last year and 15s. in 1914. The income for the year amounted to £6,544, an increase of £1,669 over the previous year, and the expenditure to £4,604, against £3,828. Capital charges absorbed £2,208, leaving a debit balance of £268, compared with £1,037 in the previous year. Units sold numbered 361,197, against 291,507.

Coatbridge.—Valuation.—At the Coatbridge Valuation Court the Assessor agreed to a reduction of £202 on the Coatbridge and Airdrie E.S. Co.'s valuation.

Colchester.—Price Increase.—The E.S. Committee proposes to increase the charges for electricity by a further 10 per cent.

The Director of Army Contracts has informed the Council that the proposal to increase the price of electricity supplied by contract cannot be sanctioned; the Council is seeking the advice of the L.G.B. on the matter.

Continental.—Spain.—A concession has been granted for the utilisation of the water power of the river Cubillas, at Ablote (Province of Granada), for the generation of electricity.

Sweden.—The Myssjo-Oviken Kraft Aktiebolag is the name of a new company formed to establish an electricity undertaking at Kovra.

Darwen.—Year's Working.—There was a loss of £1,868 on the past year's working of the T.C. electricity undertaking.

Denby and Cumberworth.—Prov. Order.—The U.D.C. has decided not to oppose the application of the Electrical Distribution of Yorkshire, Ltd., for a prov. order to supply electricity within its area.

Derry.—Price Increase.—The Corporation has increased the charges for electricity by a further 15 per cent., making 40 per cent. over pre-war prices.

Dover.—Wages.—A demand of the Kent Division of the Workers' Union, that the war bonus of employés at the electricity works be increased to £1 per week, plus 12½ per cent., has been granted by the Corporation.

Dublin.—Proposed Curtailment of Supply.—Speaking at the Dublin Rotary Club, Mr. Lorcan Sherlock, T.C., who has been so long associated with the Corporation electricity supply undertaking, stated that he proposed submitting to the Corporation various suggestions for the curtailment of lighting facilities, private and public, including the taking of power supply during daylight hours where possible, and the cancellation of unnecessary trains and tramcars, while he would ask for a reduction of office fires and police inspection to discover coal hoarding. The Corporation, said Mr. Sherlock, did not wish to cut down any user of electricity by a single unit. It had fought a successful campaign to prevent the electricity undertaking passing into the hands of private individuals or companies, and it wanted to make the concern a paying one. He wanted support to enable the Corporation to secure increased supplies of coal—if necessary, from those who had stocks in large quantity—so that it might keep employed the industries controlled by the 1,300 motor concerns who were its customers. By cutting down the supply of electricity for lighting, the Corporation would be depriving itself of the customers who were the best payers—those who paid the largest price per unit. This policy was bound to result in a large deficit on the undertaking, and the charges for power would have to be increased, so that the loss might be reduced and no further burden be thrown on the general ratepayers. He added that whatever regulations operated in regard to electricity must also apply to gas. Mr. Kevin Kenny expressed the view that the Corporation's proposed arrangement with the promoters of the scheme for harnessing the Liffey at Lucan for electricity purposes might relieve the situation; but Mr. Sherlock said the Lucan scheme could not be put into operation this year, even if it were adopted.

The Pembroke (Dublin) Urban Council has decided on a reduction of the public electric lighting.

Dundalk.—Price Increase.—The U.D.C. has applied to the B. of T. for power to increase the maximum charges for electricity as follows:—Up to 20 units per quarter, from 13s. 4d. to 15s.; over 20, from 8d. per unit to 9d.

Folkestone.—Price Increase.—The Electricity Supply Co. has informed the T.C. that from the commencement of the September quarter the price of energy to the Corporation will be increased by ¼d. per unit, plus 15 per cent., in lieu of the previous advance of ¼d. per unit, plus 15 per cent.

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Halifax.—Early Closing.—A mass meeting of shopkeepers, recently addressed by Mr. W. M. Rogerson, borough electrical engineer, decided, with a view to economising lighting, that all shops should close at 7 p.m. on Fridays, 8 p.m. on Saturdays, and 6 p.m. on other week days.

Harrogate.—Public Lighting.—The T.C. has decided that all Corporation lights shall be extinguished throughout the winter before 10.30 p.m.; street lamps are to be lighted an hour later than last winter.

Hove.—Year's Working.—The past year's working of the Hove and Aldrington electricity undertakings, owned by the Hove T.C., resulted in a net profit of £1,380, against £745 in the previous year. Owing to the war there was great difficulty in effecting repairs during the year; four of the engines had to be entirely dismantled and re-erected, and as it was impossible to obtain new parts, old ones were used. Compared with the previous year, the cost of fuel increased by 6s. 9d. per ton.

Keighley.—Year's Working.—For the first time since 1911 the annual accounts of the Corporation Electricity Department show a loss, amounting to £591; in the previous year there was a profit of £223. A great deal of trouble was experienced during the year with all the turbo-generators, and for weeks together the continuity of supply depended upon one set. The trouble with the 5,000-kw. set has been located, and the old plant is now running better than at any time since its installation. The total capacity of the plant is now 10,000 kw. The gross revenue for the year was £33,560, compared with £28,622, whilst the expenditure amounted to £24,725, against £19,592. Capital charges amounted to £9,423, against £8,806. Units sold totalled 8,510,566, against 8,011,991, including private lighting, 489,472, against 250,216; public lighting, 26,450, against 22,300; power, 7,620,831, against 7,337,926; and traction, 373,543, against 401,549. The number of consumers increased from 710 to 747, and the maximum demand from 3,256 kw. to 3,703. The total works cost per unit was '69d., against '58d., and the over-all cost was '95d., against '84d.; the average price obtained increased from '85d. per unit to '92d.

Limavady.—Public Lighting.—The Town Hall, which has been without illumination since the closing down of the local gasworks last April, has now a complete electric light installation, and the U.D.C. is proceeding with the lighting of the streets with electricity.

Londonderry.—Price Increase.—The Corporation has increased the price of electricity by 15 per cent., making an advance of 40 per cent. since 1914.

Linthwaite.—Proposed E.L.—The U.D.C. has appointed a Committee to consider the relative cost of gas and electric lighting.

Penistone.—Mains Extensions.—The U.D.C. has given permission to the Yorkshire E.P. Co. to extend its mains to Stocksbridge, by means of overhead wires.

South Africa.—Johannesburg.—The Finance Committee has recommended an increase of 10 per cent. on the electricity accounts, which will return £20,000 per annum.

Cape Town.—A recent temporary failure in the supply of electricity in the suburban area was due to a rat causing a fault on the 11,000-volt switchgear at the central power station.

Sheffield.—Year's Working.—The total revenue of the Corporation E.S. department for the year ended March 25th last, amounted to £687,580, against £505,561 in the previous year, and the expenditure, including income-tax, to £416,883, against £292,046. Of the balance, interest absorbed £64,247, against £55,755, and sinking fund £71,107, against £62,265, leaving a credit balance of £133,372, against £95,494. These figures include the following amounts relating to the Installation and Motor Department:—Revenue, £47,923; expenditure, £44,393; capital charges, £1,223; profit, £2,306. Units sold were—for lighting, 8,371,532, against 7,311,245; public lighting, 8,861, against 2,767; power, 138,745,140, against 94,899,504; heating, 1,763,214, against 1,443,659; and traction, 23,562,260, against 22,819,683; total, 172,451,007, against 126,476,858. The number of consumers increased from 7,556 to 7,722, and the maximum demand from 46,493 k.v.a. to 57,338. The capacity of the station is now 68,225 kw. The renewals fund stands at £338,644. The cost per unit sold was '7d., against '68d., and included fuel and removal of ashes, '34d.; other generating expenses, '09d.; distribution, '08d.; and capital charges, '19d. The average prices obtained were:—Lighting and heating, 2·32d.; power, '79d.; total average price, '88d.

Price Increase.—From the September meter readings, electricity supplied by the Corporation at 2d. per unit and under is to be subject to an increase of 45 per cent., in lieu of the present increase of 33⅓ per cent.

Southport.—Control of Electricity Department.—At a meeting of the T.C., on the 10th inst., a motion was put forward for the control of the gas and electricity departments to be under one committee, in order to avoid competition.

Wages.—A letter from the E.P.E.A., asking for the 12½ per cent. bonus to be granted to the technical staff, was adjourned for further information.

Thirsk.—Public Lighting.—The Parish Council has agreed to accept the tender of the Electric Lighting Co. to light 29 street lamps at £2 3s. 3d. per lamp per annum, an increase of 8s. 3d. over the previous year.

United States.—Fuel Economy.—The New York *Times* states that the Fuel Administration announces that records show that a saving of over 60,000 kw.-hours (equal to 100 tons of coal) was made on the first of the "lightless nights" in the borough of Manhattan. The figures, it is stated, indicate a coal economy through the "lightless nights" of 40,000 tons a year in Manhattan alone. The national saving is estimated at "more than 1,000,000 tons of coal a year."

Walsall.—Year's Working.—The year ending March 31st last resulted in a loss of £3,999 on the Corporation electricity department, compared with a deficiency of £8,988 in the previous year.

Walton-on-Thames.—Price Increase.—The Council has decided to protest to the L.G.B. against the proposal of the Urban Electric Supply Co. to advance the price for electricity from 7d. to 8d. per unit.

Warrington.—Extension.—The Corporation has received the consent of the Warrington R.D.C. to supply electricity to the works of W. Mortimer & Co., which are in the area of the R.D.C.

Wishaw.—Year's Working.—The T.C. electricity undertaking showed a profit of £1,047 for the past year, against a loss of £242 in the preceding year.

Winchester.—Price Increase.—The T.C. has increased the price of electricity for all purposes by a further 15 per cent. from the end of the September quarter, making a total increase of 40 per cent. over pre-war rates.

Wolverhampton.—Year's Working.—For the past year the revenue of the Corporation electricity department amounted to £121,112, against £76,744 in the previous year. The gross profit was £17,242, but after meeting capital charges (interest, £9,290; repayment of capital, £15,493; and income-tax, £1,583) there was a debit balance of £9,124. The reserve fund increased from £14,944 to £19,565. The cost of fuel increased from £28,930 to £67,589, and wages increased by £10,018. The number of units sold for power purposes advanced from 13,222,504 to 28,144,937.

TRAMWAY AND RAILWAY NOTES.

Blackburn.—Year's Working.—The annual report states that there was a profit of £6,971 on the Corporation tramway undertaking for the past year.

Continental.—Italy.—The *Pall Mall Gazette* states that a group of English steel manufacturers has offered to provide the rolling stock and material for a projected tramway to connect Rome and Ostria.

Dublin.—Goods Traffic on Tramways.—At a meeting of the Irish Sub-Committee appointed to inquire into matters relating to inland transport, Mr. Dockrell, of the Dublin Industrial Development Association, expressed the opinion that better use should be made of the tramways, which should be linked up with the docks, and distribute goods through the city. The tramways already carried and delivered parcels very efficiently, and also carried gravel from Howth to the outlying suburbs. Motor lorries would do very well for parcels but tramways would be much better for loads of from 10 to 20 tons. The chairman of the Port and Docks Board said that, with so many concerns generating electricity in Dublin, it was impossible to get cheap power; energy could be obtained at half the price from one central station. He also suggested that a tunnel should be constructed under the Liffey.

Leeds.—Proposed Extensions.—The Tramway Committee is considering several schemes for tramway extensions in connection with the proposed development of the garden suburbs. The Committee last week inspected the Middleton housing scheme, the connection of which with the existing system will involve the building of 4 miles of new track. Schemes for extensions to Hawkerworth Wood, Roundhay, and other places are also before the Committee. It is probable that a high-speed system, up to 30 miles an hour, will be adopted.

Liverpool.—Referring to the overcrowding of the tramways, it was stated at a meeting of the Tramways Committee that, provided materials and labour could be obtained, 100 cars at present unused could be put into service.

London.—Wages.—The offer of the Railways Executive of 4s. per week advance to adult employés, and 2s. per week to those under 18, has been rejected by the N.U.R.

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Otley.—Fares.—After repeated protests against the increased fares on the Guiseley-Otley-Burnley railless-traction section of the Leeds Corporation tramways, the Otley U.D.C. has referred the matter to the B. of T.

Thornaby.—Proposed Purchase.—The Tramways Committee has recommended the T.C. to join with Stockton in the purchase of the Stockton and Thornaby tramway undertaking, subject to the division of the cost being based upon the population.

United States.—Tramway Rates.—Executives representing practically every important tramway system in the U.S.A. met in New York in August, says the *Railway News*, to consider the action of the National War Labour Board in increasing by an average of some 40 per cent. the wages paid to tramway employés in connection with the necessity for increased fares. A member of the Association's War Board presented a statement which indicated that unless relief was afforded in some way, the increase in wages awarded would bring the tramways to the verge of bankruptcy. The statistics showed that in 1916 the net income of the 1,260 tramways in the United States amounted to about $70,000,000, with a gross income of $672,000,000. For 1917 the net income had decreased to $35,000,000, and statistics of the 154 represented companies showed a decrease in net income for the first three months of 1918 of 94 per cent. The awards of the National War Labour Board, if applied generally throughout the country, would mean an increase of $100,000,000 a year in the pay-rolls of the companies—sufficient to wipe out the entire net income and to absorb over 50 per cent. of the money now paid for fixed charges. In this connection a referendum vote was cast in the city of Buffalo. The tramway company had recently raised the wages of its employés by 25 per cent., with a further advance promised, and the City Council had passed an ordinance authorising an increase of fares from 5 to 6 cents. Without such added revenues, it was said, the company would have to be placed in the hands of a receiver. But under the new Buffalo charter the proposed alteration in the terms of the tramway franchise had to be submitted to the voters, who rejected it.

TELEGRAPH AND TELEPHONE NOTES.

Telegraph Operators' Wages.—The National Joint Committee of Postal Telegraph Workers in the British Isles held a Conference at Matlock on Friday and Saturday, last week. Twenty delegates, representing 120,000 workers, attended. The chief business of the Conference was the question whether the workers should put forward a new claim for better wages for all postal telegraph employés in the country. It was decided to do this, in co-operation with the Association representing the Civil Services. The principle of equal payment for men and women was adopted.

U.S.A.-Japan.—It is reported in the *Evening News* that a new high-power wireless system is to be established between Japan and the United States. The present Japanese high-power wireless station communicates direct with Hawaii. The proposed station will work with another on the Pacific coast, and this will constitute one of the longest direct wireless services in the world. Its cost will be £80,000.

CONTRACTS OPEN AND CLOSED.

OPEN.

Manchester.—September 23rd. B. of G. Six months' supply of electric lamps. J. MacDonald, Clerk to Guardians, All Saints.

Spain.—The municipal authorities of Puente Genil (Province of Cordoba) have lately invited tenders for the concession for the electric lighting of the town during a period of ten years.

Stockton-on-Tees.—September 20th. Corporation Gas and Electricity Committees. Stores for six months. See "Official Notices" September 13th.

CLOSED.

Barnsley.—T.C. :—

Callender's Cable Co., Ltd.—E.H.T. main, £2,672.
Babcock & Wilcox, Ltd.—Draught fan for boiler, £294.
Stewarts & Lloyds, Ltd.—Steel steam pipes, £110.

Bradford.—Electricity Committee :—

Goodall, Clayton & Co., Ltd., Leeds.—Two sets of steel work for reinforcing foundations at Valley Road generating station, for Nos. 5 and 6 turbo-generators.
John Fenton & Sons, Ltd., Batley.—Purchase of the disused No. 15 slow-speed set at Valley Road.

Glasgow.—Tramways Committee. Recommended tenders :

Brake blocks.—Carron Co.
Trolley wire.—Thomas Bolton & Sons, Ltd.
Lead-covered cable.—B. I. & Helsby Cables, Ltd.
Pitch.—Robinson & Hunter.

FORTHCOMING EVENTS.

Industrial Reconstruction Council.—Tuesday, September 24th. At 6 p.m. At the Institute of Journalists, 2 & 4, Tudor Street, E.C. Conference on "Trade Boards," to be opened by Mr. J. J. Mallon.

Municipal Tramways Association (Inc.).—Thursday, September 26th. At 11 a.m. At the Town Hall, Leicester. Presidential address by Alderman S. Flint, and paper on "Some Considerations on the Post-war Position of Electric Power Supply," by Mr. E. Hatton. Annual general meeting.
Friday, September 27th. At 11 a.m. Annual general meeting resumed.

Junior Institution of Engineers.—Friday, September 27th. At 7.30 p.m. At 39, Victoria Street, S.W. Lecture on "The Most Important Piece of Machinery in the World," by Mr. P. Marshall.

NOTES.

Coal and Iron in Ireland.—At a meeting of the Irish Sub-Committee of the Parliamentary Committee on Irish Transport, held in Dublin last week, Mr. William Tatlow, B.E., representing the Arigna Coal Mining Co., Co. Roscommon, said that his company was engaged in exploiting the minerals in the Arigna Valley, to the west of Lough Allen. Coal, iron ore, fireclay, and flagstones were the minerals they produced. Coal and flagstones, for the moment, were the chief productions. Iron ore and fireclay could not be worked owing to want of transport. A railway was being constructed to connect the coal mines with the Cavan and Leitrim Railway. The iron ore and fireclay could only be developed through the waterways of the Shannon. The output of coal had increased from 82 to 120 tons per day, and there would be a further increase when the connecting railway got into operation. The largest quantity of coal produced in one year was 12,000 tons. There were about 18,000,000 to 20,000,000 tons of coal in the locality.

Foreign Trade.—The August Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures :—

	August, 1918.	*Inc. or dec.*	8 *months*, 1918. *Inc. or dec.*
Imports.			
Electrical goods ...	66,924	— 30,394	— 207,731
Machinery	924,100	+106,190	+ 1,883,046
Exports.			
Electrical goods ...	166,031	— 91,141	— 749,490
Machinery	1,364,988	—279,363	— 2,716,787

An Australian Magneto.—The Australian mail brings the news that Mr. A. T. Kwajel, of Melbourne, has devised an improved form of ignition magneto. While following Bosch practice, the machine is stated to be notable in the reduction of the number of moving parts, one brush replacing six on the Bosch; other features are a new type of armature and the ability of the machine to give a strong spark at low speeds.

Disintegration of Copper-Aluminium Alloy.—A case of disintegration of a copper-aluminium alloy was recently described by Messrs. R. Seligman and P. Williams before the Institute of Metals. A large consignment of scrap aluminium wire netting was recently received for re-melting. The bulk of this wire was in a normal state, but interspersed with it were a number of wire frames which showed unusual signs of disintegration. The surface of the wire seemed to have broken up into a number of loosely adhering grains up to 10 mm. in length uniformly inclined to the axis of the wire. On removing the loose grains a solid core of wire was disclosed, which was found by analysis to contain :—Silicon, 0·33 per cent.; iron, 0·30 per cent.; copper, 2·65 per cent. It is considered that this may be taken to have been the composition of the original wire. A sample of the other wire which had not suffered disintegration gave the following figures, which are believed to be substantially representative :—Silicon, 0·24 per cent.; iron, 0·22 per cent.; copper, 0·07 per cent. The wire had been used for a number of years solely for supporting thin slabs of gelatine, which are said to be free from all chemicals, with the exception of small quantities of hydrogen peroxide, and both the disintegrated and the unchanged wires had been used for the same purpose, and for about the same time. The disintegrated wire had apparently been very severely overdrawn, the core breaking readily when bent at right angles. On annealing, the ductility of the core was restored, showing that its brittleness was not due to disintegration. The unchanged wire was soft. The grains were coated with a grey substance, presumably alumina, but when washed with concentrated nitric acid the coating was largely removed, and the metallic surface of the grains was exposed. Under magnification of 30 diameters it was evident that the grains were composite, and on warming them with dilute nitric acid they were further resolved into what were in all probability the ultimate grains, the largest of which was about 0·1 mm. long. In the present instance two causes have probably contributed to the disintegration—namely, the excessive work put upon the wire in the first instance, and the copper with which it was, no doubt unintentionally, alloyed. By analysis it was established that there was a very definite difference between the copper content of the grains which had been warmed with dilute nitric acid and of the unchanged core, but that the grains were far from being pure aluminium. The copper content of the grains was found to be 2·49 per cent., and that of the core of unaltered wire 2·65 per cent.

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Annealing Cold-Rolled Aluminium Sheet.—Mr. R. J. Anderson's paper, read before the Institute of Metals last week, answers the inquiry, may not cold-rolled aluminium sheet be softened by relatively short annealing exposures at the same or somewhat more elevated temperatures. It is shown that the lighter gauges of cold-rolled aluminium sheet can be softened by such an abbreviated exposure as three minutes at 400 deg. C. The tests in the mill with aluminium annealed by short-time exposures to heat, demonstrated that metal so treated fulfils the draw-press requirements, and that the percentage of defective shapes was smaller than with similar metal annealed by an exposure for, say, 24 hours at 370 deg. C. The experiments were made upon aluminium of the following analysis: copper, 0.25 per cent.; iron, 0.45 per cent.; manganese, trace; silicon, 0.35 per cent.; aluminium by difference, 98.95 per cent. The samples were exposed to various temperatures and for various lengths of time, the annealing being done in a small electric furnace of the resistance type. Temperatures were measured with the Northrup Pyrovolter, using base metal couples which had previously been calibrated by the usual methods. The samples were annealed by placing them in the already heated furnace, allowing them to remain for the required time, and then withdrawing them so that they cooled in air. Not over five samples were annealed at a time, and the individual pieces were separated by small pieces of light-gauge aluminium sheet, so that free access of heat could obtain in all parts of a pile. Conditions were maintained as nearly alike as possible, and all samples had identical treatment other than for the variable factors of time and temperature. The samples were considered to be softened when the Shore hardness number was 4-5, and indentation values, secured with the Erichsen apparatus, served as a guide to their drawing qualities. From the present results, it appears that the tendency toward blistering increases with the increased thinness of the sheets; however, for the times and temperatures employed, visual examination showed that the blistering was not so severe, except in a few cases, as to ruin the sheets. What blistering did occur was usually very slight, and required careful examination to observe it. The formation of blisters also seems to be associated with the higher temperatures, *i.e.*, the tendency increases with more elevated temperatures. Annealing tests made in an oxygenated atmosphere, obtained by leading tank oxygen into the furnace, showed that this condition of the furnace atmosphere did not influence the formation of blisters. Tests in a reducing atmosphere were not performed. While conclusive evidence is not at hand, blisters appear to be associated with the escape of occluded gases from the metal on heating, and it has been observed that blisters invariably form at or near the position of occluded dross in the sheets. It has been observed that if the anhealing is effected by an exposure of, say, 24 hours at about 370 deg. C., that a heavy percentage of defective shapes results from the draw-press operation. In an observed instance on a large number of drawn blanks (4,400) this was 30 per cent. In order to test the effectiveness of short annealing, 200 cold-rolled No. 22-gauge circles were annealed for three minutes at 475 deg. C. and drawn in a typical draw-press operation into a given shape; there was but one defective shape resulting from rupture in the press, or a scrap loss of 0.5 per cent. Other tests made on various gauges of sheet which had been annealed for relatively short times, ranging from five to sixty minutes, gave scrap losses of less than 1.0 per cent. in all cases. The author urges investigators to consider the possibilities of abbreviated exposures at various temperatures as being able to confer workable properties upon the metal, and concomittantly to effect this with less fuel, in shorter time, and with a smaller percentage of defectives in the subsequent drawing.

The Effect of Progressive Cold Work upon the Tensile Properties of Pure Copper.—In this paper, presented to the Institute of Metals last week, Mr. W. E. Alkins gives an account of an inquiry into the change in tensile strength of copper in the form of wire as it is progressively hardened by cold drawing in the ordinary way. Earlier experiments have been carried out by Messrs. Thomas Bolton* and D. R. Pye.

While the experimental results give a smooth curve for the tensile strength against diameter or sectional area, they at the same time show conclusively that the effect of a certain amount of cold work at any stage is intimately connected with the previous history of the metal. Thus, there is one stage in the drawing at which a reduction of area of almost 10 per cent. (from 0.372 in. to 0.348 in. diameter) is accompanied by no change in tensile strength.

It appears that in the drawing of copper the phenomena which present themselves are not of that simple nature which the amorphous theory would lead us to expect. That theory regards the process as continuous, in that further cold work always produces more amorphous material and gives therefore increased hardness. Yet it is shown that over a limited range reduction in area by cold work is accompanied by no change in tensile strength—and of this the amorphous theory, as at present interpreted, offers no explanation. It appears legitimate, in the absence of quantitative data, to assume that the amount of cold work actually performed on a metal during drawing is measured by the decrease in cross-sectional area; granting this assumption, it is concluded that two distinct changes occur during the hard-drawing of copper which do not occur simultaneously. Some further evidence in support of this view has been obtained, and will be brought forward later. The variation of several other physical properties of the metal as it was drawn down was investigated, and such varied properties as density, elongation—both general and at fracture—scleroscope hardness, and so on, were all found to change in a similar way to tensile strength. Thus, for example, the density becomes constant over a limited range at 8.889, which corresponds to the specific volume 0.11251, the values for the annealed bolt being 8.9165 and 0.11214 respectively. In the case of every property investigated analogous results were obtained. It is intended that a full account of this and of further work shall form the subject of a subsequent paper. As a tentative explanation of the results recorded, it is suggested that: When copper is subjected to cold work by drawing through dies, the first change which occurs is allotropic in nature; after this change is complete, *i.e.*, presumably, when the whole of the metal has undergonne transformation, a second change sets in, which may be regarded either as allotropic or as explicable on the lines of the amorphous theory; of the two possibilities, the latter appears to be the more probable.

Further experiments now in hand will perhaps throw more light on the whole question of the applicability or otherwise of the views of Cohen to the phenomena under investigation. It should be borne in mind that there is no experimental proof that an allotropic change *precedes* the formation of amorphous metal; apparently the changes might occur in the reverse order, though this would involve the transformation of amorphous into crystalline metal by the action of cold work. In this connection it is worthy of note that amorphous copper itself must be regarded as an allotropic modification, and therefore to assume the amorphous theory of the hardening of metals is to postulate the occurrence of allotropy amongst the metals. The effect of progressive cold-drawing upon pure copper resolves itself into two distinct phenomena, which may perhaps best be regarded as an allotropic change followed by a second transformation, probably to be explained on the lines of the amorphous theory.

* Elec. Rev., January, 1907.

Possibilities with Higher Steam Pressures.—In an article in the *Electrical World* of July 13th, Mr. Eskil Berg states that with steam at 800 lb. pressure and 800 deg. F., 1 KW.-hour could be produced on 11,750 B.TH.U.; also that sufficient superheat only to reduce the condensation in the turbine to a practicable minimum was found advisable. The practical gain by superheat was about 2½ times as great as the theoretical. By far the most important loss was that due to friction in nozzles and blades and windage loss of disks and blades. It was this loss that was reduced by the use of superheat. The use of a 200-deg. superheat would reduce the friction and windage loss about one-quarter.

High steam pressure with no superheat had the disadvantage of producing more moisture through the turbine. It was therefore advisable to combine high pressure with superheat so as to produce a more efficient turbine.

With steam pressure of 200 lb. gauge, 150 deg. superheat (temperature of 538 deg.), and a vacuum of 28.5 in., the present practice of turbine plants in America, the ratio of maximum available heat for work to the total heat was only about 31.25 per cent. In Europe, however, steam temperatures as high as 700 deg. Fahr. were now used (corresponding to a steam pressure of 500 lb. and 233 deg. superheat), so the ratio of available heat was about 36.3 per cent. This permitted a fuel saving of 16 per cent., compared with conditions in America.

Turbine generator sets were now built having an over-all efficiency of more than 80 per cent., including generator losses, which, with a boiler efficiency of 80 per cent., would give an efficiency from fuel amounting to $36.3 \times 0.80 \times 0.80 = 23.25$ per cent. Since 1 KW.-hour = 3,412 B.TH.U., the B.TH.U. required to produce 1 KW.-hour at the switchboard = $3,412 \div 0.2325 = 14,675$. On the other hand, if 800 lb. pressure and 800 deg. temperature were used, the efficiency would be 38.75 per cent., and with a boiler efficiency of 88 per cent. (obtainable with liquid fuel, forced draught and preheated combustion air) a kilowatt-hour could be obtained on $38.75 \times 0.88 \times 0.85 = 29$ per cent., or $3,412 \div 0.29 = 11,750$ B.TH.U. This was equivalent to $11,750 \div 19,000 = 0.62$ lb. of fuel oil per kilowatt-hour.

Diesel-engine advocates now claimed about 0.55 lb. of fuel oil per kilowatt-hour, but this was obtained only with a fuel about 50 per cent. higher in price than that which could be satisfactorily burned under a boiler. When full advantage had been taken of the various processes that were used in transforming the energy of the fuel into mechanical energy through the medium of steam, the steam process compared quite favourably with results obtained at the present time with internal-combustion engines.

In a discussion on this subject which took place at a joint meeting of the Western Society of Engineers and the Chicago sections of the American Society of Mechanical Engineers and the American Institute of Electrical Engineers lately, questions arose as to the practicability of obtaining piping and equipment that would withstand higher pressures and superheats, whether the increased cost of the equipment would keep pace with the gain in economy, the probability of higher radiation losses, the possibility of superheat high enough to give dry steam at the turbine exhaust, the possible advantages

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of resuperheating the steam for the lower stages with the waste heat from the boilers, and the interference of economisers in obtaining the theoretical advantages from higher pressures and superheat.

To show that the design of equipment for the higher pressures mentioned was not impracticable the author referred to the case of De Laval, in 1897, supplying all the electrical energy for lighting the Exposition of Arts and Industries in Stockholm with turbo-generating sets operated from boilers of his own design using over 1,500 lb. pressure. Of course the units were small, four being rated at 100 H.P. and two at 50 H.P. each.

To get dry steam at the exhaust in the average turbine would require excessive superheat. Enough superheat to reduce the moisture to 5 or 6 per cent. at the turbine exhaust was about the practical limit.

The author held that the cost of high-pressure equipment would be less than that of present equipment. This applied particularly to the boiler. Smaller tubes could be used, say, of 1-in. (2.54 cm.) diameter, and the boiler could be smaller, lighter and cheaper than boilers carrying the lower pressures of to-day. All auxiliaries would have to be redesigned, and it would probably be best to eliminate joints and weld the piping system solid.

There would be a little more moisture from condensation at the casing. The use of the flue gases for resuperheating the steam for the lower stages would necessitate splitting the turbine into two elements, so that the residual velocity would be lost, causing a drop of 5 or 6 per cent. in efficiency. It would also introduce undesirable complications. However, there might be a gain in using an oil-fired superheater for the purpose, allowing the gases to pass into the boiler.

A 45,000-KW. Compound Turbo-Generator.—An unusually well-illustrated description of a 45,000-KW. cross-compound reaction Westinghouse turbine recently put in commission at the South Street station of the Narragansett Electric Lighting Co., Providence, R.I., is given in *Power* of August 27th. The turbine is of the double-unit type, consisting of a high and low-pressure turbine, each connected through a flexible coupling to its own generator, having a capacity of 22,500 KW., and mounted on separate bedplates supported on foundations lying parallel to each other. The energy given up by the steam at full load is equally divided between the high and low-pressure turbines, the generators dividing the load in half; at lower loads a greater proportion is carried by the high-pressure element. The unit was designed to operate with a steam pressure at the throttle of 200 lb. with 100° F. superheat, and a vacuum of 29 in. at the exhaust, while the generators have a capacity of 23,750 K.V.A., 11,000 volts, three-phase, 60 cycles, at 0·95 power factor, the high-pressure element having a speed of 1,800 R.P.M. and the low-pressure 1,200 R.P.M. It is stated that the condenser equipment for this turbine consists of the largest condensing apparatus in the world. The unit is composed of two separate and distinct low-level jet condensers, which can be operated together or separately, if necessary.

Electric Welding in Shipbuilding.—It is stated in the daily Press that Lloyd's Register, having already approved one system of electric welding in shipbuilding, as recently announced in our pages, is now prepared to consider other similar applications from any electric welding companies, with a view to their processes being recognised by the Society, and to their names being added to a list of companies whose processes have been approved as fulfilling the Society's conditions.

The Whitley Report and State Service.—The recent Trade Union Congress at Derby carried by 2,374,000 votes to 753,000 a resolution calling upon the Government to apply the principles of the Whitley Report to all Departments of State service. The A.S.E. spokesman voiced the opposition of that organisation by saying that while the Whitley proposals were all very well for sections of industry which could only secure justice by Wages Boards and other forms of State interference, when they reached the stage where the organised workers by virtue of their own organisation were able to make a definite claim, and back it up, they did not need them. The Locomotive Engineers, through their representative, expressed a similar opinion. "They had had too much of the balancing power between employers and employed around a table. They wanted a little more of the ascendancy of Labour at the negotiation table, so that their claims should be granted. They wanted not conciliation but right and justice." The postal clerks, it seems, regard the Whitley scheme as a stepping-stone, affording them insight into the administrative side of the undertaking, so as to equip them better for successful democratic control. The shipbuilding industry was stated to have thrown over the report, and the carpenters and joiners also opposed it. The debate, as reported, seems to have limited itself practically to speeches in opposition to the motion; indeed, according to the *Times*, the whole discussion did not occupy more than 15 minutes.

The A.S.E. Amalgamation Proposals.—According to the *Daily Telegraph*, the proposals submitted by the Amalgamated Society of Engineers for the amalgamation of the Unions in engineering, shipbuilding, and cognate trades were further discussed at a Conference at York, last week. "The delegates, representing 13 Unions, unanimously adopted a resolution declaring themselves in favour of the principle of amalgamation, and appointed a Sub-Committee to draw up a scheme. It was stated that if the scheme for amalgamation succeeded, it would embrace nearly 600,000 members, and would thus become the most powerful union of skilled craftsmen in the United Kingdom."

Educational.—MUNICIPAL COLLEGE OF TECHNOLOGY, UNIVERSITY OF MANCHESTER.—We have received the prospectus of University courses for the coming session. Prof. Miles Walker is the head of the Department of Electrical Engineering, and Prof. G. G. Stoney of the Department of Mechanical Engineering. The Michaelmas term will commence on October 3rd, and students will be enrolled on September 30th and October 1st and 2nd. We have also received Vol. IX of "Technology," the record of investigations undertaken by members of the College, which was previously styled the "*Journal* of the School of Technology."

Electric Steel Production.—A recent development in the metallurgical industry which merits comment is the very great increase in the production of steel made by electric furnaces. According to Prof. H. C. H. Carpenter, F.R.S., of the Imperial College of Science and Technology, previously to the war the output was so small that it did not figure in any returns of steel production. Nevertheless, in 1917 no less than 110,000 tons of electric steel was made, of which 90,000 tons was in the form of ingots and 20,000 tons in castings. At the present time upwards of 50 furnaces are at work in the various Sheffield works.

Electric Steel Furnaces in the U.S.—Mr. H. C. DuBois, of the Chemical and Explosives Division of the U.S. War Industries Board, Washington, stated in a letter, says the *Iron and Coal Trades Review*, that at the present time the Board was discouraging anyone from starting new furnaces on electric steel, because the Steel Division of the Board had reported that its records showed that at the present time electric steel production was somewhat in excess of the demand and the electrode situation was critical. The Board could not encourage any further consumption of electrodes where the product made by the use of such electrodes was not of vital importance. Mr. Carl H. Booth, president of the Booth-Hall Co., in reply to this letter, sent a protest to the Steel Division of the War Industries Board, pointing out that only two months before, Mr. J. L. Replogle had made a public statement that the steel demands for building ships and the requirements of the Army and Navy were very great.

Appointments Vacant.—Shift engineer (73s. 6d.) for the Dewsbury Corporation Electricity Department; engineer-in-charge (£173) for the Tunbridge Wells Corporation Electricity Works. See our advertisement pages to-day.

Volunteer Notes.—LONDON ARMY TROOPS COMPANIES, VOLUNTEER ENGINEERS.—Headquarters: Balderton Street, Oxford Street, W. 1.

Corps Orders No. 39, by Lieut.-Colonel C. B. Clay, V.D., Commanding:—
Captain of the Week.—Capt. W. Darley Bentley.
Next for Duty.—Capt. E. G. Fleming.
Sunday, September 22nd.—Annual Musketry Course at Pirbright. Parade, Waterloo Station, 8.45 a.m. Dress: Drill Order, with rifles. Mid-day and tea rations to be carried.
Monday, September 23rd, to Saturday, September 28th.—Drills as usual.
Sunday, September 29th.—Commandant's Parade, Waterloo Station, 8.45 a.m., for work at Esher. Dress: Drill Order, without rifles. Mid-day and tea rations to be carried.

C. HIGGINS, *Capt.* R.E., *Adjutant.*

The Industrial Reconstruction Council.—The first annual general meeting of this Council was held on Tuesday at the Institute of Journalists, the chairman, Mr. E. J. P. Benn, C.B.E., presiding over a large gathering. In his *résumé* of the present year's work Mr. Benn remarked on the growth of public interest in the problems of industrial reconstruction after the war. It was the first topic discussed in all quarters and by all classes. He ventured to hope that it was in no small measure due to the efforts of the I.R.C. that the principle underlying the Whitley Report was now so widely accepted, and that everywhere our industries were awakening to the need for closer organisation. The I.R.C. held fast to its watchword of Industrial Self-Government, and by insisting on the only sane interpretation of that phrase, was, he thought, doing useful work in counteracting the dangerous revolutionary influences that were abroad. Mr. Benn gave a brief summary of the year's activities in the way of meetings, lectures, conferences, and the publication and distribution of literature, and made a strong appeal to those present to secure fresh adherents to the cause, and thus further the possibilities of future development. Lieut.-Col. E. Pottinger, D.S.O., organising secretary, in presenting the financial statement, announced that the autumn work in the provinces would largely consist in the establishment of Branch Reconstruction Associations, which should keep local interest and enthusiasm constantly stimulated in each industrial centre.

Lightning Explodes a Boiler.—In a letter to *Power*, Mr. A. W. Kirby describes how a steam boiler that was installed at a laundry at Baldwin City, Kan., was exploded by lightning. The boiler was of the marine type, and had been in service less than a year; it operated at less than 100 lb. pressure, although the safety valve furnished by the builders was set at 120 lb., and at times the pressure reached that point. At the time of the explosion the boiler was carrying 80 lb., and had about 3 in. of water in the glass. When the lightning struck the boiler house, the boiler immediately exploded, blowing out both ends of the building and throwing the boiler about 70 ft. from its original position. The boiler was mounted on wooden skids, and was not very well earthed, and so made a fair mark for lightning. The top of the safety valve was blown off, and the large flue was ruptured at the back seam, while some of the rivets were pulled through the sheet, and some sheared. Had it not been that two persons saw the lightning strike the boiler room, the cause of the explosion would have been doubted. There was a whistle above the roof, and it is said that the lightning struck this whistle first.

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Inquiry.—A correspondent wishes to get into touch with a British firm that is working the Schoop spraying process, especially in connection with the coating of cloth, &c.

Electric Heating Appliances in America.—The War Services Committee of the Electric Heating Appliance Manufacturers held a conference in Washington, last month, with the Priorities Committee of the War Industries Board, the object being to supply information and evidence to the latter Committee on the conservation of raw material, fuel, and labour in the manufacture, use, and sale of electric heating appliances. There are 190 manufacturers of such appliances in the United States, and the volume of business for 1917 amounted to $13,000,000. The electric heating-appliance work given a "Class A" priority by the Committee consists of ranges, ovens, and other cooking equipment, air and water heaters, soldering irons, glue pots, and electrically-heated clothing, &c., for use in the Army, Navy, hospitals, and munition works. The Priorities Commissioner asked the Committee to go through the industry and use freely the knife, and "cut right down to the quick" every appliance produced that was not essential, so as to reduce the consumption of raw materials.—*Electrical World.*

Coal From Peat.—Mr. Samuel C. Davidson, chairman of the well-known Sirocco Engineering Works, Belfast, has patented a method of treating peat and forming it into synthetic coal, which should in some measure meet the serious shortage in the Irish supply at the moment, and assist eventually the British supply. Mr. Davidson's method consists of putting back into the peat certain oils washed away from it owing to its proximity to the surface of the land, previously disintegrating it and mixing it with 15 per cent. of pitch dust. The pulp thus formed is subjected to hydraulic pressure, which turns out square blocks of fuel, which burn well. Many attempts have been made in Ireland to treat peat in a manner that would give it the approximate heating and lasting qualities of coal, but most of these were failures. Mr. Davidson's process is simple and comparatively cheap. Peat in Ireland is running up to the unheard-of price of £2 10s. per ton.

The New List of Certified Occupations.—As we receive from time to time questions from correspondents respecting their position under the Military Service Acts, we would recommend all who are in any doubt as to the age and medical grade at which they come under protection to secure a copy of the new List of Certified Occupations (R 136 Revised), which comes into force on September 26th. It can be obtained through any bookseller, or direct from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2, price 1d. It supersedes all previous lists of Certified Occupations. The conditions determining a claim to be in a certified occupation are stated, and it should be noted that no man employed in any of the certified occupations specified is covered unless he was employed in the same occupation (not necessarily by the same employer) on or before January 1st, 1918, and has been since so employed. If a man has not been examined and placed either in a medical grade or in a medical category he will be regarded as in Grade I. We select a few of the more directly electrical employments for quotation here:—Directing heads, managers, or departmental managers of businesses are certified if in Grade I or II, if born before 1875.

	Man certified if born in or before the year stated. Grade I.	Grade II.
MAINTENANCE AND REPAIRING STAFF:—		
Mechanic, Electrician or Electrical Fitter, Mill Joiner, Bricklayer, and other skilled men wholly or principally engaged in the maintenance or repair of their employers' plant, machinery, or tools	1884	1888
[For Electrician or Electrical Fitter engaged in the maintenance, running, or repair of motors and other electrical plant, in factories other than their employers', see under Electrical Engineering.]		
ENGINEERING WORKS AND FOUNDRIES engaged in manufacturing or repairing machinery or plant, or power-driven vehicles for use in trade or industry:—		
(a) Foreman	1882	1885
(b) Fitter; turner; erector; pattern maker; moulder or other skilled workman	1882	1885
**(c) All other classes of workmen	1874	1877
ELECTRICAL ENGINEERING:—		
(a) Foreman	1882	1888
(b) Turner; fitter; erector; electrician or other skilled workman	1882	1888
(c) Wireman	1880	1888
**(d) All other classes of workmen	1874	1877
LOCAL GOVERNMENT AUTHORITIES:—		
Officials on the Administrative or Technical Staffs (excepting those in trading undertakings carried on by Local Authorities, or in other classes mentioned elsewhere in the List)	1883	1885
ELECTRICAL GENERATING STATIONS, TRANSMISSION AND DISTRIBUTING MAINS AND LINES (including those for Tramway Undertakings and Electric Railways):—		
(a) Station engineer; shift engineer; sub-station attendant-in-charge	1890	1893
(b) Switchboard attendant; cable jointer; overhead lineman; electrical fitter (sub-stations); engineman; stoker	1888	1890
**(c) All other classes of workmen	1875	1877
RAILWAY SERVICE, INCLUDING WORKSHOPS AND SHEDS:—		
Man in respect of whom the Railway Company have furnished to the appropriate local officer of the Ministry of National Service a certificate stating that he is indispensable to the Company	1894	1894
BOILER INSURANCE COMPANIES:—		
Boiler, Machinery, or Electrical Inspector; Technical Office Staff	1888	1890

** To be within the certification, a man in Grade III must have been born on or before the year 1903.

Fatality. — Alexander Cameron, a Glasgow tramway motorman, was accidentally killed at Partick depôt at midnight on Saturday. According to a Press report, he had brought his car into the depôt, and the conductress, after reversing the trolley, had gone into the office with her cash. Cameron, observing that the trolley had jumped from the wire, left his platform to adjust it, but he had apparently left the controller on, and immediately the trolley touched the wire the car bounced forward, knocking him down. His body was almost severed in two by the wheels.

Carbide of Calcium in Germany.—It has just transpired that a large power station of a capacity of 25,000 KW. has been built at Kattowitz, Upper Silesia, during the course of the war, and is now in regular operation, together with plant for the production of 20,000 tons of carbide of calcium per annum. The combined undertaking has been carried out in connection with the utilisation of coal from the Prince Pless coal mining fields. The management of the latter has now entered into an agreement with the metal firm of Beer, Sonderheimer & Co., of Frankfort-on-Main, to form a company under the title of the Prinzengrube Power and Smelting Works Co. for the purpose of taking over the power station and carbide works, the share capital being £450,000 and the proposed loan capital £300,000. Each of the two parties to the agreement has acquired one half of the share capital, no banks having any participation, and the contract includes arrangements for the delivery of coal from the Pless mines.

Institution Notes.—Institution of Municipal Engineers.—On the occasion of the annual general meeting at Southall, Middlesex, on October 9th and 10th, a visit is to be paid to Messrs. Lowden's lamp works, where the complete manufacture of incandescent electric lamps will be seen.

Municipal Tramways Association (Inc.).—The annual meeting will be held at the Town Hall, Leicester, on September 20th and 27th. The Executive Council will meet at the Town Hall at 10 a.m., and there will be a reception by the Mayor of Leicester (Ald. North, J.P.), and the Leicester Tramways Committee, at 10.30 a.m., followed by the general meeting at 11 o'clock. Ald. S. Flint, J.P., chairman of the Leicester Tramways Committee, will deliver his presidential address, and Mr. E. Hatton (Newcastle-on-Tyne) will read a paper on "The Post-War Position of Electric Power Supply," the discussion being opened by Mr. J. M. McElroy (Manchester). The Mayor will give a luncheon at 1 p.m., and on the resumption of the meeting at 3 p.m. the report of the Executive Council on the formation of a National Joint Council for the Tramway Industry will be considered, a statement on the subject being made by Mr. McElroy.

On the following day the Executive Council will meet at 10, the Managers' Section at 10.30, and the business meeting of the Association will be resumed at 11 to receive the report of the Executive Council and the Treasurer's statement, and to elect officers. At 1 p.m. a luncheon, given by the President of the Association, Ald. S. Flint, will conclude the proceedings.

Electrical Power Engineers' Association.—A meeting will be held at the Terminus Hotel, Brighton Station Gates, Queen's Road, Brighton, on Monday, the 23rd inst., at 7 p.m., to discuss the formation of a South-Coast Branch of the above Association. Mr. A. C. Bostel, chairman of the London and Southern Division, will address the meeting. All technical engineers engaged in the electric supply industry are heartily invited, and it is hoped that as many as possible will make a special endeavour to attend.

A Liverpool Electricians' Strike.—The strike of electricians at Liverpool has been temporarily settled. The Electrical Trades Union and the Ministry of Labour were successful in persuading the men to resume work, pending further negotiations on the non-Union question, which was the cause of the dispute.

It will be remembered that the strike was the result of a movement on the part of the Electrical Trades Union to compel supervising engineers, foremen, and charge hands to join their Union. In this connection it is interesting to note that the National Association of Supervising Electricians has been registered as a Trade Union, and, of course, provides for precisely the class of men to which the agitation relates.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—The salary of Mr. A. R. DAYSON, manager of the Sunderland Corporation tramway department, has been increased from £600 to £700 per annum.

Mr. WM. FORBES, formerly traffic superintendent of the Aberdeen tramways, has been appointed manager of the system, in succession to Mr. R. S. Pilcher, who was recently appointed manager of the Edinburgh tramways.

Luton Town Council has increased salaries of the electrical engineer's staff as follows: Mr. H. A. KELL, chief assistant, from £265 to £300 a year; Mr. A. H. GATES, chief technical

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assistant, from £250 to £280; and Mr. R. Harding, chief clerk, from £200 to £225.

Blackburn Corporation Electricity Committee has recommended a grant of £500 to Mr. P. P. Wheelwright, the borough electrical engineer, for extra work performed in connection with Government supplies.

The Walsall Council has approved of the recommendation of the Tramways Committee mentioned last week, advancing the salary of Mr. R. L. Horsfield, the tramways manager.

Mr. Hugh Purves, lately manager of the Capetown Corporation's electric light works, Dock Road, Capetown, has been appointed electrical engineer at Paarl, Cape Province, in place of Mr. Wragg, who recently resigned.

Mr. A. Dimmack, electrical and mechanical engineer to the Swindon Council, has resigned his position, he having received a temporary appointment under the Admiralty. The Council has decided to retain his services in connection with certain special matters, and to consider later the question of an honorarium for extensions carried out for particular works.

Lance-Bombardier H. W. Hammond, who joined the R.G.A. in October, 1916, and was sent to Hong-Kong, where he has been acting as Master Gunner's assistant, has been seconded to the Kowloon-Canton Railway Co., for temporary appointment as traffic inspector on the British section of the line. He is the son of Mr. W. E. Hammond, traffic manager of the Metropolitan Electric Tramways, Ltd., and vice-chairman of the Metropolitan Association of Electric Tramway Managers. Lance-Bombardier Hammond joined the staff of the Metropolitan Electric Tramways, Ltd., in 1904; he was transferred, in 1913, to the British Electrical Federation, and three years later to the London Electric Railways, both the latter appointments being in the claims departments.

General.—Mr. Albert Vickers, on account of his advanced years and failing health, has placed his resignation of the chairmanship of Vickers, Ltd., in the hands of the board. Mr. Douglas Vickers has been appointed chairman.

Mr. Austin Hopkinson, electrical engineer, Manchester, son of Sir Alfred Hopkinson, has been adopted as prospective Conservative candidate for the newly-formed Mossley Division of Lancashire.

Mr. R. W. Dalton, H.M. Trade Commissioner in New Zealand, arrives in this country about the middle of October on his official visit. He will be at the disposal of manufacturers and others desiring information regarding New Zealand trade during his stay in London, and his tour of provincial centres which is to follow. Those who desire to make appointments should write to the Comptroller-General, Department of Overseas Trade (Development and Intelligence), 73, Basinghall Street, London, E.C. 2, using the reference number D.O.T. 36,732/18.

Dr. H. S. Hele-Shaw and Dr. Guglielmo Marconi have been elected Honorary Fellows of the Society of Engineers.

Roll of Honour.—Lance-Corporal G. H. Robinson, City of London Yeomanry (Rough Riders), an apprentice with Messrs. Foote & Milne, Ltd., and son of Mr. G. W. Robinson, who is estimator to the firm, was captured near Jerusalem last November. He is now reported to have died of dysentry in January in Asia Minor.

Lance-Corporal A. Y. Young, who has been killed at Salonica, was formerly employed in the Glasgow Electricity Department.

Lance-Corporal L. D. Adlington, reported killed in action, was employed at the Birmingham Electric Supply Department.

Private W. U. Priestley, London Regiment, an apprentice engineer at Blackpool Electricity Works, has been wounded.

Lance-Corporal I. Pitsforth, who has died of wounds, was employed in Bradford as an electrical engineer.

Lieutenant Mozley, R.E., son of Mr. H. Mozley, the manager of the Burnley Corporation Tramways, has been promoted to the rank of Captain.

Lieutenant F. Emerson, L.R.B., killed in action, was in private life in business with his brother, Mr. R. B. Emerson, at Southend-on-Sea, as an electrical engineer.

Gunner L. Haynes, Tank Corps, reported killed after being missing since November, 1917, was with Messrs. Siemens Bros., of Stafford.

Driver A. C. Collins, R.F.A., who was on the Wallasey municipal tramway staff, has been awarded the Military Medal.

Lieutenant H. F. Driver, M.C., who has fallen in action, was articled to Messrs. Bailey, Grundy & Barrett, Ltd., electrical engineers, of Cambridge. He had gained the Military Cross.

Sapper J. Cartmell, R.E., who has been killed in action, was 27 years of age, and was an electrician with the Blackpool Tower Co.

Sub-Lieutenant W. Chapman, Naval Division, who has fallen in action, was a member of the Manchester Corporation Electricity Department staff.

Sapper F. Williamson, R.E., who has died of wounds received during a night attack, served at the Dardanelles before going to France. He was employed at the generating station, Tame Valley, Dukinfield.

Sergeant J. Bird, Gordon Highlanders, who has died of wounds, was an employé of Messrs. Dick, Kerr & Co., Ltd., Preston.

Private W. Haigh, Essex Regiment, who has been killed in action, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Obituary.—Mr. W. S. Insull.—Mr. W. Samuel Insull, whose death occurred in London last Saturday, at the age of 86 years, was the father of Mr. Samuel Insull, the well-known electrical authority in the U.S.A., who went to America some thirty years ago.

NEW COMPANIES REGISTERED.

Remco Carbon Co., Ltd. (151,393).—Private company. Registered September 10th. Capital, £7,625 in 7,500 ord. shares of £1 each, and 2,500 def. shares of 1s. each. To carry on the business of manufacturers of, and dealers in, electrical apparatus of all kinds used in connection with supply of electricity for heat, light, power, telegraphy, &c. The subscribers (each with one ord. share) are:—C. Oliver, Milton Ironworks, Gravesend, electrical engineer; W. M. D. Tell, Viggory Mead, Horsell, Woking, electrical engineer. The first directors are to be appointed by the subscribers. Solicitor: E. P. Bilbrough, 5, Fenchurch Street, E.C.

Andrew Ness, Ltd. (151,386).—Private company. Registered September 10th. Capital, £60,000 in £1 shares (30,000 pref.). Engineers, contractors, electroplaters, electrochemists, ironfounders, metal depositors, refiners, and inlayers, metallurgists, &c. Agreements with A. Ness, the Canonbury Engineering Co., Ltd., and the Plessy Co., Ltd. The subscribers (each with one pref. share) are:—Ethel M. Lawrence, 139, Plimsoll Road, Highbury, N. 2, solicitor's clerk; C. Bowen, 7, Ely Place, E.C. 1, solicitor. The first directors are: A. Ness, J. S. Elliott, J. F. Carr, A. W. Browne, and Q. Marino. Registered office: 147, Cottenham Road, Upper Holloway, N.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Duram, Ltd.—Particulars of £20,000 7½ per cent. debentures, created June 11th, 1918, filed, the whole amount being issued on September 2nd. Property charged: The company's undertaking and property, present and future, inciuding uncalled capital. No trustees.

F. & A. Parkinson, Ltd.—Mortgage dated September 2nd, 1918, to secure £2,750 charged on land at Nether Moors, Guiseley, and dwelling-houses, &c., erected thereon (Greenshaw Terrace, Guiseley). Holders: Bradford Third Equitable Benefit Building Society, Bradford.

Anglo-Portuguese Telephone Co., Ltd. (24,545).—Capital, £200,000 in £1 shares. Return dated June 5th, 1918. 150,000 shares issued; £51,046 paid; £98,954 considered as paid. Mortgages and charges: £33,160.

Blackburn, Starling & Co., Ltd. (61,302).—Capital, £12,000 in £1 shares. Return dated July 24th, 1918. All shares taken up; £8,100 paid; £3,900 considered as paid. Mortgages and charges: Nil.

Anchor Cable Co., Ltd. (69,073).—Capital, £250,000 in £10 shares. Return dated July 25th, 1918. 6,500 shares issued; £61,000 paid; £4,000 considered as paid. Mortgages and charges: £50,000.

Barnsley & District Electric Traction Co., Ltd. (72,962).—Capital, £50,000 in £5 shares (5,000 pref. and 5,000 ord.). Return dated June 11th, 1918. 4,400 pref. and 4,007 ord. shares issued; £42,035 paid; mortgages and charges: £21,000.

British Thomson-Houston Co., Ltd. (47,982).—Capital, £800,000 in £10 shares (40,000 ord. and 40,000 pref.). Return dated July 31st, 1918. All shares issued; £725,310 paid on 32,531 ord. and 40,000 pref.; £74,690 considered as paid on 7,469 ord. Mortgages and charges: £168,195.

Babcock & Wilcox, Ltd. (65,805).—Capital, £1,960,000 in 100,000 6 per cent. pref., 200,000 5 per cent. second pref., and 1,660,000 ord. shares of £1 each. Return dated June 6th, 1918. 100,000 6 per cent. pref., 179,056 5 per cent. second pref., and 1,660,000 ord. taken up; £539,056 paid on 360,000 ord. and 179,056 second pref.; £1,400,000 considered as paid on 100,000 6 per cent. pref. and 1,300,000 ord. Mortgages and charges: Nil.

CITY NOTES.

Stock Exchange Notices.—The Committee has ordered the undermentioned securities to be quoted in the Official List:—

Oriental Telephone & Electric Co., Ltd.—110,087 additional ordinary share of £1 each, fully paid (Nos. 179,364 to 289,450).

Tees Power Station Co., Ltd.—£600,000 6 per cent. first mortgage debentures of £100 each (Nos. 1 to 6,000) (registered).

Rees Roturbo Manufacturing Co., Ltd.—The available balance at September 30th, 1917, amounted to £66,730. After adding to depreciation reserve £18,000, and placing to general reserve £25,000, it is proposed to pay dividends on the preference shares for the two years and two months ended December 31st, 1911, at 5 per cent., and to carry forward £17,143. Owing to certain rumours about the company, the directors wish to state that they are not negotiating for the sale of the business or works at Wolverhampton.—*Financial Times.*

American Telephone & Telegraph Co.—Two per cent., less income tax, for the quarter.

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East Anglian Engineering Co., Ltd.—At the annual meeting, at Stowmarket, on September 7th, Mr. L. Tibbenham presiding, supported by Mr. Drury Stowe, director, it was resolved that, after allowing for depreciation, reserve for bad debts, and directors' fees, a dividend of 6 per cent. be paid to all shareholders. A vote of thanks was passed to the chairman for the successful working of the concern. This is the first dividend paid since the company's formation in 1898.

Official Announcement re Companies.—The following are to be struck off the list within three months unless cause is shown to the contrary:—

Aero Fire Alarm, Ltd.
Asbestos and Asbestic Co., Ltd.
Curative Electricity Co., Ltd.
"Float" Electric Co., Ltd.
Platinum Substitutes, Ltd.

British Insulated and Helsby Cables, Ltd.—Interim dividend of 9d. per share, less tax.

British Aluminium Co., Ltd.—Dividend at the rate of 8 per cent. per annum, less income-tax, on the ordinary shares, and at the rate of 6 per cent. per annum, less income-tax, on the preference shares, both for the six months to June 30th.

Bromley (Kent) Electric Light & Power Co., Ltd.—Interim dividend at the rate of 4 per cent. per annum (2s. per share), less income-tax, on the ordinary shares for the half-year.

Mackay Companies.—Quarterly dividend 1½ per cent., less tax, on common stock.

Eastern Extension Telegraph Co., Ltd.—Second quarterly interim dividend 3s. per share, free of tax.

STOCKS AND SHARES.

Tuesday Evening.

The condition of Stock Exchange business is not unsatisfactory in some of the markets, although, taking the House as a whole, it cannot be said that there is much going on. The proposals put forward by the Austrian Government for a non-committal peace conference were regarded as an indication that one partner of the enemy has had more than enough of the war, and, although no special importance was attached to this, it serves to underline the confident sentiment produced by the advance of the Allies. Therefore, prices are good, the most surprising stock in the list being Consols, which have risen rapidly until they stand on a level showing a return of about 3 per cent. net on the money, allowing for income-tax at 6s. in the £.

Metropolitans have fallen back to 26, so that for a day or two they stood at the same price as Districts, a curious position seeing that the latter have had no dividend for 36 years, whereas the Metropolitan has paid poorly indeed, but regularly. The curtailment of railway services next month is expected to provide the tubes and 'buses with an ever-increasing amount of traffic, although the issues of the Underground Electric Railways of London have not improved, the £10 shares, indeed, being ½ easier for lack of attention from its recent supporters. Districts have receded ¼. In the trustee group there is £5,000 Metropolitan 3½ per cent. preference on offer at 57¼, at which the return to an investor comes to just over 6 per cent. on the money, with a fair amount of cover at the back of it. The brisk demand for these preference and debenture stocks seems singular, considering how little more the return is from them than can be obtained from the National War Bonds.

It is thought possible in the market that the electric lighting undertakings may have to reduce their dividends in view of the shortage of coal and ever-increasing demands of labour. The Charing Cross Co., it may be recalled, passed the interim dividend in respect of the last half-year, and some think that most of the other London companies will be obliged to make a small cut in the dividends for the final half of the twelvemonth. Meanwhile, of course, the principal prop is the character of the war news, and there is no evidence of proprietors wishing to sell their shares. Most of the prices are unchanged on the week, business being as quiet as usual. Westminsters are 5s. better at 6, and Metropolitans have lost a trifle.

The main interest centres around manufacturing companies' shares. The lively dealings in British Aluminiums have come to a pause, and the price of the shares is easier on disappointment that the dividend is not increased. Ediswans continue to be an active market, and in their new guise are as popular as they were before. The price keeps in the neighbourhood of 16s. The first preference continue to be quoted about 22s. 6d., and the last business marked in the 4 per cent. first debenture stock was at 75 and 76. General Electrics remain at 18¼, and the new shares became fully-paid this week. They stand about 10s. lower than their seniors. The new preference have been changing hands between 10 and 10½. Crompton ordinary are unaltered at 16s., and the preference at £1. Babcock & Wilcox, after being a little over £4, reverted to the round figure. Metallurgical shares hold their present price of 4¼. Siemens have risen to 6¾. The telegraph manufacturing shares are very steady, with a further demand for India-Rubber and Telegraph Constructions; the latter are 5s. higher on the week. Colliery shares are on the rise on account of the coal position, and a number of armament issues are a shade harder.

Amongst the various ex dividend markings which have occurred during the past few days, Globe Telegraph & Trust ordinary are noticeable because they have recovered the 2s. deducted from the price. City of London Electrics ordinary and preference are up on balance. The telegraph market is firm throughout. Revival of speculative interest is shown by a rise of ⅛ in West India and Panama. Marconis have advanced to 4½ bid, and are once more an animated market. Chile Telephones are ⅛ up at 7¼. Orientals are good at 3⅛. Expectation in this case is looking for an early announcement with regard to the distribution of surplus assets, and is concerned with estimates of what this is likely to be in hard cash. The idea is that shareholders will receive 25s. per share, if not more, and that this will have no effect upon the earning capacity of the company, which is likely to continue its present payment of 10 per cent. dividends without interruption. Cuba ordinary have risen 10¼, and Chiles at 7½ are also better.

The foreign group is not so good. After their giddy rise, Mexican Light issues have come back to a slight extent, and the first mortgage bonds are 2 points down at 61. British Columbia Electric Railways remain weak and unsupported, and Brazilian Tractions lost a point of the rise which they recently achieved. The gamble which sprang up in some of the low-priced foreign shares has quieted down, but it is noticeable that quotations are well maintained.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Sept. 17, 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6⅝	—	£7 17 0
Charing Cross Ordinary	5	4	3⅛	—	6 8 0
do. do. do. 4½ Pref.	4½	4½	3¼	—	6 18 6
Chelsea	3	5	3⅛xd	—	7 16 10
City of London	8	8	11½xd	+ ⅜	7 2 3
do. do. 6 per cent. Pref.	6	6	9⅜	—	6 3 1
County of London	7	7	9½xd	—	7 1 9
do. do. 6 per cent. Pref.	6	6	9⅜	—	6 4 8
Kensington Ordinary	6	7	5⅛	—	6 17 7
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	4	5	9¼	—	7 13 10
Metropolitan	3	4	3⅛	— 1/16	6 10 7
do. 4½ per cent. Pref.	4½	4½	3¾	—	6 18 6
St. James' and Pall Mall	8	9	6½	—	6 18 6
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	6	+ ⅛	7 10 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	97½	—	6 3 0
do. Def.	1½	1½	23⅜	—	6 7 8
Chile Telephone	8	8	7⅝	+ ⅛	5 6 8
Cuba Sub. Ord.	7	7	10½	+ ¼	*6 13 4
Eastern Extension	8	8	15⅜	—	*5 3 3
Eastern Tel. Ord.	8	8	158½	—	*5 1 0
Globe Tel. and T. Ord.	7	7	14½xd	+2/-	*4 17 5
do. do. Pref.	6	6	10½xd	—	5 17 1
Great Northern Tel.	24	22	38	+ ½	5 15 9
Indo-European	13	—	57½	—	5 12 6
Marconi	15	20	4½	+ ¼	4 9 0
Oriental Telephone Ord.	10	10	3⅛	—	3 4 0
United R. Plate Tel.	8	8	7½	—	*5 3 3
West India and Panama	6d.	1/3	1⅛	+ ⅛	*3 6 8
Western Telegraph	8	8	16½	+ ⅛	*4 17 0
Home Rails.					
Central London Ord. Assented	4	4	60½	—	6 12 3
Metropolitan			26	— ½	3 17 0
do. District	Nil	Nil	25½	— ½	Nil
Underground Electric Ordinary	Nil	Nil	2⅞	— ⅛	Nil
do. do. "A"	Nil	Nil	8/-	—	Nil
do. do. Income	6	4	83½	— ½	*4 16 3
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅝	—	6 9 9
Anglo-Arg. Trams. First Pref.	5½	5½	3⅞	—	—
do. do. 2nd Pref.	5½	—	2⅝	—	—
do. do. 5 Deb.	5	5	67	+1	7 9 5
Brazil Tractions	—	—	47	— ½	
Bombay Electric Pref.	6	6	10⅝	—	5 11 7
British Columbia Elec. Rly. Pref.	5	5	56½	— ½	8 17 0
do. do. Preferred	Nil	Nil	41⅝	— ⅛	Nil
do. do. Deferred	Nil	Nil	38	— 1	Nil
do. do. Deb.	4½	4½	57½xd	—	7 7 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	50	—	Nil
do. 6 per cent. Bonds	Nil	Nil	42	—	Nil
Mexican Light Common	Nil	Nil	28	— 1	Nil
do. Pref.	Nil	Nil	40	—1½	Nil
do. 1st Bonds	Nil	Nil	61	—2	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	4	—	3 15 0
British Aluminium Ord.	10	10	1⅝	— ⅛	5 5 0
British Insulated Ord.	20	20	2⅞	+ ⅛	4 6 6
British Westinghouse Pref.	7½	7½	2⅝	—	5 9 1
Callenders	20	25	10⅜	— ½	5 16 8
do. 5 Pref.	5	5	4½	+ ⅛	5 11 1
Castner-Kellner	22	20	3⅝	—	5 10 4
Edison-Swan, "A"	—	—	⅝	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	10	1⅜	—	7 5 6
Gen. Elec. Pref.	6	6	10⅜	—	6 5 4
do. Ord.	10	10	13⅝	—	*5 8 1
Henley	25	25	2¼	+ 1/16	5 11 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	—	*5 16 9
Telegraph Con,	20	20	47½	+5/-	*6 1 0

*Dividends paid free of Income Tax.

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THE DUTIES OF THE PROGRESS DEPARTMENT.

By W. J. HISCOX.

(*Continued from page* 261.)

The Tool Room and the Pattern Shop.

(*c*) *The Tool Room.*—As soon as the instructions (in the form of detail drawings and specification lists) are issued to the shops, the tool room and the pattern shop are the first two departments to receive the attentions of the progress man. His methods in connection with these two departments are dissimilar in some respects, so we will first of all deal with the tool room, following up our observations with regard to the tool-drawing office contained in the preceding article.

It is an understood thing in all engineering factories that you cannot hustle a toolmaker. No matter how urgent or important the job may be, he goes about his work in a quiet, methodical manner, and the progress man must use the utmost tact and discretion to deal successfully with this peculiar department. This is written quite seriously, for although on the average production-job the operator can be persuaded to extend himself to meet a certain exigency, the intricate nature of this work, and the mathematical accuracy necessary to produce a good tool, render it imperative that no influence shall be exerted with the idea of rushing the toolmaker. He is willing to do all in his power to meet the demands of the factory, as is evidenced by the fact that he often works long hours on a particularly arduous task, and the progress man will do well to remember these points, and not allow his zeal to outrun his discretion. The chief aim, therefore, of the Progress Department in this connection is to ensure for the tool room adequate time for the completion of the necessary parts, and this can be done by pressing the tool-drawing office to issue the instructions with the least possible delay.

Apart from the foregoing, it is necessary for the progress man to interest himself in tool-room production, for the head of this department is cast in the same mould as heads of other departments, and does not always give priority to the most urgent orders, unless constantly reminded of his obligations by the progress man. There is no reason why the dating system cannot be applied to this department—*i.e.*, a covering delivery date for all tools required in connection with one order, with intermediate dates, if necessary, for the completion of those tools which should be in commission first.

A complete record of all outstanding tools, &c., is kept in the Progress Department, as instanced in the previous article. From this the progress man gauges the urgency of the tool relative to the order it is required for, and estimates a completion date accordingly. As each tool is completed, a copy of the delivery note which accompanies the piece to its destination should be sent to the Progress Department, so that the list of outstanding tools may be corrected.

Apart from the dislocation and consequent delay of production brought about by the late completion of tools, another aspect in connection with tool-room progress must be considered. It sometimes happens that a special order, for which jigs are required, is wanted out in a hurry. The jigs are not ready to time, and the shop foreman, after waiting as long as possible, perceives that there is no possibility of getting the jigs in time for him to complete the unit by the date demanded. He therefore sends the part to the marking-off table, has it marked off and drilled (or milled), and the completed article leaves the factory in accordance with programme. A few days (or weeks) afterwards the jigs arrive, and are promptly turned into the tool store, perhaps never to be wanted again. Thus, through not exerting pressure early enough, either in the tool-drawing office or in the tool room, all this unnecessary expense has been incurred, apart from the fact that the tool maker might have spent his time on something which would have been of use, the marker-off could have given his attention to another equally important job, and the drilling (or milling) operator could have done two jobs in the time taken to do the one in question.

(*d*) *The Pattern Shop.*—This department is an easier proposition to handle from a progress point of view than the tool room. The parent of the foundry, it is one of the very earliest departments to receive the attention of the progress man, for the castings are the limiting feature in the case of the majority of production orders.

The arrival of the detail drawing bearing the order number, and showing that a new pattern is required, should be sufficient to induce the pattern shop foreman to commence operations, and the subsequent receipt of the specification list will confirm his decision, and also group together the whole of the patterns required in connection with this particular order. The pattern shop and the foundry always work in conjunction, whether under one head or run as separate concerns, consequently there is no necessity to time-fix the pattern shop, as the foundry date will be sufficient to inform the pattern maker as to the urgency of any particular pattern.

The Progress Department will record the pattern numbers of all castings required in connection with the order, with a column in which to record the date on which each pattern is sent to the foundry, irrespective of whether a new pattern is to be made or an existing pattern utilised. The pattern shop foreman should send a delivery note with each pattern sent to the foundry, a duplicate copy of this note being sent to the Progress Department. In the event of a pattern being already in the foundry, in use in connection with another order, the same formula should be observed, the delivery note in this case being endorsed "Pattern already in foundry."

The progress man will urge outstanding patterns the moment he considers the margin of time allowed for the completion of the casting has reached its minimum, and may then exact a definite promise of completion from the pattern shop.

When an alteration is necessary to a pattern already in the foundry, the pattern maker should ask on a return note for the pattern, two copies of this note being sent to the foundry, and the foundry foreman, upon returning the pattern, should forward to the Progress Department one copy of the return note, stating thereon the date upon which the return was effected. The pattern would then be treated as a new part by the Progress Department, and a revised date, if necessary, would be given for the completion of the casting.

(*To be continued.*)

THE ELECTRICAL PROPERTIES OF VULCANISED FIBRE.*

By WILLIAM EVES.

The accompanying curves were plotted from test data obtained at the Massachusetts Institute of Technology. In all, 4,000 tests were made, including red, black and grey fibre. The tests were all made with the same electrodes, and the voltage was increased at the constant rate of 1,000 volts per second. At temperatures higher than room temperature the samples were prepared by heating in an oven for one hour for the thinner specimens and from four to five hours for the thicker. Fig. 1, referring to grey fibre of ½-in. thickness, shows an average decrease in breakdown voltage in the 25° to 100° C. temperature range of 77 per cent. Tests on a thickness of 0·03 in. showed an increase of 80 per cent. in breakdown voltage for the same range of temperature. The voltage required to break down a sample of thickness greater than ½ in. was greater than most commercial voltages. A comparison of results on black fibre of 0·067 in. thickness showed an average increase of 12 per cent. in breakdown voltage. Greater thicknesses showed a decrease with increase in temperature.

The results of tests with red fibre of ¼ in. thickness showed the average decrease in breakdown voltage in the range from 25° to 100° C. to be approximately 60 per cent. Thin red fibre showed an average increase in breakdown voltage from 25° to 100° of approximately 20 per cent.

The most plausible theory for the change from an increasing variable with increasing temperature to a decreasing variable with increasing temperature but with an increase in thickness, was that the small amount of moisture and zinc chloride in solution caused the resistivity to decrease with increase in temperature, while the fibre lost a certain amount of its contained moisture when heated, greater thicknesses doing so much less rapidly than

* *Electric Railway Journal*, Vol. 51. No. 5.

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lesser thicknesses, but not at all in proportion to the thickness. The results of many tests made with the fibre of five large manufacturers were averaged, and the composite results are shown in fig. 2. This curve gives values for room temperature only.

Breakdown Voltages* of Several Thicknesses of Vulcanised Fibre.

Thickness in inches.	Breakdown value. Volts per 0·001 in.
1/32	225 to 425
1/16	150 to 300
1/8	125 to 275
1/4	100 to 225
1/2	75 to 150

* Results higher than these have frequently been observed, but these limits will include the majority of cases.

Grey fibre was made from paper of the natural colour with no colouring matter of any kind. Black contained a small amount of lamp black or other colouring matter, and red was coloured with a relatively large amount of various grades of oxide of iron. Any

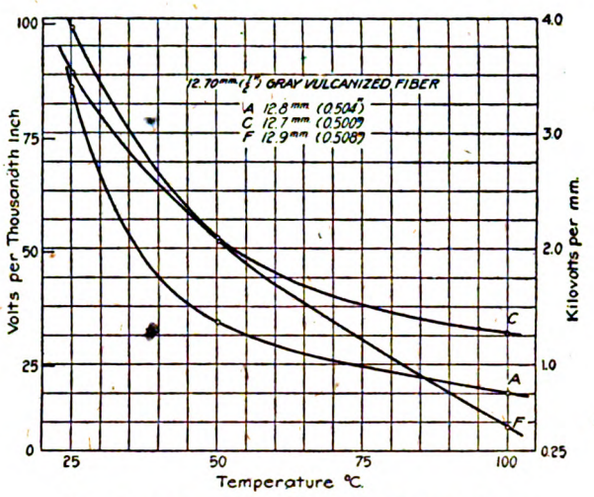

Fig. 1.—Breakdown Voltage of ½-in. Grey Vulcanised Fibre.

loading material placed in the paper from which vulcanised fibre was made, tended to interfere to some extent with the chemical treatment, and the result was a less homogeneous material. Colouring matter acted as a loading material and produced a slightly more "papery" fibre, which usually had a higher breakdown value because of the greater degree of lamination. Fibre was made from three grades of paper, which varied in the degree to which they were gelatinised by the chemical action. The paper from which ⅛ in. to ¾ in. fibre was made was treated to the greatest extent with the zinc chloride, and consequently a more homogeneous material with low breakdown voltage resulted. In a large number of cases the loading factor of red fibre was so much more

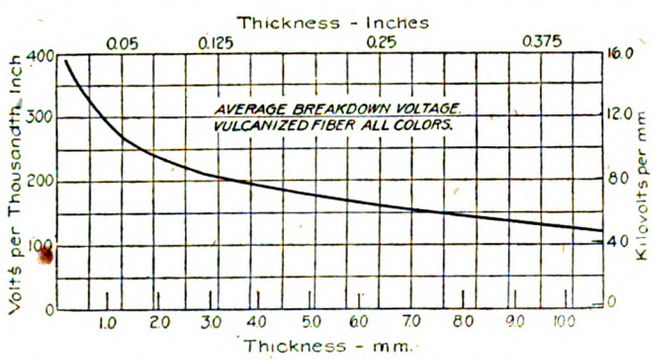

Fig. 2.—Average Breakdown Voltage of Vulcanised Fibre of all Colours.

pronounced than the tendency for the small amount of solution of oxide of iron to lower the breakdown voltage, that the dielectric strength of red fibre would be higher than that of grey fibre. Black fibre was usually between the red and grey grades and nearer the grey in its breakdown voltage.

As vulcanized fibre lost its normal amount of contained moisture, its pliability decreased, and finally it became brittle. This was caused either by application of a sustained temperature of 80° to 100° C., or of higher temperatures up to 200° C. for shorter periods of time. At the latter temperature charring commenced. It had the following strengths in pounds per sq. in.: Tensile, 9000-13,000; compressive, 33,000-43,000; shearing, 9,000-13,000.

Vulcanised fibre was not waterproof. It absorbed water to a certain degree, but was not injured by either hot or cold water, for it returned to its original dimensions and properties when dried. Most dilute acids and alkalis caused no effect other than the effect of water, but concentrated acids caused disintegration. Organic solvents and all oils had absolutely no effect and were not absorbed in the slightest degree.

If the breakdown voltage per thousandth of an inch, the specific gravity, and the cost per pound of vulcanised fibre were compared with the corresponding values for other insulating materials, it would be found that the commercial insulation value of vulcanised fibre was very high. Its ability to be machined with great accuracy and to be bent, punched, and formed to shape should be taken into account. In fact, it could be used in many cases where no other material would answer.

NEW ELECTRIC FURNACES.

(*Concluded from p. 246.*)

An electric furnace for the forging and annealing of steel, using silicon carbide as resistor, was described in a paper read before the Association of Iron and Steel Electrical Engineers, U.S.A., by Mr. Wirt S. Scott; we are indebted to the *Electrical Review*, of Chicago, for the following particulars:—

Mr. Scott's experimental work on resistor-type furnaces for forging has continued through several years. Various combinations of materials, consisting of granular graphite, coke, charcoal, and carbon blocks, have been given exhaustive tests, always with the same general results, all of the above resistor materials being unsuitable for an electric forging furnace.

To secure even moderately successful results, it was found that resistor material must be of the purest carbon or graphite. It is quite difficult to obtain a supply sufficient for operating furnaces. If there is any slag or ash left from the combustion of the resistor, it remains in the bed, so that the relative proportion of such material is gradually increasing with time, causing an increase in the resistance of the furnace.

If the slag or ash is fusible at the temperature of the resistor bed, a clinker will be formed which very rapidly extends through the granular mass, resulting in a rapid increase in resistance and consequent failure to heat.

When the furnace was maintained for a considerable length of time at sufficiently high temperature to turn out heated steel at 1,800 deg. F., it was found that the temperature in the bottom of the resistor bed exceeded the safe limits of refractory materials. With a temperature of 1,800 deg. on the surface of the bed, the temperature at the bottom was approximately 3,600 deg. This great temperature difference is due to the electrical characteristics of carbon, in that as the temperature increases the resistance decreases. An increase in temperature at any part lowers the resistance

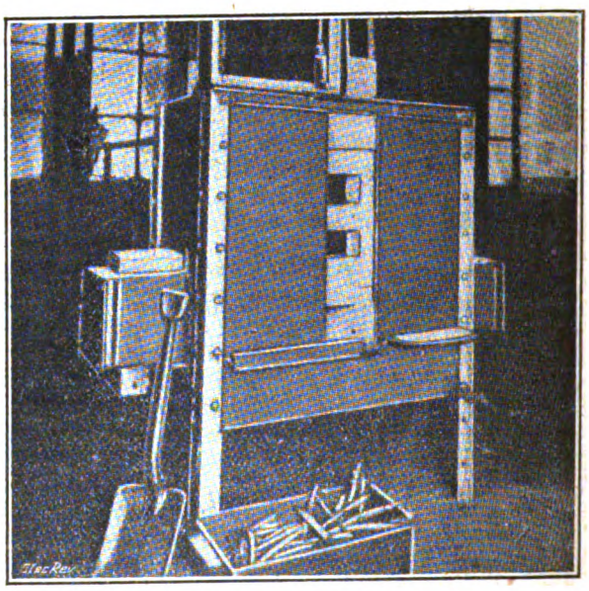

Fig. 2.—A 15-kw. Double-opening Forging Furnace with Pre-heating Chamber.

through that part, which in turn causes more current to flow, and so on, the temperature gradually increasing with the current.

If heat is generated only on the floor of the hearth, the work is heated from the under side only, and instead of receiving heat from the walls and roof, it gives off heat, thereby always having a great difference in the temperature on the two opposite sides. In order to heat the upper surface to a sufficiently high temperature, the lower surface must be overheated.

In 1916 experiments were begun using carbide as a resistance material.

There is no oxidisation of this material in pure oxygen at 1,000 deg. C. From 1,500 to 1,800 deg. C. oxidisation is very much retarded by the fused silica coating. Neutral or reducing gases, such as carbon monoxide, nitrogen, and hydro-

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gen, have little or no action. The hardness is between that of the ruby and the diamond. The specific gravity is 3.12 to 3.20. A tensile strength of 1,400 lb. per sq. in. may be attained. At ordinary temperature its conductivity is very low, being several times less than that of carbon. With increase of temperature its conductivity increases very rapidly. The resistivity of the bricks varies with differences in porosity and chemical composition. At 75 deg. F. it is 50 ohms per cm.^{3}; at 1,000 deg. F., 18 ohms; at 1,800 deg. F., 3.7 ohms; at 2,550 deg. F., 0.65 ohm per cm.^{3}

The temperature of decomposition is above 4,000 deg. F., which is approximately 1,500 deg. higher than the hottest temperature required at the surface of the resistor. Due to the construction of furnace employed, the atmosphere in the furnace chamber is non-oxidising, and under these conditions the resistor is non-consuming. It may be moulded in block form, allowing the heating element to be placed in any desirable position around the heating chamber. Due to its high tensile strength, the roof of the heating chamber as well as the hearth may be made out of these resistor blocks. The fact that it has a large negative temperature-resistance coefficient may be utilised in the control of the furnace temperature by controlling the current input to this resistor material.

The first furnace of this type proved conclusively that a temperature of 1,800 deg. F. could be obtained and maintained for an indefinite period so far as the resistor material was concerned.

The second complete furnace had overall dimensions of 46 in. wide, 38 in. deep by 48 in. high, inclusive of an iron stand 12 in. high. The resistor consisted of two blocks 2½ by 4½ in. cross section by 9 in. in length, connected in parallel, one over the heating chamber and one underneath, 2½ in. apart, forming a heating chamber 7 in. wide, 11 in. deep by 2½ in. high. The resistors were surrounded and embedded in a refractory lining made up principally of a crucible clay and a graphite mixture. Surrounding this extremely hot area, silica bricks were used backed up by ordinary fire bricks.

Electrode chimneys or wells were used to connect the resistors with the terminals. The electrodes consisted of granular graphite and an amorphous carbon rod 4 in. square by 20 in. long embedded in each electrode well, and extending upward from near the steel terminal plate at the bottom of each well to the ends of the two resistors. The granular graphite ensures electrical contact between the resistor blocks and the carbon block, and between the carbon block and the terminal plate. A cool terminal is thus obtained.

The heat insulation on the outside of the furnace consisted of 4½ in. of high-grade insulating brick all round, except opposite the electrode wells and around the door. Thin sheet steel held in place by angle iron and tie rods clamped the insulating bricks together.

The starting voltage on this furnace was 75 volts, and the time required to raise the temperature of the heating chamber to a forging temperature of 1,800 deg. F. was two hours. The power required at full load was 10 KW., or approximately 300 amperes at 33 volts. At no load, a consumption of 5 KW. or 200 amperes at 25 volts obtained. This corresponds to an efficiency of 50 per cent.

The longest continuous run extended over a period of 15 days, or 370 hours, the furnace being maintained continuously at a forging temperature of 1,800 deg. After these tests an examination of the resistors was made, but no perceptible effect due to heating could be determined.

The control equipment consisted of a 110-volt transformer with knife switches for obtaining starting voltage, and interlocked magnet switches, push-button operated, for obtaining the required running voltage. A circuit-breaker was used for protecting the furnace against an increase in current above the safe operating value.

The first furnace to be placed in continuous operation under actual shop conditions was made early in 1917. This furnace, a duplicate of the one described, was installed in the tool forging shop of the Westinghouse Electric & Manufacturing Co., and has been in operation for a period of one year, with highly encouraging results. Many runs have been made of continuous operation for periods of 400 to 500 hours, heating high-speed steel to 1,850 deg. F., and drop forgings to 2,200 deg., without any records of resistor failure, or any perceptible deterioration in the resistor due to the high operating temperature. One run of 500 hours was made at a temperature of 2,650 deg. without experiencing any difficulty whatever.

For high-speed steel work, it was found advisable to preheat it before placing it in the heating chamber. A preheating chamber was constructed under the heating chamber, consisting of an opening in the front of the furnace just below the lower resistor, into which the tools could be placed for preheating to eliminate strains that otherwise would be set up in the steel when placed in the furnace.

Another furnace has been built and placed in operation having a heating chamber 18 in. wide, 12 in. deep, and 4½ in. high. The capacity of this furnace is 20 KW., the starting voltage 220, and the running voltage 70. The efficiency is 60 per cent. This furnace is designed to operate on steel drop forgings requiring a temperature of 2,300 deg. F.

As the furnace increases in temperature it is necessary to step down to lower voltages. The control equipment thus far developed is semi-automatic in its action.

The furnace has a very wide application, but experiments thus far have been confined to forging, vitreous enamelling, and the reheating of glassware. A special furnace has been constructed, and is successfully operated for the forming of lamp chimneys.

The furnace described offers an ideal solution for forging and annealing steel, because uniform temperature is obtained in all parts of the heating chambers; the temperature found to produce the most satisfactory results may be obtained and maintained indefinitely; a neutral atmosphere is obtained in the furnace chamber, thereby eliminating the major part of the oxidisation of the steel.

In the *Iron and Coal Trades Review* of April 12th, 1918, particulars were given of the Stobie 15-ton electric furnace.

Until recently large electric furnaces, when used experimentally for melting from cold scrap, revealed in a very marked degree the following defects: (1) The localising of the melting to the region within reach of the arc on each electrode; (2) the rapid destruction of the roof by the high radiant heat of the arcs, which becomes disastrous in large-span roofs; (3) the cutting away of the electrode holes and the extensive surface burning of the electrodes by the flames which gush out of the electrode holes in the roof; (4) the rapid tapering of the electrodes within the furnace, due to

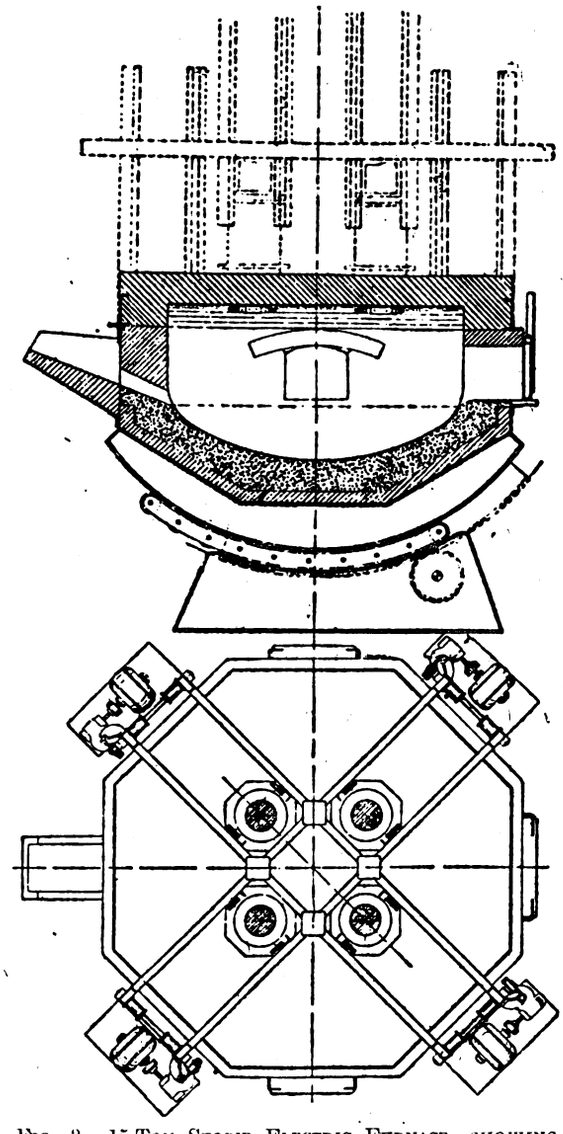

FIG. 3.—15-TON STOBIE ELECTRIC FURNACE, SHOWING ELECTRODE ECONOMISERS.

oxidisation by the air drawn in through the doors as a result of the chimney effect of the last-mentioned defect; (5) the phenomenally quick loss of heat by the furnace after tapping, resulting from the hurricane of cold air which flows through the furnace doors and out of the electrode holes the moment the doors are opened for fettling and charging.

Each of these defects arose from the impossibility of stopping up the gaps around each electrode where the latter passes through the roof. An important improvement has recently been devised by Mr. Victor Stobie whereby an electric furnace can be completely sealed up, notwithstanding the number of gaps in the roof.

The 15-ton furnace seen in operation by our contemporary's representative at the Stobie Steel Works is the largest electric furnace in this country. A section and plan are given in fig. 3, which shows the roller-tilting gear—a unique feature. By this gear, which is driven from a 15-H.P. motor, the furnace is tilted towards the platform for slag removal,

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an opening in the platform permitting the discharged slag to fall to the shop floor level into a bogie for removal. The same mechanism tilts the furnace in the reverse direction for tapping.

The furnace is three-phase, as were the majority of the early types of large arc furnaces. (Mr. Stobie, however, is now building mainly two-phase four-electrode furnaces.)

The principle of the furnace is as follows:—Three electrodes above the bath are connected to the three phases of a four-wire star-connected supply, whilst the fourth electrode is connected to the middle or neutral point of the supply system. The electrode arc gaps above the metal are adjusted according to the phase and interlinked pressures. Any reduction in the resistance of the arc gaps under one of the three-phase electrodes will reduce the resistance of the phase circuit by a greater percentage than it will reduce the resistance of the interlinked circuit; therefore, excess current is taken by the fourth or neutral electrode. Obviously, when a three-phase electric furnace is working the phases are never balanced, owing to the constant movement and fluctuation in the resistance of the material which is being melted and the "waviness" of the surface of the bath when molten, so that the neutral electrode will constantly carry current and do its share of the heating or melting of the charge.

As regards electrode consumption, the major portion of it does not take place at the arcing points, but results from the surface burning of the carbon all over those parts of the electrode which are inside the melting chamber, and up to a point about 12 in. above the roof, and it will be well within the mark to say that from 50 per cent. to 70 per cent. of the heavy expenditure on electrodes is wasted through this defect. Amongst many devices employed to remedy this defect, which is of more serious moment in the large furnaces, mention may be made of a method of (1) enveloping the carbons with asbestos paste held in position with wire-netting, (2) coating the electrodes with non-burning paints, and (3) surrounding the electrodes with water-cooled cylinders extending well inside the furnace. With regard to (1), this is very expensive to apply, and quickly perishes within the melting chamber; in (2) the non-burning coatings all expand and fall away from the non-expanding electrode; and in (3) the internal water jackets are most wasteful of heat, are ineffective, and a source of danger within the furnace.

Observation shows that at one or two feet above the roof in most electric furnaces, the electrodes, even when raised high for charging, are seldom at a temperature at which they can burn; therefore that is the only point at which a permanently good seal can be made round the electrodes. It is only necessary to enclose hermetically an electrode from the roof up to that point to prevent its burning away, and the consequent escape of the heated gases from the furnace.

For this purpose Mr. Stobie provides a light metal cylinder a few inches larger in diameter than the electrode, and about 2 ft. in length, which is fixed on to the roof round each electrode. A sealing of fireclay is made where the bottom of the cylinder meets the roof, and the top end of the jacket is covered with a sealing plate which prevents the passage of the flames, the electrode passing through a neatly fitting hole in the centre of the cover plate. In effect this improvement has accomplished far more than one would expect from so simple a device, and it may be worth while to consider the results of its application in detail.

1. As there is no chimney effect no cold air is drawn into the furnace.
2. Practically all surface combustion of electrodes is arrested.
3. A really reducing, carbon depositing (when desirable) atmosphere is constantly present within the melting chamber.
4. The entire original sectional area of the electrodes is available for current carrying, as they do not become pencil-pointed. The electrodes may therefore be of much smaller diameter for a given current supply. In addition to cutting down electrode costs, this permits a reduction in the size of electrode holes in the roof, and thus strengthens the roof.
6. There is no heat loss from escaping flame, and at the same time there is a corresponding increase in speed of work.
7. Heavy carbonaceous vapours in the furnace act as an opaque pall between the heat from the arc and the roof, thus reducing cost of repairs to both roof and lining.
8. Electrode holders and gear keep cool without water-coolers.
9. Cooler working conditions exist for the furnace hands and the melting shop generally.
10. After tapping, the heat is retained in the furnace just as in the open-hearth furnace. This considerably reduces the fluctuations of current on starting, preserves the lining, and speeds up the melting.

It is claimed that a large electric furnace with the Stobie economisers attached can produce best-quality steels at the same price as an equal-sized Siemens furnace, and the product is, of course, well known to be more perfect in finish and composition than the best open-hearth furnace steels.

At the time of our contemporary's visit to Dunston one 15-ton Stobie furnace was making nickel-chrome steel in six hours from tap to tap—in fact, the books show that there is a regular output of 24 heats per week. The actual life of the roof has not really been determined; output at the moment is the vital necessity, and no risks are therefore taken, the roof being replaced every third week.

The energy consumption per ton of saleable ingots (nickel-chrome steel) varies from 600 to 625 units. The actual loss is 2½ per cent. of the total metal charged. In July, 1917, the output was over 1,000 tons, a figure which has since been maintained.

Two new 15-ton furnaces have recently been put into commission, and designs have been made for a 30-ton furnace fitted with the Stobie economisers, and the inventor claims that 60-ton electric furnaces are feasible provided they are fitted with economisers. It is claimed that the Stobie type of economiser can be applied to all existing types of electric furnaces, and will effect economies estimated at between 30s. and 40s. per ton of steel manufactured.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

14,213. "Electric arc lamps." W. Engelke & H. H. Wrench. September 2nd.
14,221. "Electric switchgear." H. W Clothier, R. W. Gregory and A. Reyrolle & Co. September 2nd.
14,223. "Alternating-current relays." C. V. Drysdale. September 2nd.
14,227. "Sparking plugs for internal-combustion engines." J. K. White. September 2nd.
14,228. "Determining electrical characteristics of high-frequency oscillation circuits." N. P. Hinton. September 2nd.
14,235. "Electric-arc furnaces." J. Bibby. September 2nd.
14,239. "Electromagnetic speed-controlling device." Remy Electric Co. September 2nd. (U.S.A., September 1st, 1917.)
14,242. "Safety device for oil tanks of electric transformers, &c." Akt. Ges. Brown, Boveri et Cie. September 2nd. (Germany, September 1st, 1917.)
14,264. "Electric welding." W. E. Leonard. September 2nd.
14,284. "Electric lamp and switch holder." A. P. Rutherford. September 3rd.
14,301. "Electrical warp stop-motion for looms." H. Burton & A. Uttley. September 3rd.
14,315. "Dynamo-electric machine." British Thomson-Houston Co. and A. A. Pollock. September 3rd.
14,322. "Welding controllers." Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) September 3rd.
14,328. "Incandescent electric lamps." W. H. Higgs. September 3rd.
14,350. "Electro-magnetic separator." W. E. Poole. September 4th.
14,362. "Electric motor control gear." R. H. Barbour, E. Schattner and J. R. Walton. September 4th.
14,372. "Means for improving conductivity at joints of electrodes." C. W. Kayser & D. W. MacDonald. September 4th.
14,397. "Electric relay mechanism." G. A. Betclander. September 4th. (Sweden, September 4th, 1917.)
14,401. "Ignition sparking plugs for internal-combustion engines." F. L. Rapson. September 4th.
14,448. "Electric light and heat fittings." C. J. Lane & G. L. Wingate. September 5th.
14,451. "Lock-out switches." Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) September 5th.
14,458. "Telephone apparatus." M. Latour. September 5th. (France, September 5th, 1917.)
14,475. "Sparking plugs for electrical ignition systems." W. A. Jones. September 6th.
14,505. "Magneto-electric generating machines for lighting vehicles, &c." N. C. F. Jensen & M. J. E. Tilney. September 6th.
14,510. "Electric arc lamps." W. T. Coulson. September 6th.
14,523. "Adjustable interrupter for ignition dynamos." Splitdorf Electrical Co. September 6th. (U.S.A., May 16th.)
14,530. "Electric accumulators." W. G. Pearson & S. D. White. September 6th.
14,559. "Direct-current dynamo-electric machines." B. J. Shillito. September 7th.
14,567. "Signalling apparatus." British Thomson-Houston Co. (General Electric Co., U.S.A.) September 7th.
14,574. "Electric ignition devices for internal-combustion engines." A. H. Midgley and C. A. Vandervell & Co. September 7th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

10,164. Machine switching telephone systems. Western Electric Co. and L. Polinkowsky. July 13th, 1917. (118,133.)
11,511. Electric welding. S. C. Cary. August 10th, 1917. (118,138.)
11,534. Magnetic compasses and electric lamps for use therewith. R. S. Mason & A. E. Martin. August 10th, 1917. (118,139.)
11,544. Sparking control of aviation engines. W. T. Warren, M. G. Smiles & W. D. Smiles. August 10th, 1917. (118,140.)
11,927. Electric switches. Bosch Magneto Co. March 10th, 1916. (109,798.)
12,423. Surface electrical conduits and fittings therefor. A. E. White (American Conduit Manufacturing Co.). August 29th, 1917. (118,183.)
14,361. High-tension receiving switch for use with mercury interrupters. A. C. Gunstone & G. Pearce. October 4th, 1917. (118,161.)
14,748. Control of the temperature in electrically-heated apparatus. J. Kiell & A. A. Stow. October 11th, 1917. (118,186.)
15,425. Machines for making electrodes for batteries. S. L. Casella. December 7th, 1916. (111,838.)
16,637. Manufacture of electric cables. C. J. Beaver & E. A. Claremont. November 13th, 1917. (Addition to 4,808/17.) (118,199.)
17,546. Electric fuses. Multiplex Fuse Corporation. March 31st, 1917. (114,820.)
17,802. Electric ignition apparatus for internal-combustion engines. H. Lucas & J. H. Chambers. December 1st, 1917. (118,207.)
17,942. Electric secondary or storage batteries. F. E. Whitney. September 20th, 1917. (118,208.)
19,090. Receiver for wireless telegraphy. J. F. Miller. December 27th, 1917. (118,218.)

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THE GREATEST INDUSTRIAL PROBLEM.

THE Committee on Relations between Employers and Employed appointed by the Ministry of Reconstruction has got to the end of its tether. In other words, having been appointed for the purpose of making and considering suggestions and advancing recommendations, it has finished its work. It had to consider (1) what could be done to secure permanent improvement in industrial relations; and (2) to recommend means for the systematic review of industrial conditions affecting those relations, so that future improvement in conditions could be ensured.

What the Committee has accomplished is well known. It has recommended the setting-up of joint industrial Councils, District Councils, and Works Committees on lines which are familiar to our readers. The furtherance of those very desirable objects is in the hands of others, and that very important work is making a measure of progress. What remains, then, for the Committee to do, save to issue a final report, in which it reaffirms its conviction of the urgency of the matter? There will be found none, we believe, to question the soundness of the conviction that we have arrived at a stage of the war when of any further action respecting industrial relations it must be said, "What thou doest do quickly!" There is, says the Committee, "pressing need that every organised industry should equip itself with a representative machinery capable of dealing with the large questions of common interest to employers and employed arising in war-time, during demobilisation, and in the period after the war." The hope is expressed that when the Joint Councils have gained confidence and experience in dealing with the urgent problems of the moment, they will find their sphere of usefulness to be much wider than they imagined at their inception. We quite think that this will be so, but the urgent problems of the moment are enough to go on with, and it is useless to ignore the fact that confidence and experience will not be established or gained very rapidly. Certain Councils and Committees are at work, and the Ministry of Labour has a Department engaged in collecting and codifying the results of their activities and experience—such as they are; but notwithstanding all the propaganda and other effort down to date, we cannot pretend that the termination of the labours of the Whitley Committee finds us where we ought to be if we are going to have machinery capable of rendering the required service in the critical times that lie ahead. Really we have not got much further than to secure a fairly general discussion of the merits of the Whitley idea, and a commencement of its practical application in a few directions, and some recommendations on conciliation and arbitration, together with proposals for a Standing Arbitration Council to deal with differences or disagreements.

It would be unwise to ignore the opposition to the Whitley

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idea that exists in the engineering industry and in some other sections. That opposition, as we have intimated on several occasions, centres around the question of "control" of industry. Everything depends, we suppose, upon what is meant by "control." If it means giving all classes of workers an interest in the profits of a business, that is a proposition definite enough to form the basis of discussion, given a suitable attitude on both sides. If the employing side flatly refuses it without fair consideration, closing its eyes to all the signs that have been written during the last four years, with an indisposition to reduce the spirit of self-interest or to show any accommodation, it must not be supposed under to-day's conditions that there the matter will end. What does the Committee say on this point as it closes its labours?

On the question of the adoption of schemes of Profit-sharing and Co-partnership we have considered the evidence at present available, and have felt bound to come to the conclusion that it does not justify us in putting forward any general recommendations.

Is it possible to congratulate the Committee upon this inconclusive conclusion? It has recommended measures for giving the several industries a large share of self-government through Joint Industrial Committees, but it trembles at the thought of going further, and leaves the problems that are already on the horizon with the Ministry of Labour and the Ministry of Reconstruction, and with the Industrial Councils, because if it undertook further inquiries there would be overlapping. Of course, it was hardly to be expected that a Committee representing directly opposite interests would be able to come to a completely unanimous conclusion, unless in the nature of a very definite compromise, and we seem to be able to read into the wording of this final report the existence of a good deal of difference of opinion and laborious discussion between the members themselves. Confirmation of this thought is found in a minority report signed by J. R. Clynes, J. A. Hobson, A. Susan Lawrence, J. J. Mallon, and Mona Wilson. These members say:—

While recognising that the more amicable relations thus established between Capital and Labour will afford an atmosphere generally favourable to industrial peace and progress, we desire to express our view that a complete identity of interests between Capital and Labour cannot be thus effected, and that such machinery cannot be expected to furnish a settlement for the more serious conflicts of interests involved in the working of an economic system primarily governed and directed by motives of private profit.

Thus we find that these members, while they concur in the general inability of the Committee to make recommendations respecting profit-sharing and co-partnership, are unable to foresee a continued period of industrial content so long as we have private enterprise as the great impelling force in industry, for that is what they mean by "the motives of private profit." They want little short of State control of industry, which would mean that Labour would share the profits, if any, with the State, or that the whole nation should be in co-partnership in all industry. Otherwise, in their opinion, we cannot avoid serious conflicts. Is there available any evidence to justify the belief that industrial peace would be secured by the elimination of private interest? Would it be worth having at such a price? Would international competition considerately eliminate itself? Has the war changed human nature?—of course it has not. Apparently the full Committee, when properly limiting itself to the terms of its appointment, considers that it has advanced recommendations which, when they are generally applied, will be likely to secure "a permanent improvement in the relations between employers and workmen"; but the zeal of the minority seems to have carried them much further, and to have brought them up against the entire economic system of industry, because it will not permit of what, if we may say so, is the impossible—the elimination of our very common human nature and its weaknesses. We, of course, recognise that many of the differences that arise in industry are based on little else than the suspicion that the employer or the shareholder is taking more than his share, while there is lacking any authority which can settle what the respective shares ought to be of both the profits and the losses. To suggest, however, that there is no middle course which will help us to conduct human affairs on lines which shall be equitable to Capital and Labour alike, savours more of the sentiment of the heart than of the common-sense of the mind. In one of his lectures already referred to somewhat fully in these pages, Mr. W. L. Hichens suggested the limitation of the rate of dividend on industrial capital. We believe that in the days to come some such measure will be more widely and more seriously discussed. A complication may enter when there are no profits to divide after wages have been raised and better conditions ensured. The rate of dividend would presumably be such that the risk of lean years or years of actual loss would be prepared against by the establishment of equalisation funds after due provision had been made for financial stability of the business. Labour would not be prepared to bear the losses, but would risk the loss of employment if the concern were compelled to shut down. It might be able to secure work elsewhere or to draw State unemployment insurance, but the shareholder would not be able to recover his lost capital.

The circumstance that the full Committee can make no recommendations concerning middle courses, while the minority can advance nothing more than nationalisation of everything, inclines us to see that all that remains at the end of this final Report is the hope that is inspired by the Whitley Industrial Councils. That hope is growing, as we are heartily glad to see, but, in our opinion, the mountain of deliberative effort has brought forth only a mouse if we consider it in comparison with the huge wall of difficulty that will be confronting us when the war ends. Of course, we speak comparatively; we have never hesitated to give the strongest possible approval to the Whitley principles, but these alone will not suffice to quench the fires that we fear may burst out if something does not happen to change the spirit of many workers and to curb the activities of recalcitrant minorities who delight in strife.

Far be it from us to withhold credit from those to whom it is due, or to encourage a gloomy outlook respecting the future; but in view of the vagueness of public utterances of statesmen and politicians, and of the fact that Dr. Addison's Committee has terminated its labours, of the unquestionably strong movements of an uncertain character that exist in many parts of the country, of the possibly sentimental view in regard to industrial conditions that women voters may be expected to exercise at the polls when we come to an election, we think the time has arrived for a round table conference as suggested by the Alliance of Employers and Employed. It is time to see whither we are tending, and, if possible, conceive means for averting a calamity which will bring no good but only harm to both sides.

The decision in the case of the railwaymen's latest demand is encouraging the idea that wages must rise in proportion to the increase in the cost of living, and at the moment of going to press a strike is in progress. We venture to believe that some classes of workers would be poorer than they are to-day if their advances had been thus regulated; they would not be buying pianos, paying for the best provisions, and giving the bootmaker or the draper whatever price he liked to ask. If the proportional increase principle is to be State approved the State ought to bring its weight more influentially to bear in keeping down the cost of living. In many parts of the country the shopkeeper is reaping a harvest. Who pays? The people, who, in consequence, are always "asking for more."

The next best evil to an inconclusive peace is the continuation of the present tendencies in the industrial world, and to cope with these the Whitley principle is seemingly impotent.

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Canadian Guilds of Research.

Our Special Correspondent in Canada reports that the Honorary Advisory Council for Scientific and Industrial Research is advocating the establishment in Canada of Guilds for Research. The Council points out that the majority of Canadian industries are relatively small, and, consequently, have not the resources to undertake research but by means of Guilds. All firms in a particular line of industry would be linked together in order that these expenses might be pooled. It is hinted that if the levies or subscriptions of the firms to the Guild are insufficient to meet expenses, assistance may be given for a period of years by the Government.

Some of the advantages which would accrue to members of such Guilds are stated as follows :—

The results of all research work undertaken by the Guild will be immediately available to each and every member.

The right to recommend specific problems for research, and, if the problems be approved by the Committee of Management, the right to have the research carried out without cost to the firm suggesting them.

The right to a periodical service of information for the purpose of keeping in touch with all technical developments of the particular industry in question.

Firms which did not join a Guild would naturally not be in a position to compete with those which did, especially in those cases in which great economy had been effected by improved processes. All information of this nature would, of course, be denied them.

Fuel Economy.

The crucial importance of the fuel question, and the imperative necessity of rigid economy in the consumption of coal as a war measure, are being pressed upon the public attention by the Coal Controller as urgently as possible. A Conference of London Mayors and municipal officials was held for this purpose on Friday last, at which the President of the Board of Trade and the Coal Controller made statements on the subject, and an instructional pamphlet containing useful hints to consumers is about to be issued. It is clear that during the coming winter there will be a serious deficiency in our supplies of fuel, apart from the rationing scheme, and it is the duty of every patriotic householder or other consumer to restrict his consumption to the barest possible minimum.

In the article commencing on this page, Mr. E. C. de Segundo discusses the comparative values of the various forms of fuel on the bases of cost and heating "effectiveness," making due allowance for the efficiencies of conversion. His results, indicating that in spite of the deplorably low efficiency of domestic grates and ranges, coal is the cheapest form of fuel for heating, and at the same time makes the least demand upon our resources, when assessed on the above bases, are in accordance with those of previous writers on this subject. In passing, we may point out that the figure which he has taken for the coal consumption per KW.-hour—5·5 lb.—is, to our mind, a liberal one, and may be criticised by the managers of large generating stations; but the author states that he has adopted this figure as an average for large and small plants throughout the country.

There is, however, another aspect of the matter to which attention should be drawn—namely, the use factor. It is well known to electrical men that the consumption of electricity for lighting and heating, in the hands of careful people, falls far below the amount that would be anticipated on the basis of watt-hours per candle-hour or per thermal unit, simply because the current is so easily switched off when not required. Hence it does not follow from the figures that the actual consumption of electricity would be nearly so great as would appear, and in view of the enormous demand that has sprung up during the war for electric heating apparatus, which could not have happened if the cost had been prohibitive, we believe that in reality the use of electric fires is not wasteful of fuel.

As for electric cooking, that is not in doubt; the economy of this method of cooking has been established, and its increasing adoption in the National Kitchens bears testimony to its merits.

THE HOUSEHOLDER AND CLAUSE 7 OF THE COAL RATIONING ORDER.

By ED. C. De SEGUNDO, A.M.Inst.C.E.

There seems to be a widespread feeling of perplexity amongst householders with regard to their position under the provisions of Clause 7 of the "Household Fuel and Lighting Order, 1918." This clause reads as follows :—

> Fuel may be taken as coal, gas, or electricity at the option of the consumer in accordance with the following rules (Clause 7) :—
> In calculating a ton of fuel :—
> (*a*) Anthracite shall count as fuel at the same rate as ordinary coal.
> (*b*) 3 tons of coke shall count as 2 tons of fuel, and so in proportion for other quantities.
> (*c*) Briquettes (not exceeding 2½ lb. in weight) shall count as 1,000 to the ton.
> (*d*) 15,000 cb. ft. of gas shall count as 1 ton of fuel.
> (*e*) 800 Board of Trade units of electricity shall count as 1 ton of fuel.
> The quantity of fuel to be taken as gas or electricity must be calculated to the nearest quarter of a ton.

The non-technical public appear to assume—and, perhaps, not unnaturally, from the wording of the clause—that the words "shall count as" are synonymous with "is equivalent in heating value to," and, further, that it is immaterial, not only as regards the quantity of heat obtained, but also as regards the eking out of our coal supplies, whether a ton of anthracite, or a ton of coal, or a ton and a half of coke, or 15,000 cb. ft. of gas, or 800 Board of Trade units of electricity be consumed.

This is, of course, not the intent of the Order, and anyone possessing a rudimentary knowledge of thermal equivalents knows that the calorific values of the quantities just mentioned are by no means equal; but it is, perhaps, not realised how widely different they are, nor is it fully apparent at first sight, even to the technical man, why the authorities are so anxious that the consumption of gas and of electrical energy should be curtailed in the greatest possible measure during the coming months.

A few figures and explanations may, perhaps, serve to enable the public to see more clearly in the matter. The calorific values and prices in London to-day may, for the purposes of rough comparison, be taken as follows :—

	Calorific value. Therms.	Price (present time).
British anthracite, per lb. ...	15,000	61s. 6d. per ton.
Coal, per lb.	14,000	44s. 6d. „ „
Coke, per lb.	12,500	(say) 44s. 0d. „ „
Coal gas (present day) per cb. ft.	500	„ 4s. 0d. per 1,000 cb. ft.
KW.-hour	3,400	„ 1½d.

The prices of gas and electrical energy vary in different parts of London, but the above assumptions are sufficiently near the mark for the purposes of my argument. The heat values of the quantities mentioned in Clause 7 of the Order, and the cost per million therms at present prices, may be taken as under :—

	Therms.	Pence.
1 ton anthracite (British) ...	33,500,000	22
1 ton coal	31,000,000	17·2
1½ tons coke	42,000,000	19·0
15,000 cb. ft. of gas	7,500,000	96·9
800 KW.-hours	2,700,000	444·0

At first blush, therefore, the householder who consults his Molesworth or his Kempe, jumps to the conclusion that the authorities are either crassly ignorant, or are seeking to make him pay for sources of heat somewhat in inverse proportion to their heat values. A few days ago a statement appeared in one of the daily newspapers to the effect that Prof. X. had pointed out that 30,000 cb. ft. of gas was the proper "householder's equivalent" of a ton of coal. It is not easy to see upon what principle this figure is arrived at. The determination of what might be termed the "effective" equivalents with any degree of scientific accuracy is scarcely possible, for reasons which I need hardly point out to readers of a technical journal.

In view of the abnormally low stocks, and of our impaired productive capacity, the Coal Controller is faced with the necessity of devising ways and means whereby the coal consumed throughout the country may become productive of the

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highest "effective" results, and—so far as the householder is concerned—whereby the amount of heat necessary to enable him to keep himself warm, cook his food, and light his house during the coming months, may be obtained at a minimum expenditure of fuel. Available labour and transport facilities are necessarily dominant factors in the situation, so that the determination of the "equivalents" in Clause 7 has been by no means merely a matter of simple arithmetic, and, at best, can only be of the nature of a compromise.

Now, the chief concern of the average man is how to keep his house suitably warmed during the cold weather, and we may, therefore, take the fuel consumption for heating as our basis for discussion. It is well known that in open fireplaces of the type found in the vast majority of houses in London, probably 90 per cent. of the heat value of the coal consumed is wasted owing to incomplete combustion, to the mania most people have for poking the fire, and to the heat escaping with the products of combustion up the chimney, but let us take 85 per cent. as the average loss, all round, in coal-fired heating apparatus. In some types of gas fire the percentage of heat lost may be higher than 90 per cent. In gas stoves connected to a flue (as, of course, they all should be), even assuming the combustion to be complete, certainly over 50 per cent. of the heat will be lost as far as radiation into the room is concerned. In certain types of electric heater it may be assumed that practically the whole of the thermal equivalent of the electrical energy dissipated is of value for warming the room. Let us assume a loss of 10 per cent.

On the basis of the above efficiencies, the "effective" heat obtained by the householder from the five commodities becomes :—

1 ton anthracite ...	(about)	5,000,000	therms.
1 ton coal		4,500,000	,,
1½ tons of coke		6,000,000	,,
15,000 cb. ft. of gas		3,400,000	
800 KW.-hours		2,400,000	

We next have to look into the fuel consumed in gas works and central electric generating stations per 15,000 cb. ft. of gas and per 800 KW.-hours supplied to the householder.

In the production of gas 1 ton of coal is converted, on the average, into about 10,000 cb. ft. of gas and about 1,500 lb. of coke, plus about 180 lb. of residual products, which do not enter into our calculations. About 25 per cent. of the coke made is consumed in heating the retorts, so that the fuel required for the production of 15,000 cb. ft. of gas is about 1¾ tons. I am informed that about 94 per cent. of the gas produced is accounted for in the meter readings, so that 15,000 cb. ft. registered by the householder's meter corresponds, on the average, to nearly 1·9 tons of fuel consumed at the gas works.

SUMMARISED RESULTS.

	Anthracite. 1 ton.	Coal. 1 ton.	Coke. 1¼ tons.	Gas. 15,000 cb. ft.	Electricity. 800 units.
Estimated "effective" heat (average efficiency of open grates and other coal-fired apparatus used by householder, taken at 15 per cent.). (Therms.)	5,000,000	4,500,000	6,000,000	—	—
Average efficiency of gas fires and gas stoves, 45 per cent. (Therms.) ..	—	—	—	3,400,000	—
Electric heater (for heating rooms, say 90 per cent. efficiency). (Therms.) ..	—	—	—	—	2,400,000
Cost. (Pence.)	738	524	792	720	1,600
Relative cost (coal taken as unity)	1·58	1·00	1·48	1·35	3·00
Demand on coal resources. (Tons.)	1	1	2·25	1·86	2·00
Cost per 1,000 therms "effective" heat. (Pence.)	0·148	0·119	0·132	0·21	0·50
Relative cost (coal taken as unity)	1·24	1·00	1·11	1·77	5·38
Demand on coal resources per 4,500,000 therms "effective" heat obtained by householder. (Tons.)	0·9	1·00	1·69	2·2*	3·8

*Of this quantity about 1·1 tons net of coke would be available for sale, but 2·2 tons of coal would have to be *provided* in the first instance.

The coal consumption per KW.-hour delivered to consumers' terminals varies considerably according to circumstances, but an average of 5·5 lb. for large and small plants throughout the country will not, I imagine, be very wide of the mark. This would correspond to the consumption of about 2 tons of coal per 800 KW.-hours used by the householder.

Therefore, in allowing 15,000 cb. ft. of gas and 800 units "to count as" 1 ton of fuel, the Controller has to provide the gas and electricity works with about 1·86 tons and about 2 tons of fuel respectively. Reducing these results to the basis of the "effective" heat that the householder may be assumed to obtain from the consumption of 1 ton of coal in his open grates, &c., we find that the Controller would have to provide for gas and electricity works about 2·2 tons and 3·6 tons of coal respectively. These results are summarised in the table in the preceding column.

These figures serve to show that the effective heating of our houses by gas and by electrical energy makes large demands upon our coal resources, and that the authorities have, therefore, good reason for urging the necessity of reducing the consumption of gas and electricity for heating as far as possible during the coming months. The figures indicate further, that, by so doing, the householder will be acting in his own best interests.

THE DUTIES OF THE PROGRESS DEPARTMENT.

By W. J. HISCOX.

(*Continued from page* 285.)

(*e*) THE PURCHASING DEPARTMENT. (*f*) THE GENERAL STORE.

(*e*) *The Purchasing Department.*—Having dealt with the preliminary departments, the progress man's next consideration is the source of supply, and the Purchasing Department soon demands his attention. The importance of this department, from a progress point of view, varies in many factories, and is determined by the amount and the nature of the material in demand from outside sources. Where the firm possesses a foundry and a smith's shop of such capacity as will ensure an adequate supply of material to meet the demand, the Purchasing Department obviously does not enjoy that degree of importance extended to that department in connection with a factory which cannot maintain itself in the output of rough parts; and it is, therefore, confined to the duties of ordering the necessary raw material to meet the store's requirements, together with finished parts—such as springs, rubber details, &c., which the factory cannot produce.

In the case of a factory which depends to a very large extent on outside firms for the necessary supplies of rough material, as well as for finished parts, the Progress Department must arrange for the early delivery of such parts, in order to allow the machine and fitting shops ample time to perform their operations, and yet ensure the completed unit being dispatched in accordance with programme.

When the specification lists have been received the Progress Department should give the Purchasing Department delivery dates for both rough and finished material, and if, after inquiry, a certain part cannot be delivered by the date given, this information must be promptly given to the Progress Department, together with a report showing what the Purchasing Department proposes to do in the matter, such as instituting inquiries with another firm, with a view to facilitating delivery.

Although there is no necessity for the Progress Department to receive copies of all letters from outside contractors, it is essential that such copies should be received where the letter deals with the question of delivery, together with a copy of the Purchasing Department's reply to any such letter. It is just as necessary for the Progress Department to have the fullest information concerning the delivery prospects of parts from outside sources as for the parts being produced in the factory, and every effort should be made by the Purchasing Department to keep the Progress Department fully posted in all matters affecting delivery.

A works copy of every order placed with outside contractors should be sent to the Progress Department, such copy containing, in addition to the official terms of the order, the works order number, drawing numbers, and other information not generally given to the supplier. These works copies would be filed for reference in the Progress Department, and a list of all material required from outside compiled (if desirable) by the section progress man. for his own convenience. The progress man would issue reminders to the Purchasing Department whenever he con-

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sidered there was any likelihood of delay in the delivery of a specific order, and he should be in a position to authorise the sending of a telegram, or even a travelling progress man, to a firm, in connection with matters of supreme importance.

(*f*) *The General Store.*—The practice of treating this department on a different basis to the other factory departments is very common, and is a great mistake. The general store has certain obligations to meet in connection with an order, and these obligations should be fulfilled by the store, without that department having to await the initiative of another department.

The general store should be given a date for the delivery of the parts to be supplied, as in the case of all other departments, and the fullest information should be given on the specification list to enable the store to discharge its liabilities at the earliest possible moment. The size and amount of bar material should be given, and it should not be necessary for the shops to requisition material required in connection with a production order. The receipt of the specification list in the store should be quite sufficient to authorise the issue of material to the departments requiring it.

When there is insufficient stock of a certain part to meet the demand, the Progress Department should be promptly advised, further information relating to the source of supply, and the stock order number in the event of the article in question being produced in the works, being furnished. Upon receipt of this intimation, the Progress Department would at once take the necessary steps to speed up the completion of the required article.

The supply of the necessary rough material in connection with the order, for machining purposes, should be the storekeeper's first consideration, and immediately upon receipt of the specification list he should satisfy himself that an adequate supply of material is available, even if this material is not required immediately. Every shortage should be notified to the Progress Department, the order number affected being quoted, and that department would then get into touch with the Purchasing Department, with a view to urging the suppliers to facilitate delivery.

In a factory where the Receiving Department is controlled by the general store, the storekeeper should arrange for the Progress Department to have each morning a complete list of all goods received the preceding day, full information with regard to the works order number, drawing numbers, &c., being supplied. An entry on the Inwards List to the effect that 50 ft. of special steel has been received does not necessarily suggest to the progress man that this is connected with a number of bushes to various drawing numbers shown on the specification list, and it is the duty of the receiving clerk, therefore, to give on the inwards sheet the drawing numbers and the order number for which any special bar material has been received.

The question of stock orders issued at the instance of the General Store is one which demands the serious consideration of the Progress Department, and in some large concerns a special progress section has been instituted to deal exclusively with such orders. In the case of ordinary stock component parts, the orders are issued by the General Store automatically as the actual stock reaches the official minimum figure, and ordinarily these orders need not trouble the progress man unless the requirements of production orders render his intervention necessary. Where assembled units, such as motor-end shields, collector rings, &c., are stocked, each stock order covering the making of these should be submitted to the Progress Department for a completion date to be affixed, and the order should be treated in the shops in exactly the same manner as a production order.

The progress man should have access to any part or section of the general store, and although he should not interfere with the working arrangements of the store, he should be free to interrogate any charge-hand or person in authority with regard to any specific point in which he is interested. This, if carried out in an amicable manner, will go far to maintain the good relationship between the two departments, and at the same time ensure the material being issued to each shop, to the mutual satisfaction of all the parties concerned.

(To be continued.)

THE ELECTRICITY SUPPLY OF ARCHANGEL.

A description of the electrical installations of Archangel appeared in a recent issue of the *Elektrichestvo*, which says that previously to the year 1914 the population of Archangel amounted to 45,000, and the town possessed three D.C. generating stations, owned by Ya. A. Makaroff, E. K. Plotnikoff, and the Commercial Union. The maximum load of the first was about 200 kw. at 220 volts; the second about 125 kw. at 110 volts, and the third about 100 kw. at 2 × 110 volts. Thus the total maximum load amounted to about 425 kw.

In the year 1912-13 the further development of these stations was to a certain extent prevented by the great length of the town, and the inadequate capacity of the plant installed. As the development of Archangel proceeded with rapid strides, the town's prosperity promised a greater and greater demand on the stations, which could not be satisfied by the private concerns.

In the year 1913 the Town Council of Archangel decided to construct its own tramways and electricity works, and for this and other requirements raised a loan of 3,000,000 roubles nominal. It was decided to close the private stations.

According to the plan of operations drawn up, it was proposed to begin work in the early spring of 1914, and to complete it some time in 1915. Some preparatory work had been done already in the autumn of 1913, and orders for plant were placed in December of that year. But in the very midst of the work the war broke out, and the completion of the scheme in 1915 became impossible. Besides, the military operations prevented the realisation of the debenture loan that had been authorised. Notwithstanding all the difficulties of the situation, the town did not stop the work; the necessary money for the continuation of the work was obtained by short-term loans, and the private firms were authorised to continue through one more lighting season. In August, 1915, the town finally closed the private stations and started its own supply.

In view of the growth of the town, and the rapidly increasing demand for power, as well as the requirements of the tramways and public lighting, it was estimated that plant of 750-800 kw. would be required to begin with. Having regard also to the contemplated reduction of price, and the extension of the supply to the whole of the town, it was decided to erect a station of 1,000 kw. with provision for future extensions.

A glance at the map of the town (fig. 1) shows the unusual shape of the area of supply, which rendered the adoption of three-phase current at high pressure advisable. The pressure adopted was 3,300 volts at 50 cycles per second.

It was not possible to find a suitable site for the station in the centre of the town, consequently it was erected on land belonging to the Town Council on the bank of the river outside the town. From this position it was easy to carry high-pressure overhead lines through the unpopulated area beyond the Obvodny Canal. Moreover, in immediate proximity to it there is the town water distribution station which facilitates the necessary water supply to the works.

In Archangel coal, firewood, and the waste of the sawmills are used as fuel. Coal is mostly imported from England; the freight previously to the war was very low, as steamers for want of other cargoes brought coal from England as ballast, so that it was possible to have the finest Cardiff coal in Archangel at from 15 to 18 copecks per pood (about £1 per ton). Such a low price for coal left it almost without competitors, particularly for large power installations. In the great swamps surround-

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ing the town there are immense reserves of peat, and Archangel itself is half built on peat. All the area beyond the Obvodny Canal, along which the high-pressure line passes, constitutes a continuous peat marsh. To treat the peat specially for such a relatively small installation as the town electricity works would not be feasible, particularly with

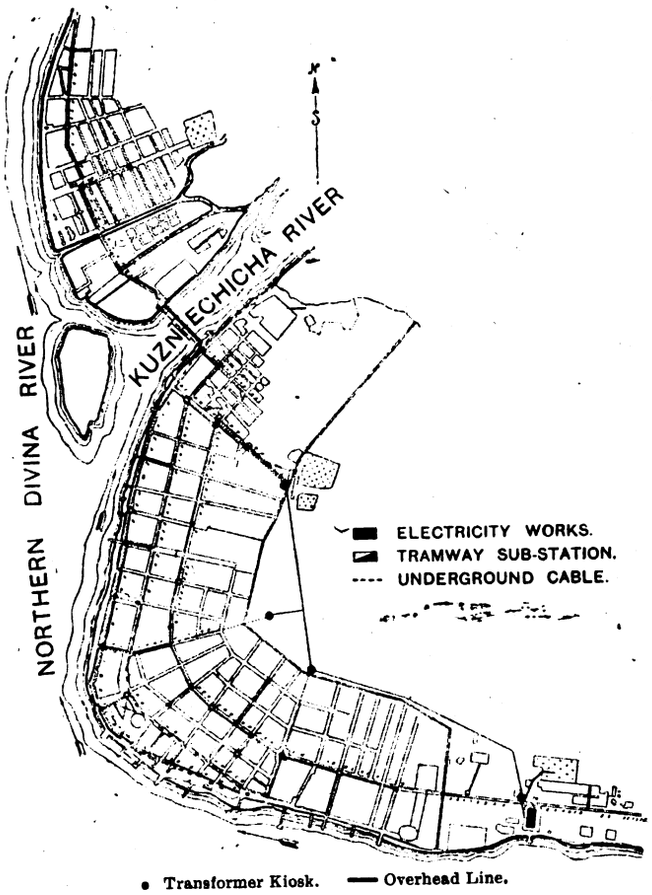

Fig. 1.—Plan of Archangel.

coal so cheap, but no doubt in the future this kind of fuel will take its proper place in Archangel. Under the circumstances coal was selected as the fuel, but lately, in view of the scarcity of coal, the question of preparing peat has assumed fresh interest, and it is possible that the Town Council will begin to work it.

The generating plant was installed in an already existing warehouse. In the boiler room there are two "Harbe" boilers of 225 m². heating surface each, supplemented by Green economisers, with 168 m². heating surface, and Sulzer superheaters of 93 m². heating surface. Each of the boilers can deliver 9,000 kg. of steam per hour. The boilers are fitted with mechanical stokers made by Vibo Vissen, feeding the fuel from below, and with air-cooled furnace bars. Fan draught is employed, and in addition the Schwabach system of exhaust fans has been installed. The fan was chosen with a liberal rating, and takes 34 h.p. The capacity of the exhaust fan is quite sufficient to serve both boilers at once.

Boiler feed is provided for by an electrically-driven pump and a turbo-pump of 30 and 40 h.p. respectively. In order to use the heat of the exhaust steam, a special heater is employed through which part of the feed water passes before reaching the economiser.

As the turbines are fitted with jet condensers, it was necessary to pay particular attention to the quality of the water used for feeding the boilers. The water of the Northern Dwina, because of its hardness, could not be used for boiler feed without preliminary treatment, so a Zeifert water purifying apparatus was provided. In order to reduce the cost of the apparatus as much as possible the boiler water is not obtained direct from the river, but is previously cleaned in the town water system.

In the engine-room three 3-phase turbo-generators were installed, of the impulse type, on the de Laval multiple system, running at 3,000 r.p.m., and rated at 500 kw. each. The guarantees given by the maker, G. Trek, allow for a consumption at full load of 7.3 kg. of steam per kw.-hour, at three-quarter load 7.6, and at half load 8.1 kg., the power factor being unity, and the steam superheated to 300 deg. C., at a pressure of 180 lb. per sq. in., and with a vacuum of not less than 93 per cent. With a power factor of 0.8 the generators develop 625 k.v.a.

The turbo-generators are of the de Laval multiple system (Laval Steam Turbine Works), and differ little from the impulse machines of other makers. The turbines have seven stages, in the first of which a Curtis wheel is used, with four regulating nozzles.

The generators also are of usual construction, and are provided with separate exciters on the shaft ends. Fan cooling is provided, the air being drawn through filters.

Koerting jet condensers are installed, which are able to maintain the vacuum named of 93 per cent. To supply the necessary condensation water from the river two centrifugal electric pumps are installed in the basement, each of which can deal with two turbines at full load. On the river bank a ferro-concrete water collecting and settling pit has been constructed which is connected to the pumps by means of cast-iron pipes. In order that dirty water may not reach the settling pit, a pipe has been laid on the bed of the river, about 50 metres long, and 500 mm. in diameter, through which the water reaches the pit by gravity. The end of this pipe is curved upwards, and is covered by a grating.

As the station is intended for the supply of electricity for both lighting and tramways simultaneously, and the tramway load is very irregular, pressure regulators have been installed. At the time of maximum load, the momentary fluctuations will be not more than 7-8 per cent. of the total

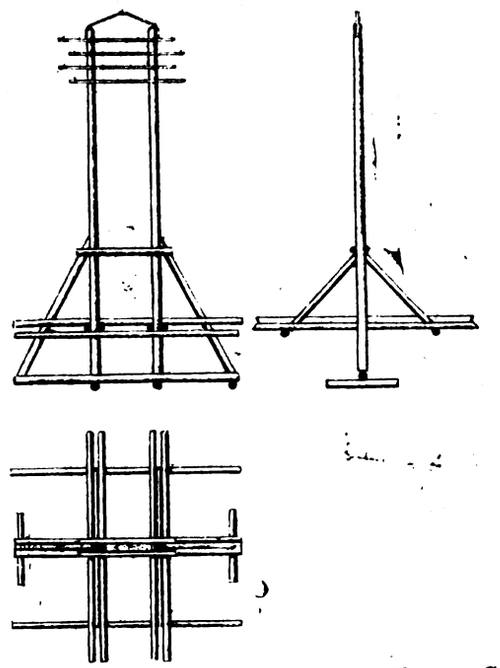

Fig. 2.—Construction of Standards for Marshy Ground.

load of the station, and the pressure regulators may not be necessary, but it will be different at other times when the total load on the station is much smaller, and the relative importance of the tramway load is greater. Hence, two quick-acting automatic pressure regulators, on the Brown-Boveri

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system, have been installed, one of them being spare.

The switchboard is of marble, and carries the measuring instruments and the pressure regulators, together with the handles for controlling the oil switches. All the high-pressure apparatus, instrument transformers, oil switches, lightning arresters, &c., are placed in the basement under the distributing board in ferro-concrete cubicles.

An overhead crane, of 10 tons capacity, is provided in the engine room. The electrical equipment of the station was carried out by the Siemens-Schuckert concern.

The high-pressure cables from the central station run underground to a small ferro-concrete kiosk, 9.5 m. in height, containing apparatus for the transfer of six feeder lines (four lighting and two tramway) from underground to overhead. The total number of feeder conductors leaving the kiosk is 18, to which are added eight control conductors, making the total 26. Control conductors are not provided for the tramway sub-station. The conductors are divided over four cross-arms of channel iron of a length of 3 m., fixed to pairs of poles (fig. 2). The upper ends of each pair of poles are connected by an arched support for the steel earthing conductor. The total cross-section of the suspended conductors is about 970 mm². From the overhead high-pressure line, separate feeders branch into the town where necessary.

On account of the great weight of the overhead conductors and the softness of the ground over which the high-pressure line passes, the poles were placed in pairs. The work of fixing these poles was not easy, as the ground beyond the Obvodny Canal is a peat marsh, covered with a water-saturated peat crust of about 1 metre thickness. This peat crust is in places so thin that in setting the poles there were cases of the workmen sinking through. Under the crust there is a semi-liquid mass, the depth of which is from 6 to 8 metres. Under the semi-liquid mass there is solid ground—very probably clay. Only at the central station and the Lutheran Cemetery does the clay outcrop. Thus most of the standards for the high-pressure line had to be placed on marshy ground, and the possibility of employing the usual methods of setting the poles was quite the exception.

In consequence of the great depth at which the firm ground lay, recourse had to be had to fixing the standards in the upper peat crust, a reliable hold in which could only be attained by attaching them to a raft under the surface, consisting of a number of logs bolted together. The function of the frame of logs consists in, first, preventing the standards from settling in the marsh, and, secondly, preventing them from inclining to one side before the wind, or from any other cause. The construction of the framing is shown clearly in fig. 2; for one pair of standards there are used about 15 pieces of 20 to 28-ft. logs, with sides of 5 to 9 in., joined together with bolts and cramps. Since, as shown above, the standards of the high-pressure line are fixed only in the upper peat crust, and, so to speak, float, for the purpose of giving the line greater strength and stability every eighth pair of standards was anchored by four piles, 35 ft. long, sunk to the solid ground, to the upper part of which the logs of the rafts were fixed with bolts.

The distance between the centres of both standards of a pair was 1.75 metres, and the span between pairs of standards 31 to 36 metres. The total number of standards was 114. Besides standards in pairs, eight ordinary standards were installed for branching from the high-pressure line to the transfer kiosk at Byegoff. The total length of the high-pressure overhead line is about 4 km.

Although great storms are rather rare in the North, all the same, for the protection of the overhead high-pressure system from disturbance by atmospheric electricity, due provision was made by installing an earthed conductor over the high-pressure conductors. This conductor served also for earthing the cross-arms of all the standards by means of a vertical iron rod.

TRADE STATISTICS OF SWITZERLAND.

IMPORTS.

The following figures of the imports of electrical and similar goods into Switzerland in the year 1916 are taken from the recently-issued trade statistics; the figures for 1915 are added for purposes of comparison, and notes of increases or decreases are given.

	1915. Francs.	1916. Francs.	Inc. or dec. Francs.
Electric cable not insulated.—			
From Germany	2,000	7,000	+ 5,000
Electric cable insulated with rubber or paper.—			
From Germany	5,000	33,000	+ 28,000
,, Great Britain ...	1,000	92,000	+ 91,000
,, France	4,000	57,000	+ 53,000
,, Italy	142,000	100,000	− 42,000
,, Other countries ...	—	3,000	+ 3,000
Total	152,000	285,000	+ 133,000
Cable ditto covered with lead and iron-armoured.—			
From Germany	53,000	54,000	+ 1,000
Cable insulated with rubber or paper and covered with textiles.—			
From Germany	6,000	1,000	− 5,000
,, Italy	184,000	40,000	− 144,000
,, Great Britain ...	27,000	14,000	− 13,000
,, France	—	52,000	+ 52,000
,, Other countries ...	1,000	7,000	+ 6,000
Total	218,000	114,000	− 104,000
Cable ditto covered with lead.—			
From Germany	—	3,000	+ 3,000
,, Italy	3,000	1,500	− 1,500
Total	3,000	4,500	+ 1,500
Dynamo-electric machines and electric transformers.—			
From Germany	900,000	221,000	− 679,000
,, France	25,000	12,000	− 13,000
,, Italy	12,000	22,000	+ 10,000
,, Great Britain ...	24,000	8,000	− 16,000
,, Other countries ...	4,000	25,000*	+ 21,000
Total	965,000	288,000	− 677,000
* United States 24,000 fcs.			
Accumulators, batteries, electrodes.—			
From Germany	103,000	42,000	− 61,000
,, Italy	29,000	26,000	− 3,000
,, France	10,000	5,000	− 5,000
,, Other countries ...	3,000	27,000	+ 24,000
Total	145,000	100,000	− 45,000
Insulators, mounted.—			
From Germany	33,000	32,000	− 1,000
,, France	1,000	1,000	—
Total	34,000	33,000	− 1,000
Electric meters.—			
From Germany	873,000	895,000	+ 22,000
,, France	111,000	40,000	− 71,000
,, Italy	7,000	—	− 7,000
,, Great Britain ...	3,000	—	− 3,000
,, Other countries ...	4,000	8,000*	+ 4,000
Total	998,000	943,000	− 55,000
* United States 5,000 fcs.			
Telegraph and telephone apparatus.—			
From Germany	191,000	443,000	+ 252,000
,, Belgium	35,000	—	− 35,000
,, Great Britain ...	45,000	292,000	+ 247,000
,, Sweden	58,000	1,000	− 57,000
,, Other countries ...	20,000	70,000*	+ 50,000
Total	349,000	806,000	+ 457,000
* United States 30,000 fcs.			

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EXPORTS.

The following figures show the exports of electrical and similar machinery from Switzerland in 1916 compared with 1915. The diversity of Switzerland's growing export trade is noteworthy:—

	1915. Francs.	1916. Francs.	Inc. or dec. Francs.
Accumulators, batteries, electrodes.—			
To Germany	21,000	6,000	− 15,000
,, France	539,000	665,000	+ 126,000
,, Italy	140,000	69,000	− 71,000
,, Greece	25,000	41,000	+ 16,000
,, Egypt	—	7,000	+ 7,000
,, Brazil	—	14,000	+ 14,000
,, Other countries ...	93,000	329,000*	+ 236,000
Total	818,000	1,131,000	+ 313,000

* Russia 53,000 fcs.

Steam engines, cranes, pumps, turbines, &c.—			
To Germany	1,515,000	1,406,000	− 109,000
,, France	755,000	2,325,000	+ 1,570,000
,, Belgium	17,000	38,000	+ 21,000
,, Russia	1,189,000	2,563,000	+ 1,374,000
,, British India	131,000	45,000	− 86,000
,, Japan	21,000	310,000	+ 289,000
,, Great Britain	648,000	168,000	− 480,000
,, Spain	372,000	636,000	+ 264,000
,, Other countries ...	814,000*	1,296,000†	+ 482,000
Total	5,462,000	8,787,000	+ 3,325,000

* Sweden 127,000 fcs., Chile 192,000 fcs.

† China 269,000 fcs.

Dynamo-electric machines and electric transformers of all kinds.—			
To Germany	2,998,000	4,904,000	+ 1,906,000
,, Austria	893,000	1,368,000	+ 475,000
,, France	3,523,000	6,881,000	+ 3,358,000
,, Italy	1,089,000	873,000	− 216,000
,, Belgium	35,000	152,000	+ 117,000
,, Great Britain	1,798,000	642,000	− 1,156,000
,, Russia	843,000	1,578,000	+ 735,000
,, Spain	1,204,000	2,217,000	+ 1,013,000
,, British India	201,000	44,000	− 157,000
,, Brazil	102,000	872,000	+ 770,000
,, Argentina	982,000	331,000	− 651,000
,, Netherlands	497,000	1,427,000	+ 930,000
,, Norway	611,000	180,000	− 431,000
,, Other countries ...	470,000	1,170,000*	+ 700,000
Total	15,246,000	22,639,000	+ 7,393,000

* Portugal 147,000 fcs., Dutch Indies 370,000 fcs.

Electric meters.—			
To Germany	803,000	793,000	− 10,000
,, Austria-Hungary ...	118,000	176,000	+ 58,000
,, France	155,000	348,000	+ 193,000
,, Italy	373,000	959,000	+ 586,000
,, Great Britain	387,000	402,000	+ 15,000
,, Russia	400,000	417,000	+ 17,000
,, Spain	150,000	174,000	+ 24,000
,, Japan	153,000	361,000	+ 208,000
,, Other countries ...	365,000	674,000*	+ 309,000
Total	2,904,000	4,304,000	+ 1,400,000

* Includes Australia 247,000 fcs.

*Steam, benzine, and electric locomotives.**—			
To France	68,000	654,000	+ 586,000
,, Austria-Hungary ...	—	1,113,000	+ 1,113,000
,, Dutch East Indies ...	385,000	—	− 385,000
,, Other countries ...	387,000†	887,000‡	+ 500,000
Total	840,000	2,654,000	+ 1,814,000

* Electric locos. in 1916, 23,000 fcs.; in 1915, 11,000 fcs.

† Includes Philippines 113,000 fcs.

‡ Includes Italy 571,000 fcs.

Electric cable, not insulated.—			
To Germany	1,000	8,000	+ 7,000
,, Italy	—	2,000	+ 2,000
,, Other countries ...	300	1,000	+ 700
Total	1,300	11,000	+ 9,700

Electric cable, insulated with rubber or paper.—			
To Germany	135,000	2,000	− 133,000
,, France	4,000	6,000	+ 2,000
,, Italy	—	15,000	+ 15,000
,, Roumania	11,000	28,000	+ 17,000
,, Other countries ...	9,000*	1,000	− 8,000
Total	159,000	52,000	− 107,000

* Greece 8,000 fcs.

	1915. Francs.	1916. Francs.	Inc. or dec. Francs.
Cable, ditto, covered with lead.—			
To Germany	1,000	500	− 500
,, Great Britain	158,000	108,000	− 50,000
,, Other countries ...	—	500	+ 500
Total	159,000	109,000	− 50,000
Cables, ditto, covered with lead and iron armoured.—			
To Germany	23,000	123,000	+ 100,000
,, Great Britain	12,000	—	− 12,000
,, France	—	8,000	+ 8,000
,, Egypt	7,000	—	− 7,000
,, Argentina	—	94,000	+ 94,000
,, Other countries ...	—	12,000	+ 12,000
Total	42,000	237,000	+ 195,000
Cable, insulated with rubber or paper, and covered with textiles.—			
To Germany	69,000	66,000	− 3,000
,, France	—	4,000	+ 4,000
,, Italy	—	17,000	+ 17,000
,, Great Britain	8,000	—	− 8,000
,, Other countries ...	10,000	14,000	+ 4,000
Total	87,000	101,000	+ 14,000
Cable, ditto, covered with lead.—			
To Germany	2,000	2,000	—

Note.—25 francs = £1.

WAR ITEMS.

Letters from France.—A Captain in the R.A.F., writing from France, says:—

"Many thanks for Review, which is as regular as it is welcome. The articles on future problems are particularly interesting, and it is very refreshing to note the clear underlying implication, in some of the statements, that some earnest endeavour will be made to restore personal, as well as material, values after the war. That possibility has been a sheet-anchor to many of us."

The Female Car-Drivers of Paris.—In the course of a recent article entitled "The Week in Paris," a *Times* correspondent says:—

"As all know, the women of the people in France have replaced the men most admirably, and an article in the *Victoire* gives a clear account of how the Parisian women have proved capable tramway drivers. They learn their job as quickly as the men, and there have been no more accidents registered by the company since there have been wattwomen than there used to be when there were only wattmen. Wattwomen must be strong, as they drive 10 hours a day, and during those hours they are obliged to stand all the time; nerves must be solid, and hands that work the brakes must be muscular. The most perfect self-control is necessary. To learn the working of a tramway-car with underground and overhead systems, and the rules of driving, takes a month; after that the women act as ticket-punchers for a week or two, thereby learning the necessary collaboration with the driver in the matter of giving the current at different points of the line and the various ways of signalling danger, as well as of calling the stops. The drivers earn 5f. 50c. a day, with 5f. extra for high cost of living, and added to this they are entitled to several prizes for expert work and regular supplements every three and six months. On arriving at the depôt in the morning, they find their work sheet all ready. Some do their 10 hours' work straight off with only an hour and 10 minutes stop for their mid-day meal, others who do the early morning and late night work, get five hours rest in the day. The two reproaches brought against the women as workers in the broad sense are that they allow personal feelings to interfere too often and upset the harmony of the work by refusing to go on duty with women they do not like, and that they stay away from their work for the most trivial reasons, in their own slang, *pour se chauffer*."

The New List of Certified Occupations.—With reference to our extracts from the above list in our last issue, it must be borne in mind that the inclusion of a man in the list does not in itself exempt him from military service. His case will be heard by a Tribunal in the ordinary way, but the Tribunal will be guided by the fact that the applicant is included in the list, and the National Service representative will only in very exceptional circumstances oppose his exemption. The list is confined to questions of exemptions coming before Tribunals. It is announced in various newspapers that the position of men of the new military age, whose occupations are in the list, is not affected, the current instruction still holding good that they are not required at present to undergo medical examination. If they receive notices they should be returned.

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The Training of Disabled Soldiers in Germany.—The Electrotechnical Training School of the Physical Society of Frankfort-on-Main reports that the managers in 1917-18 devoted their efforts exclusively to the training and improvement of disabled soldiers belonging to the electrical trades. Funds have been placed at the disposal of the school privately, and the instruction, which averages seven months, is given free of charge.

Pensions of Discharged Men.—The Ministry of Munitions has circulated for use as a poster in munitions workshops, a statement by the Minister of Pensions regarding the position of discharged soldiers and sailors as wage-earners. He says that an impression seems to exist that men by working full time and earning increased wages will by such means cause a reduction in their pension. He points out that whatever a man may earn, it will in no way interfere with his permanent pension, and that where a temporary pension has been granted, the earning capacity of the man will not in any way determine the amount of his pension, which will be reassessed solely on the degree of his physical disablement. A man need not answer any questions as regards his employment or the amount of his earnings when being examined before a medical board.

Exemption Applications.—The Hull Appeal Tribunal had under consideration the case of an employé of the city engineer's department, a Grade 1 man, 28 years of age, an electrician and electrical fitter. According to the *Eastern Morning News*, the notice of appeal urged that the local Tribunal did not give special consideration to the character of the employment, and the appellant's fitness for it. The local Tribunal, on the other hand, intimated that they were of opinion the appellant should be made available for Army service. They did not consider, after four years of war, that they were justified in granting further exemption to a man of his age and grade, and they were of opinion that the Corporation would be able to arrange for another man to do the work. For the department, it was said that it was a special case. The city engineer had always resisted any application made to him to appeal for men, but in that case he had no alternative. The man's duties were entirely in connection with public institutions and public utility services, and they had been unable to make any other provision for carrying on his work. He looked after the electrical machinery in the city engineer's department, including four automatic sewage pumping plants, two electrically-driven bridges over the river Hull, the fire brigade alarm calls, intercommunication telephones at the city hospital, Evan Fraser Hospital, small-pox hospital, and tuberculosis sanatorium, sewage pumps at the V.A.D. hospital, the fire alarms at the Willerby Asylum, and the hospitals, the tramway junctions, bridge signals, the electric crane at the pier, the tramway welding plant, the city hall fans and electric lighting, the Guildhall fans and lifts, &c. Before the war they had seven men in the department, but now they had only appellant and one substitute. The Tribunal allowed four months' exemption, the chairman remarking that they would be able to see what the military situation was at the end of that period, and whether the Corporation had been able to get a man in his place.

Before the Stratford-on-Avon rural Tribunal, Mr. C. T. Garland appealed for the retention of G. E. Evemy (44, Grade 2, B2), electrician, engaged in supplying electricity to farms and houses at Moreton Morrell. It was stated that the man, who had served in the Army, had taken the place of a man who had gone on munitions, and that there was no one to replace him. The National Service representative suggested that with his knowledge of electricity Evemy would be exceedingly useful in the Flying Corps. Six months were conceded.

At Broadstairs, the Isle of Thanet Tramway & Lighting Co. appealed for two employés, one aged 38 and B1, and the other 42, Grade 3. Each was granted three months on the ground that they were employed on work of national importance.

Hereford Tribunal has granted exemption until March 1st to W. Preece (42, Grade 3), electrician with Messrs. Daffern and Edwards.

Dorset Appeal Court has granted six months' temporary exemption to T. H. Escott (32), electrician with Messrs. Brooking & Co., electrical engineers.

Littleborough Tribunal has granted six months' exemption to E. S. Nuttall (Grade 3), electrician, appealed for by the Sladen Wood Mill Co.

At Chatham, the Tramway Co. appealed for five employés. It was stated that one of the men (30, Grade 1) had been substituted. He was refused exemption, and the others were each granted three months.

Cambridge Tribunal has granted temporary exemption to W. Maskell (48, Grade 2, B2), electrical engineer in charge of the University power station.

Electrical Imports into Spain.—The imports of dynamos and electric motors into Spain during the first four months of the current year only attained a value of £89,280, as compared with £126,760 in the corresponding period of 1917. There was also a marked decrease in the imports of electric cable and wire—from £6,480 to £1,120.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Falk, Stadelmann & Co., Ltd.

I notice certain notes with regard to Falk, Stadelmann & Co. in your issue of this week, wherein you say that the business was incorporated as a company in 1887, and practically the whole of the capital from its inception has been held by British subjects.

I enclose you an excerpt from the records at Somerset House, which, if you can find room to publish it, will leave your readers in a position to judge which of the two statements—that of *John Bull* in your previous issue, or the mention in your last issue—be the correct one.

I think it is the duty of the electrical Press to make these matters as plain as possible, and trust you will find room for this letter and the excerpt enclosed.

An English Manufacturer.

[COPY.]

FALK, STADELMANN & CO., LTD.

Incorporated June 8th, 1887, to take over and carry into effect an agreement between SOLOMON FALK and MONTZ and BERNARD THURNAUER.

Directors. — Max Falk, 11, Fitzjohn Avenue, N.W.
Louis Thurnauer, 23, Pembridge Crescent, W.
Victor Falk, 5, Lancaster Place, N.W.
Gustav Falk, 19, Fawley Road, N.W.

Capital.—Issued for cash, £239,460, and for other consideration, £153,330. Value, £392,790.

Chief shareholders.	Mrs. Zerlina Falk, Albert Pappenheimer, Max Falk — Joint holding ...	£95,470
	Bernard Thurnauer, Nuremberg	77,447
	Victor Falk	51,294
	Max Falk	51,294
	Louis Thurnauer	88,133
	Jacob Friedmann	2,200
	Gustav Falk	1,500
	Hugo Falk	1,000
	Pauline Israel, Hochburg	1,000
	Victor Falk, Zerlina Falk, A. Pappenheimer — Joint holding. ...	10,000
	Victor Falk, Max Falk — "	3,000
	Zerlina Falk	6,482
	Victor Falk, Felix Rose	2,500

[Agreeing with "An English Manufacturer" that the matter should be made as plain as possible, and in order to avoid delay, we adopted the plan, not unusual in such cases, of forwarding a proof of the letter to the company named for its observations.

As a result, we are given to understand that the excerpt given above, in substance correctly records—although not so in minor detail—the return made three years ago. It is not considered to affect the statement made in our last issue. The present shareholders are all British subjects, and no shares are enemy-held. The holding of £77,447 by Mr. Bernard Thurnauer has, as mentioned last week, been acquired by the company. This holding, which was criticised in the article originally quoted as having been taken over, consisted of £28,080 Ordinary Shares and £49,367 5 per cent. Preference Shares. The Preference shares carry no voting power, and, therefore, have no control in the affairs of the company, while the ordinary shareholding, as will be seen, amounted to approximately 7 per cent. only of the total issued capital—viz., £392,790. The holding which is described as "Chief Shareholders" represents a Trust created under the will of the late Mr. S. Falk, the founder of the company. Mr. S. Falk settled in this country in the year 1875, when he was 21 years of age. He was a British subject; he was naturalised 30 years ago. The other shareholders—so far as they are not British-born—have likewise been naturalised for periods varying from 20 to 26 years, they having resided in this country from 30 to 36 years. The only exception is that of two younger members, having a nominal holding. They were denationalised before they were 18 years of age, and have been naturalised for some years.

It is, perhaps, irrelevant, but yet it is only right that it should be known, that the chairman of the company has two sons, born here, holding commissions in His Majesty's Army, and that they are on active service overseas. The only one then of eligible age volunteered for service before the Military Service Acts came into force.—EDS. E.R.]

Ozone in the Treatment of Wounds.

I notice in the account of the exhibits at the British Scientific Products Exhibition an account of an ozoniser for which certain wonderful and special claims are made. I am not so much concerned with this as with the manner in which the statement is worded, and which, if read by the ordinary reader, without special knowledge of the subject, is likely to mislead him,

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In the first place, the opening statement that the brush discharge attacks the nitrogen, breaking much of it into nitrous compounds, is not the fact. Any ozone apparatus which performs this feat by means of the brush discharge would have to be specially designed for the purpose, because any ordinary ozone apparatus of the type described—that is, working with a silent discharge—could only produce a very fractional percentage of nitrogen compounds under the worst conditions. As a matter of fact, the apparatus manufactured by my company was submitted 12 years ago to a very searching investigation by a well-known consulting chemist and public analyst (an authority which I consider to be the only correct one for the purpose named), with the result that, even at high concentrations, no trace of nitrogen compounds was found.

The use of ozone for surgical and therapeutic treatment was not general in this country from the fact that its use for the purpose was doubted, so far as efficacy was concerned, and not from any question of nitrogen compounds, because it was always a simple matter, even if those compounds had been formed, to eliminate them.

Like all these matters in this country, it was left to the inventors of the apparatus to prove its value, and for the last 12 or more years I have been engaged on that work.

My company has supplied a very large number of apparatus, not only for the purpose mentioned in your notice of September 20th, but for many other therapeutic uses, and these apparatus have always been supplied under medical supervision.

The ozoniser in question, we understand, makes use of ordinary air as an ozonising medium. There is a great objection on the part of many who are best able to judge that the use of ozone under such circumstances is not as good or advisable, certainly for the treatment of suppurating wounds and sinuses, as ozone when made from oxygen. The reasons are too obvious to need discussion, and I, personally, should refuse to supply such an apparatus, as I have done on several occasions. It is true that it has the merit of cheapness and it obviates the necessity of the use of oxygen in cylinders, but the other disadvantages for the purpose mentioned are too obvious to need a comparison on the question of cost or convenience.

With regard to the point of ionisation—this point is common to any ozone apparatus using the brush or silent discharge.

As to the tests having shown a large increase of ozone produced by the apparatus in question over other methods, it would have been to the point if details of the comparison had been given. When I am able to tell you that an apparatus of my own invention some eight or nine years ago, which is still being supplied by my company in its original form, takes only some 6 or 8 watts to work it, you will realise that any comparison of efficiency as regards yield of ozone per kilowatt is a little bit out of place; and, in fact, I doubt very much whether any reliable comparison could be made, or, if made, would be of any value whatever.

The apparatus in question will, for the 6 or 8 watts, produce considerably more ozone than is likely to be necessary to be used on the worst case of suppurating wound.

Edward L. Joseph,
Director and General Manager, Ozonair, Ltd.

London, S.W.,
September 24th, 1918.

The Electrical Trades Union and Discharged Soldiers.

A correspondent sends us the following cutting from *John Bull* for September 14th :—

Intimidation.—A discharged soldier got employment under the Minister of Pensions as an electrician—his old trade. Sent to Chilwell, on arrival he was asked whether he belonged to the Electrical Trade Union. He did not—having lived 80 miles distant from any branch—but was quite willing to join, and paid 2s. 6d. proposition fee. Next day he was told he must be a member of the Union for three months before the men would work with him, and he had to leave at a moment's notice. It is difficult fitly to describe such treatment.

Our correspondent thinks that the extract will be of interest to readers of the Review. He considers that it will appeal "to any right, fair, just, and ordinary reasonable individual, but in these qualities, not to mention human sympathy, the Union is evidently lacking." He says that the action described reflects utter discredit upon members and officials alike, and that the concluding comment of *John Bull* is apt and right. He adds that "it is up to the duty, honour, and manhood of this Union to rectify and prevent any further occurrences" of the kind referred to.

The Percentage Error.

Mr. Bullen's article on percentage error is correct as far as it goes, but where more than one percentage is considered—as in the case of the potential transformers and current transformers of the meters—the subtractions lead to complications, and, as shown a short time ago in the case of complicated discounts, calculations involving additions and subtractions lead to error if not taken in the correct order.

To get over this, the best way is to give the "efficiency" of the meters or apparatus. The case given by Mr. Bullen would be 140 per cent. efficiency. Now it is a simple slide-rule calculation to work out: True units = 100 × (observed units/efficiency), therefore: Units for quarter = 100 × (400/140) = 287.

By this method, if the potential transformers had been given as 101 per cent. and the current as 98·5 per cent., the calculations are mple, and only a slide-rule need be used.

W. J. Minton.

London, N.W., *September 17th*, 1918.

LEGAL.

Factory Act Prosecution.

At Newcastle-upon-Tyne Police Court, on the 20th inst., Messrs. Swan, Hunter & Wigham Richardson, Ltd., were charged under the Factory Act with having failed to take adequate precautions properly to earth an electrically-driven punching machine at their Neptune shipyard, Walker-on-Tyne, and with having failed to protect the live cables.

Mr. W. B. Lauder, H.M. Inspector of Factories, stated that on August 2nd Samuel Dunbavin, aged 17, received an electric shock while working at the machine, and was killed. The machine had become charged with electricity owing to the insulating wrapping of the cable becoming bared and touching the top of the compensator. Had the machine been properly earthed it would not have become so charged.

Mr. H. Ingledew, on behalf of the defendant company, said the machine was overhauled in June, and it appeared to be quite in order. The machine had been worked night and day, and owing to the excessive vibration and the shortage of labour (half of the electricians having been taken away), the earthing wire had probably worked loose. No one regretted the accident more than did his clients.

The Magistrates imposed penalties of £50 and £5.

Lighting Order Prosecution.

At Rochdale, last week, the Rochdale Electric Co., Ltd., was summoned under the Lighting, Heating, and Power Order, 1918, for unlawfully using lights in its shop front. The Chief Constable pointed out that under the Order, which was made in April last, it was not permissible to have an artificial light of any description in either a shop window or shop front. The Order was quite distinct from the Light Restriction Order. A fine of 5s. was imposed.

BUSINESS NOTES.

Trading with the Enemy.—The *London Gazette* for September 20th contains further lists of persons and bodies in the following countries with whom trading is prohibited :—Brazil, Chile, Denmark, Greece, Mexico, Morocco, Netherlands, Netherlands East Indies, Spain, and Sweden.

Co-operative Export Trade Expansion.—At a meeting held in Manchester, last week, it was resolved to proceed with the formation of a British Manufacturers' Corporation for After-the-War Trade, as suggested by Sir Charles Mandleberg, whose proposals have been fully described in our pages. It is stated that 300 firms have already given their support, and it is expected that the number will reach 1,000 after the Corporation is established. A Provisional Committee has been appointed, with Sir C. Mandleberg as chairman. An annual subscription of £200 per member is mentioned.

New Canadian Industries.—Our Special Correspondent in Canada writes :—"The *Canadian Chemical Journal* for July gives some particulars regarding the industries which are springing up around the Shawinigan Falls, near Montreal.

"Canadian Ferro Alloys, Ltd., will have six furnaces of a daily capacity of 17 tons of ferro alloys each.

"The Canadian Aloxite Co. has 14 furnaces employed in turning out abrasives.

"The Canada Carbide Co., the Canadian Electrode Co., and the Canadian Electro Products Co. are other firms taking power from this source.

"Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, announced a few weeks ago that the Provisional Government had authorised the development of 130,000 H.P. at Nipigon, in New Ontario, which is in the north-western portion of the Province. There are great mineral resources in that region, and it is with the object of enabling these to be developed that the authorisation has been granted. Survey work is already being carried out in connection with this scheme by the Commission. The development of some 25,000 H.P. at High Falls, on the Rideau River, not very far from Ottawa, has also been approved of. The Power Committee of the House of Representatives at Washington has been informed that at the end of 1919 the Hydro-Electric Power Commission will be able to supply the United States with 200,000 H.P., to be increased by 30,000 H.P. per month until 300,000 H.P. is reached.

"From 75 to 80 per cent. of the power at present being supplied by the Commission, which amounts to about 200,000 H.P. altogether, is used in the production of munitions, and, to enable this great demand to be met, cities have had to cut down their lighting loads and generally to economise in other ways; for instance, 12,000 H.P. has been set free in Toronto alone, so that the supply for munitions purposes might be met."

Trade Announcement.—The Export Sales Department of the Western Electric Co., Ltd., has been removed to offices at Oswaldestre House, Norfolk Street, W.C. 2. (Tel.: City 3400.)

Non-Ferrous Metal Industry Act.—The *London Gazette* for September 24th contains a further list of licences granted under this Act.

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Catalogues.—Messrs. Siemens Bros. & Co., Ltd., Palace Place Mansions, Kensington Court, London, W. 8.—Pamphlet, No. V 535, of 12 pages, containing a full account, with diagrams and half-tones, of the Siemens vacuum arrester for the protection of telegraph and telephone installations and their users against H.T. discharges.

Book Notices.—We have received a copy of the first number of the *Industrial League Journal* (September, 6d.), which is to be issued quarterly, for furthering the work of the Industrial League (56, Victoria Street, S.W.). There is a "Foreword," by Mr. G. H. Roberts, M.P., Minister of Labour, who is a member of the League Executive, and the other contents include a report of proceedings in connection with the formation of the Bradford District Branch last May; an article by Mr. H. G. Williams on "The Need and Possibilities of Increased Production;" and a full report of the first of a series of conferences (on the subject of Workshop Committees) held at Westminster in April. Copies of the *Journal*, and of other literature of the League, are available for general distribution.

"The Central" for June contains a portrait and memoir, by Prof. Dalby, of Sir John Wolfe Barry, the late chairman of the Delegacy; there is also an article on "The Organisation of the Technical Worker," and the remainder of the issue consists of "Old Student Notes."

"A Small Book on Electric Motors, C.C. and A.C." By W. Perren Maycock. Pp. ix. + 192; 128 figs. London: Sir Isaac Pitman and Sons, Ltd. Price 5s. net.

"Modern Engineering Measuring Tools." By Ernest Pull. Pp. viii + 115; 110 figs. London: Crosby Lockwood & Son. Price 4s. 6d. net.

A Barcelona Lamp Company.—The Barcelona company styled "Wolfram, Fabrica de Lamparas Electricas, S.A.," has changed its name to "Fabricacion Nacional de Lamparas Electricas, S.A.," increasing at the same time its capital to 1,000,000 pesetas. Its managing director bears the cognomen of Mauricio (Mauritz) Grisau.

U.S. Trade in South America.—The *Times* Buenos Aires correspondent says that the United States is preparing for trade expansion after the war, and elaborate plans have been made to increase the Consular Service in South America. The most experienced officers will be assigned to these posts, and the number of Consulates in Argentina and Chile will probably be doubled.

Bankruptcy Proceedings.—William T. Smith, electrical and mechanical engineer, Bolton.—The adjourned examination of this debtor was down for September 18th, at the Court House, Mawdsley Street, Bolton, but the case was again formally adjourned.

Brockie, James, mechanical engineer, 41, London Road, Forest Hill, Kent.—Application for discharge to be heard at Greenwich, October 18th.

Exhibition of "Key" Industries.—By permission of the Ministry of Munitions, an Exhibition of New British and "Key" Industries, organised by the Industrial Section of the Tariff Reform League, will be held at the Central Hall, Westminster, London, next month. The Exhibition will be opened, by ticket only, on Monday, October 7th, and to the general public, admission free, on and after Tuesday, October 8th. It will remain open until October 22nd, after which it will be shown in Manchester and other leading provincial centres of population. The object of the Exhibition is to illustrate the facts respecting the more important of the so-called "key" or "pivotal" industries recommended for special treatment by the Government Committee on Industrial and Commercial Policy after the War. The Committee has secured the active co-operation and assistance of important firms interested in the industries concerned, many of whom have contributed exhibits and expert information. Any reader interested in the matter should communicate with Mr. Edward J. Duveen, chairman of the Industrial Section, Tariff Reform League, 7, Victoria Street, London, S.W. 1.

LIGHTING AND POWER NOTES.

Barnes.—Proposed Loan.—The U.D.C. has applied to the L.G.B. for a loan of £1,220, for electrical extensions to the refuse destructor.

Belfast.—New Generating Station.—Last week members of the Corporation, Sir John Snell, and Mr. J. H. Rider, consulting engineers, and officials of the Harbour Board paid a visit to the site of the new generating station at Queen's Road, where luncheon was served. Having outlined the history of the electricity undertaking, the chairman said the question of coal economy was involved in the development of the department. The East Bridge Street station contained 20 generating sets, which were out of date, and the silting-up of the Lagan interfered with condensation. It was estimated that the coal consumption at the new station would be less than 2¼ lb. per unit, compared with 4½ lb. at East Bridge Street. Sir John Snell said the new station was being laid out to house 25,000-kw. generators. The chairman of the Harbour Board said he hoped that eventually the Corporation would have to spend one million pounds on developments.

The E.L. Committee has recommended the Corporation to accept tenders, amounting to £200,000, for plant in connection with the new generating station.

Blackburn.—Year's Working.—The annual report states that there was a profit of £4,472 on the Corporation electricity undertaking for the past year.

Chatham.—Price Increase.—The Kent E.P. Co. has increased its charges for electricity as follows:—For power, to 2¼d. per unit; lighting, from 6d. to 8d. per unit; for supply by contract for power, and weekly, monthly, and special accounts for lighting, by 20 per cent.

Dublin.—Fuel Shortage.—A consultation between the Dublin Industrial Development Association, the E.L. Committee, and the Irish Coal Controller has resulted in the following proposals for economy in lighting. If the proposals are adopted the Controller has agreed to supply enough coal to carry them into effect, even if he has to commandeer it from other sources. The proposals include the closing of shops at 5 p.m., or, alternatively, to close between 3.30 and 5.30, and to remain open until 9.30 p.m.; offices to close at 4 p.m.; private houses to be rationed as follows:—1, 2 or 3 rooms, 110 units per annum; 4-6 rooms, 160; 7-9 rooms, 210; over 9 rooms, 250 units, or two-thirds of the supply in 1914; theatres to close by 10.30 p.m.; picture theatres to close between 3.30 and 5.30; out-door theatre lighting to be prohibited, and the total lighting to be reduced by 25 per cent. compared with 1914; factories to have preference for energy for power purposes, but factory lighting is not to be more than 80 per cent. of the pre-war lighting. It was stated that the contractor would not enter into any contracts for coal this year, owing to the critical position.

Similar proposals to those made at Dublin for economy in lighting were made at a special meeting of the Belfast Corporation last week.

Falkirk.—Mains Extensions.—Subject to sanction being obtained, the E.L. Committee has decided to borrow £5,000 for the purpose of extending the mains at Pleasance, and to accept the tender of Callender's Cable and Construction Co. for the work.

Ireland.—Water Power.—Mr. W. Vaux Graham, of Queen Anne's Gate, S.W., has been instructed by the Water Power Committee of the B. of T. to examine and report on the available water power in Ireland, and its possibilities in relation to production of electricity, peat fuel, &c.

Leighton Buzzard.—Proposed Electricity Supply.—The U.D.C. has been informed by the Luton T.C. that there is no immediate prospect of electricity being supplied within the area of the U.D.C., but the matter will be considered later.

London.—Price Increase.—The City of London E.L. Co. has substituted the following for its present charges, the advance to take place from the end of September:—Lighting, 5d. per unit; heating, 1½d.; power 1d., plus 10s. per quarter per kw. capacity of the connected demand; all charges are subject to 60 per cent. war increase.

Hackney.—E.L. Surplus.—Of the surplus on the B.C. electricity department, amounting to £10,913, £7,327 is to be transferred to the relief of rates and £3,586 to the reserve fund for the repairs necessary at the generating station.

Hammersmith.—In recommending the B.C. to purchase three 111-microfarad condensers, at a cost of £1,875, the E.L. Committee states that one static condenser was put into commission at the Cottage sub-station, as an experiment, at the end of July last, and has been in continual operation since then. The engineer reported that tests had proved this method of meeting the difficulty of extensions to be not only feasible but economical, it having effected a saving of 18 units per hour. It would also be an advantage to have a condenser of this type on hand for rectifying the low power factor frequently obtained on consumers' premises with a motor load in another part of the district, and so temporarily obviate the necessity of laying new mains.

Londonderry.—Street Lighting.—The Corporation has adopted a scheme for the conversion of 184 lamps to one-third of their original power, or 100-c.p. for each lamp.

Lowestoft.—Price Increase.—The T.C. has advanced the charges for electricity by 1d. per unit for lighting and by 10 per cent. for power.

Maidstone.—Wages.—The application of the electricity works employés for a war bonus of £1 per week, plus 12½ per cent. on total earnings, has been granted by the Arbitrator appointed by the Chief Industrial Commissioner. The award is to date from June 1st, 1918. The members of the E.T.U. have asked for a further 3s. 6d. per week on the award of the Committee on Production.

Middlesbrough.—Electricity in Shipyards.—The Corporation has decided to supply electricity to the shipyards of Sir Raylton Dixon & Co., on Tees-Side. The cost of the mains, transformers and switchgear is estimated at £10,000. Under this scheme half a million units per month will be supplied, and also all the energy required for extensions at Cleveland Dockyard for some years to come.

Mytholmroyd.—Prov. Order.—The U.D.C. has had under consideration applications from the Electrical Distribution of Yorkshire, Ltd., and the Halifax Corporation for a prov. order

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for the supply of electricity within the area of the U.D.C.. It was decided to oppose the application of the E.D. of Y. Co., and to consent to that of the Halifax Corporation.

Melksham.—Price Increase.—The E.L. Co. has notified the U.D.C. of its intention to advance the price of electricity from 8d. to 9d. per unit.

Rotherham.—Purchase.—The Corporation has purchased the E.L. undertaking of the Mexborough and Swinton Tramways Co. for £45,000. The date of the transfer is fixed for October 1st.

South Africa. — Johannesburg. — The Council has arranged to supply electricity to the Star Milling Co. and the stone-crushing works of Mr. G. S. Stowe at 1½d. per unit for a minimum of 100,000 units per annum ; the supply is not to be taken between 5 p.m. and 11 p.m.

Swansea. — Mains Extensions. — Messrs. Richard Thomas & Co. propose to lay mains for the supply of electricity to their Cwmbwria and Cwmfelin steel works. The Corporation is extending its supply to the Landore foundry, at a cost of £350, and to the Morriston foundry, at a cost of £385.

Tewkesbury.—Proposed Price Increase.—The E.L. Co. has applied to the B. of T. for permission to advance the maximum price of electricity to 10d. per unit, but will not charge more than 8½d. without the sanction of the T.C.

United States.—Water-Power Development.—The *Electrical World* states that last year about 1,058,000 H.P. of hydro-electric plant was built and installed, representing a saving of 8½ million tons of coal and a corresponding amount of labour, production, and transport.

Weybridge.—Price Increase.—The U.D.C. has decided to oppose the application of the E.L. Co. for permission to increase the price of electricity from 7d. to 8d. per unit, on the ground that when the charge was advanced to 7d. the company promised to ask for no more during the year.

Willesden.—Price Increase.—The E.C. has recommended that the charges for electricity be advanced by an additional 10 per cent., and by 2d. in the 1s. in the case of supply by slot meter.

Access to Meters.—In cases where the electricity department has been unable to obtain access to meters, the Committee has decided to charge a minimum of 13s. 4d. per quarter.

TRAMWAY AND RAILWAY NOTES.

Continental.—Switzerland.—The receipts of the 35 Swiss tramway companies fell in 1914 and 1915 to 16,000,000 fr. (£640,000), but in 1916 they rose to 19,000,000 fr. (£760,000), and in 1917 to nearly 23,000,0000 fr. (£920,000). The profits for 1917 were 4,500,000 fr. (£180,000), as compared with the 1913 profits of 3,500,000 fr.

Clitheroe.—Proposed Light Railway.—The Light Railway Commissioners have informed the R.D.C. that they will submit the Longridge and Hellifield light railway scheme to the B. of T., provided the cost does not exceed £6,000 per mile, instead of £10,000, as estimated by the promoters.

Dewsbury.—The local manager of the Dewsbury and Ossett tramways has informed the T.C. that his men have been called up to such an extent that, unless time is allowed to train others, certain sections of the service will have to be suspended.

Edinburgh. — Queensferry Extension. — The T.C. has decided to withdraw the Queensferry tramway scheme, which was to have been the subject of an inquiry next month.

Electric Vehicle Progress.—The following proposals are before the municipalities for the purchase of electric vehicles :—Maidstone, one 3½-ton tipping wagon, to cost £1,200 ; Gloucester, one lorry, £1,200 ; Sheffield, chassis, for use as tower wagon for the tramways department ; Hull, tipping wagon, £1,165 ; Glasgow, two 2-ton vehicles, £1,168 each, and two 3½-ton vehicles, £1,432 each ; Burnley, electric vehicle for the electricity department. Ilford U.D.C. has purchased a 3½-ton "Orwell" vehicle from Mossay & Co., at £1,122. Manchester Electricity Committee has obtained tenders for a 3½-ton electric tipping wagon.

A Sub-Committee of the Willesden U.D.C. is considering the question of garage accommodation and facilities for charging three electric vehicles for the collection of refuse.

Glasgow.—Fuel Economy.—In a statement to the employés of the tramway department, Mr. J. Dalrymple, the general manager, said that by careful driving the undertaking could save 10,000 tons of coal per annum ; this would represent about £10,000, half of which would be handed to the drivers.

London.—L.C.C.—The L.C.C. and the Metropolitan Electric Tramways have arranged for an additional through service *viâ* Stamford Hill.

At one of the power stations of the Council, coke is being extensively used, and arrangements have been made for the supply of from 100 to 1,000 tons of coke per week for 12 months.

Wages.—At a Conference, last week, between the War Cabinet and the N.U.R., an agreement was arrived at regarding the wages of railway workers. The terms of settlement include an advance of 5s. per week to men and women workers over 18 years of age, and 2s. 6d. per week to those under 18 ; the Government promised to expedite the Committee on the question of equal pay for male and female labour ; railway shopmen are to receive the same awards as the engineering industry ; and a committee representing railway managements and workers is to be set up to grant automatic advances according to the exact rises in the cost of foodstuffs. After two conferences on the award, the drivers' and firemen's organisation decided to accept it under protest, as they felt that "the offer did not cover the increased cost of living peculiar to its members." Thus the true significance of the new principle in fixing increases of wages, which has been introduced by the Government, will not be missed by wage-earners, and its recognition is not likely to be confined to railway men.

Strike.—It is stated that among the railway workers who have struck work are some of the drivers of the electric trains on the North London Railway.

Owing to the crowded nature of the tramway services in West London, due to the railway workers' strike, it is stated that only munition workers, on showing their passes, were permitted to travel in cars in the munition areas.

Underground Railway Accidents.—By the breaking of an axle near Lancaster Gate Station on the Bakerloo Railway, on Saturday afternoon, traffic was disorganised for some little time.

Due to a fire on the Hampstead and Highgate Underground Railway, trains in both directions were held up for an hour on Saturday evening.

Middlesbrough. — Tramway Purchase. — The Corporation has decided to purchase the town tramways from the Imperial Tramway Co.

Morecambe.—Electric Omnibuses.—It was stated at a meeting of the Corporation that, although the Council had last session obtained an Act of Parliament enabling it to run electric omnibuses, the Tramways Committee had not been able to induce the Ministry of Munitions to issue a priority certificate for the purchase of vehicles.

Oldham.—At a meeting of the Tramways Committee, the general manager stated that the ordinary service was not maintained owing to the absence of drivers from duty. On one day 34 men were away, and during March 1,620 car-miles were lost through this cause. The question of the substitution of women was dropped, as it was thought the gradients were too steep.

Rochdale.—Flood.—Last week the Mellor Street electricity works were flooded owing to the abnormal rise of the River Spod. The works are built on a concrete raft in a pocket of the river, and the water came through the foundations, filled the ash-pits, and ran into the boiler houses. Pumping was resorted to, but the tramway service was suspended for 2½ hours in the evening, although a restricted service was run in the morning.

Rail Remodelling. — According to the *Tramway and Railway World*, the Woods-Gilbert Rail Remodelling Co., Ltd., has been formed to acquire from the Woods-Gilbert (British) Rail Grinding and Milling Co., Ltd., its whole business of tramway rail remodelling, for which it holds the exclusive patent rights in Great Britain. The company's chief business will be to renovate *in situ* tramway rails which are considered by the owners to be worn out. The 5,329 miles of tramway track in Great Britain are, in many cases, in a defective condition, and there is a great demand for the Woods-Gilbert system of re-modelling. To meet this demand the Ministry of Munitions has granted authority for the construction of five machines, in addition to the three at present at work. The cost of these new machines will be between £2,200 and £2,500 each, and three such machines have already been put in hand, and will be ready for delivery within the next three months. These machines are already booked up on contracts which will keep them employed for fully 12 months. The system was fully described in the Electrical Review of October 13th, 1916.

TELEGRAPH AND TELEPHONE NOTES.

China.—The *Evening News* states that a contract was recently concluded between the Chinese Minister of the Navy and the German Telefunken Co. for the construction of radio-telegraphic stations throughout the Republic. The agreement has been signed with a Danish firm, which has undertaken to loan £500,000 for the purpose, covering a period of 30 years, during which the Copenhagen concern, one of whose principals at one time acted as manager for the Telefunken company in Shanghai, will control the various installations, with the assistance of Chinese officials.

Germany.—An official notice was issued early in September offering rewards for the denunciation of any unauthorised wireless transmitting or receiving stations in Germany. A search for stations is constantly being made, and in case of discovery the apparatus is seized and the owner punished. The amount of the reward is fixed in each case ; it may be £5 or more.

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Grimsby.—The *Leeds Mercury* states that on September 14th the manual telephone service gave place to an installation of automatic telephones on the Siemens system. The conversion from a manual to an automatic exchange was commenced in October, 1914, but the war intervened and the work was stopped, until the need for manual switchboards at the Front led the authorities to the conclusion that if they pushed on with the automatic exchange the old Grimsby installation could be utilised elsewhere.

CONTRACTS OPEN AND CLOSED.

OPEN.

Barnes.—U.D.C. 500-KW. rotary converter, with transformers and switchgear. Electrical Engineer.

Manchester.—October 4th. Electricity Department. High and low-pressure steam and feed pipework, &c.. at Stuart Street.

Portsmouth.—October 15th. Tramways Committee. Six months' supply of stores, including various electrical items. See "Official Notices" to-day.

CLOSED.

Barnes.—U.D.C. :—

E.H.T. cable.—Siemens Bros. & Co., Ltd., £885.

Government Contracts.—List of new contracts placed in August, 1918 :—

WAR OFFICE.

Chatterton's compound.—Gutta-Percha Co.; India-Rubber, Gutta-Percha and Telegraph Works, Co., Ltd.
Dynamos and engines.—Belliss & Morcom, Ltd.
Fans, &c.—James Keith & Blackman Co., Ltd.
Generating sets.—Brush Electrical Engineering Co., Ltd.; P. Cruikshanks, Ltd.; Crossley Bros. Ltd.; Day Motor Co., Ltd.; F. Gilman; Johnson, Hurley & Martin, Ltd.; Lancashire Dynamo & Motor Co., Ltd.; R. A. Lister & Co., Ltd.; A. Scott & Partners.
Magnetos.—Fellows Magneto Co., Ltd.
Motors, &c.—British Thomson-Houston Co., Ltd.; E. Brook, Ltd.; Electrical Construction Co., Ltd.; General Electric Co., Ltd.; Igranic Electrical Co., Ltd.; Maudsley's, Ltd.; F. Parkinson & Co.; Rhodes Motors, Ltd.
Transformers.—Brush Electrical Engineering Co., Ltd.

H.M. OFFICE OF WORKS.

Electric lamps.—Pope's Electric Lamp Co.

POST OFFICE.

Telegraph apparatus.—A. W. Gamage, Ltd.; India-Rubber, Gutta-Percha and Telegraph Works, Co., Ltd.; H. White & Co.
Telephone apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.; Gent & Co., Ltd.; Western Electric Co., Ltd.
Boards for telegraph sets.—Tyer & Co., Ltd.
Battery boxes.—Siemens Bros. & Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Telegraph and telephone cable.—General Electric Co., Ltd.; Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Cases for telegraph sets.—Siemens Bros. & Co., Ltd.
Secondary cells.—Hart Accumulator Co., Ltd.
Retardation coils.—Peel-Conner Telephone Works, Ltd.
Combiners.—J. Barker & Co., Ltd.
Cords for telephones.—B. I. & Helsby Cables, Ltd.; Peel-Conner Telephone Works Co., Ltd.
Stoneware ducts.—Albion Clay Co., Ltd.
Galvanometers.—India-Rubber, Gutta-Percha & Telegraph Works, Co., Ltd.
Insulators.—J. Bourne & Son, Ltd.
Insulator spindles.—Bayliss, Jones & Bayliss, Ltd.
Suspenders for cable.—I. N. Lyons, Ltd.
Troughing.—Doulton & Co., Ltd.
Switchboard wire.—Peel-Conner Telephone Works, Ltd.
Extension of the equipment at Liverpool Bank Telephone Exchange, and provision of an exchange equipment at Liverpool Central Exchange.—Western Electric Co., Ltd.
Solder.—E. Austin & Son.—B. I. & Helsby Cables, Ltd.
Galvanised iron wire.—Whitecross Co., Ltd.

INDIA OFFICE, STORE DEPARTMENT.

Battery plates.—Chloride Electrical Storage Co., Ltd.
Cells.—General Electric Co., Ltd.
Insulator cups.—Bullers, Ltd.
Wire.—R. Johnson & Nephew, Ltd.; Whitecross & Co., Shropshire.

London.—HAMMERSMITH.—Electricity Committee :—

Two impellers' spindles, &c., for pumps for condensing water supply, £110.—Rees Roturbo Manufacturing Co., Ltd.
One impeller spindle, &c., £63.—Gwynnes, Ltd.

FORTHCOMING EVENTS.

Municipal Tramways Association (Inc.).—Friday, September 27th. At 11 a.m. At the Town Hall, Leicester. Annual general meeting.

Junior Institution of Engineers.—Friday, September 27th. At 7.30 p.m. At 39, Victoria Street, S.W. Lecture on "The Most Important Piece of Machinery in the World," by Mr. P. Marshall.

Monday, September 30th. At 3 p.m. Visit to Messrs. Carlo Gatti and Co.'s Ice Manufacturing Plant, 120, Great Cambridge Street, Hackney Road, E.

(North-Eastern Section).—Tuesday, October 1st. At the Mining Institute, Newcastle-on-Tyne. Annual general meeting.

Industrial Reconstruction Council.—Wednesday, October 2nd. At 4.30 p.m. At Saddler's Hall, Cheapside, E.C. Address on "Commerce and Industry After the War," by the Rt. Hon. Sir Albert Stanley, M.P., President of the Board of Trade.

Electrical Power Engineers' Association (Northern Division).—(Manchester Section).—Thursday, October 3rd. At 7 p.m. Smoking concert at Grosvenor Hotel, Deansgate, Manchester.

Salford Technical and Engineering Association.—Saturday, October 5th. At 7 p.m. At the Royal Technical Institute. Paper on "Railway Electrification," by Mr. S. J. McCann.

NOTES.

Volunteer Notes.—LONDON ARMY TROOPS COMPANIES, ROYAL ENGINEERS (V.). - Headquarters : Balderton Street, Oxford Street, W. 1.

Corps Orders No. 40, by Lieut.-Colonel C. B. Clay, V.D., Commanding :—
Captain of the Week.—Capt. E. G. Fleming.
Next for Duty.—Capt. W. Hynam.
Sunday, September 29th.—Commandant's Parade, at Waterloo Station, 8.45 a.m. (opposite No. 9 Platform), for work at Esher. Dress: Drill order, without rifles. Mid-day and tea rations to be carried.
Monday, September 30th, to Saturday, October 5th.—Drills as usual.
Sunday, October 6th.—Annual Musketry course at Pirbright. Parade, Waterloo Station, 8.45 a.m. Dress: Drill order, with rifles and side arms. Mid-day and tea rations to be carried.

C. HIGGINS, *Capt.* R.E., *Adjutant.*

A Technical Commission for German Copper Supply.—The president of the general meeting of the German Association of Metal and Mining Engineers (Gesellschaft Deutscher Metallhütten und Bergleute), recently held in Berlin, announced the formation of a special commission composed of expert members to consider and report on the question of securing a future supply of copper, says *Metall und Erz*. The experiences of the war have shown with impressive clearness the necessity of making the Fatherland independent of imports of copper. Every possibility in that direction will be carefully and thoroughly considered by this Commission, which was suggested, and which will be directed, by the Association.

British Oil.—Boring operations are expected to commence shortly on sites near Sheffield and Chesterfield, by Messrs. S. Pearson & Sons. It is stated that the cost of drilling a single bore under the most favourable conditions is between £30,000 and £40,000, and that a 15-in.-diameter, 4,000-ft.-deep bore is about to be commenced. In the Derbyshire district, oil is most likely to be found at a depth of 2,000 ft. It is hoped to get from this district a crude oil heavily charged with benzine, paraffin, and other valuable by-products, which will be distilled before the heavier product is sent to the Admiralty for naval use as fuel.

Fuel Economy.—According to the daily Press, the Coal Controller has issued the following statement :—"A large number of experts have been appointed to advise steam-power users how to eliminate waste. It will, however, take several years to recover the whole of the loss that is going on, as it is impossible to install more efficient plant during the war. Another cause of waste is the employment of unskilled stokers. Saving can be effected, without drastic alteration to plant, in the following directions :—Obtaining greater efficiency in the combustion of fuel ; education of stokers ; utilising the hot gases to better advantage ; using exhaust steam for feed-water heating ; more efficient utilisation of steam generated ; using condenser discharge for boiler feed ; effective lagging of steam pipes ; and disconnecting steam pipes not in use." Of the 45,000 users of steam plant in Great Britain, 364 firms have been carefully scrutinised and reported upon, and it is estimated that a saving of approximately 106,000 tons of fuel will result.

Electrolytic Disinfecting Fluid.—During the year 1917, according to the report of Dr. F. W. Alexander, Medical Officer of Health to the Borough of Stepney, 27,900 gallons of electrolytic disinfectant were manufactured, making 55,800 gallons as diluted for distribution. The cost was for materials £75 ; electrical energy, £45 ; total, £120. Since the installation of the plant, a period of 12 years, 473,469 gallons of fluid have been manufactured at a cost for electricity of £535 and materials £531 (about ½d. per gallon). The report states that, in spite of adverse criticism, the process has been a great success during the whole period of its installation.

Fuel Economy.—The *Electrical Review* of Chicago states that coal conservation to an astonishing degree is the result of the discontinuance of 24 privately operated plants in Chicago, and the consequent operation of their systems by central station service. The estimated saving in coal occasioned by this change reaches the excellent total of 54,840 tons a year. By these plants taking over central station service a total daily requirement of 2,172,000 KW.-hours has been added to the Commonwealth Edison Co.'s operating system—a figure that approximates an addition of nearly 17,000 H.P.

In addition to the above, the power division of the Commonwealth Edison Co. has closed, since January 1st, some 48 contracts calling for large installations on the company's lines. The estimated annual coal saving made by these plants using central station service is approximately 100,545 tons. It also means a service addition of 8,190,000 KW.-hours, or 47,663 H.P.

The Wild-Barfield Furnace.—In our issue of Sept. 20th we referred to the utilisation of "the remarkable change in the molecular constitution of steel at the temperature of recalescence" in connection with the hardening of steel. Messrs. Automatic and Electric Furnaces, Ltd., write pointing out that their process takes advantage of the correct determination of the *decalescent* point, and that our use of the term "recalescence" is misleading. We agree that this is so, for though both expressions relate to the same temperature, the term "decalescence" indicates that that critical point is reached with a rising temperature, the condition which we had in mind.

Copper Discovery in Russia.—According to a Reuter dispatch from Amsterdam, in the Government of Kursk a great copper lode has been discovered bearing 58 per cent. of ore. Preparations are going on for working the deposit.

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The Coal Shortage.—The seriousness of the coal situation was further explained by Sir Albert Stanley, President of the Board of Trade, at a conference of London and home county mayors at the Mansion House on Friday last. "The fuel problem is an exceedingly grave one," he said, the shortage of coal being about 36,000,000 tons. By the present rationing scheme it was hoped to save something like eight million tons, which would still leave a deficit of 28 million tons, the imperative need for economy would therefore be appreciated. In March last we were confronted with the immediate and unanswerable demand for more men for the Army. That meant the withdrawal of 100,000 men from the mines. Because the Americans were coming over in such large numbers that was no reason why men should be withdrawn from the Army to be returned to the mines. Every man, be he British, American, French, or Belgian, was needed at the front. Sir Albert asked for the help and co-operation of all consumers in economising fuel of all descriptions; there was no surplus of anything in the country at the present time, and it would be useless to economise in coal consumption, only to consume other fuels and substitutes in place of it. An all-round economy of every class of fuel would have to be made. We could hardly ask the miners to make sacrifices by working longer hours and producing greater outputs if consumers would not make correspondnig sacrifices by consuming less fuel.

Electric Arc Welding.—Mr. R. E. Kinkead's paper in the *Journal*, Cleveland Engineering Society, is confined almost entirely to the use of electric arc welding in locomotive shops, and a paper by E. Wanamaker is also submitted. The object of this paper is to show how electric are welding can assist the war problem in increasing the efficiency of locomotives. It describes the portable plant used by the Rock Island Railroad Co., where a number of such portable plants are used, with the advantage that they can be transferred from one point to another, and thus prevent any congestion. There is a lengthy table comparing in respect of cost electric welding with the old methods and with gas welding (oxy-acetylene) for practically every part of the locomotive. In some cases the reduction in cost is very great, as for example:—

	Old Method.	Gas Welding.	Electric Welding.
	$	$	$
Cross heads	356.40	120.23	37.73
Wheel spokes ...	1,276.80	113.08	35.08
Plugging and building up holes ...	349.69	280.94	140.47
Steam pipes	3.79	5.12	2.12
Flat spots on tires ...	99.86	95.77	29.77

It is estimated that the use of 150 portable plants would save $1,000,000 per annum. Similar portable plants have been sent over to France, and are there in use to a large extent. It is mentioned that new caulks to horse-shoes can be replaced without removing the shoe from the horse's hoof. In the discussion many questions were asked in respect of fusing steel and cast-iron together. The author answered that it could be done, but great difficulties arose in practice owing to contraction of the cast-iron, and by the absorption of carbon by the steel. Brass cannot be welded electrically owing to the zinc which volatilises immediately, but bronze can be welded to steel most satisfactorily. A method of welding copper wires together by using a ferrule slipped over the wire was stated to give good results. Where it was desirable to localise the heat, metal electrodes are preferable to carbon. The use of the arc for removing sand spots out of castings is described. It is stated that manganese steel can be repaired by welding, and the steel put in by the arc contains 12 per cent. of manganese.

Testing Metals by Means of X-Rays.—In *Stahl und Eisen* appears an article describing the physical nature, properties, and production of X-rays, so far as these are required for the testing of metals. Hard rays produced from, for instance, a Coolidge tube of spark-gap 27—42 cm. (equivalent to a potential difference of 180,000 to 240,000 volts) are best suited for the work. Blowholes have been detected in masses of steel 10-12 cm. thick. Visual examination with the fluorescent screen is not possible for sheets of metal thicker than 2 or 3 mm. Larger masses must be investigated photographically, with the aid of a calcium tungstate intensifying screen placed in close contact with the film. To minimise the disturbing effect of secondary radiations the sample should be surrounded by a layer of lead cast around it. This protection must be thicker as the sample increases in size; for very thick specimens a layer 15 to 20 mm. thick is required. For investigating special portions of metal, secondary radiations are best excluded by placing a thick lead tube of sufficient diameter above the region with another of shorter length between the specimen and the plate. This plate is made with a thick and very rich emulsion, which requires a much longer time of development than an ordinary plate, a glycine developer being recommended. A high-tension step-up transformer giving 120,000 to 150,000 volts is, it is stated, far better than an induction coil as a source of energy for the Coolidge tube. To minimise risk in such work the tube should be placed in a box with a thick lead lining and operated from another room, a small lead-glass window being provided for observation. The depth of flaws may be measured by making two exposures on the same plate with the tube moved horizontally a known distance. The distance apart of the two shadows then allows the depth to be calculated if the distance of the plate from the anti-cathode of the tube is known.

Electric Pump Control.—It appears, according to the *Financial News*, that in Germany trouble has frequently been experienced in connection with the electrical control of pumping motors. These were generally governed by automatic depth-actuated devices fixed at the reservoir, which cut out the motor as soon as the water had reached the required height. In a leading German paper an account is given of the Wolf apparatus recently installed at Schweinsburg, on the River Pliesse, Saxony, which so far has given complete satisfaction. An electric motor is direct-coupled to a centrifugal pump, close to which a large air vessel is fixed on the delivery pipe. On the top of this air chamber is a switch. A closed cylindrical tank is fixed at the other end of the delivery pipe, provided at the top with a small fitting, to which is attached an air release pipe. As soon as a certain pre-determined quantity of water is drawn off from the tank the air pressure in the switch-operating chamber is released, and the starting switch is closed by a spring. In plants of fairly large size the air release puts a relay circuit in action and the switch is closed by means of a positive electro-magnetic device. The pump at once commences to deliver water until the storage tank is filled, when the increased head of water compresses the controlling spring, which in turn opens the switch. It is reported that one of the largest German railways has adopted the method in connection with its locomotive supply tanks. According to recently published figures, nearly 3,500 gallons of water per hour can be delivered to a height of roughly 110 ft. at an expenditure of under 3¾ KW. per hour.

A Large Electric Crane.—In the *American Machinist* of September 21st a description is given of one of the largest electric travelling cranes ever built, which was recently shipped from the shops of the Alliance Machine Co., Alliance, Ohio, and required 16 freight cars for its transportation. Notwithstanding its huge size and the many unusual problems which were involved in its design and construction, because of the large loads to be handled, the wide variations in hoisting and lowering speeds, and the necessity for extreme accuracy of control, the crane was completed in a period of approximately nine months.

The total lifting capacity of the crane is 431 net tons, of which a weight of 336 tons is handled by the main hoist, 90 tons by the first auxiliary hoist, and 5 tons by the second. When installed this crane will occupy a position above two similar cranes of 300 tons capacity each, these latter being now under construction at the Alliance plant.

The main hoist is designed to secure accurate control, and for this reason the main trolley carries two drums driven by two trains of gearing acting together, thus eliminating the possibility of a swinging movement being imparted to the load. Both dynamic and jackshaft braking are employed in the special braking apparatus, which is so designed and arranged as to allow the operator to lower the load ¼ in. at a time. The hoisting and lowering speed under full load is 12½ ft. per minute. The main hoist is operated by two 200-H.P. motors, ensuring unusual safety of operation, as in case of emergency one motor can for a short time handle the full load alone. The two motors are coupled together to avoid any variation of speed. The auxiliary trolley, which is entirely independent of the main trolley, is of special design to meet the specifications in regard to speeds of the two separate hoists which are carried upon it; these speeds vary from 2 to 45 ft. per minute, and are controlled by a special magnetic clutch and reduction gearing. The crane runway is 120 ft. above the ground level, and the maximum lift is 100 ft. The span of the bridge is 90 ft. 4 in., and that of the trolleys 18 ft. The main trolley carries an 80-H.P. motor for the traverse, while a 30-H.P. motor serves the same purpose for the auxiliary, the speed of the traverse being about 45 ft. per minute.

The bridge is carried by 32 wheels, 30 in. in diameter, running upon a double runway. Two 50-H.P. motors acting independently supply the motive power, which is transmitted through one pair of wheels at each corner of the bridge, or eight wheels in all. The trolley and bridge trucks are designed to oscillate in all directions to compensate for any deflection caused by the load. The height from the bottom of the main hoist-hook block to the top of the block is 12 ft.

A Week-End at Blackpool.—The members of the Blackpool branch of the Electrical Trades Union, comprising practically the whole of the electricians working in the town, struck work last week-end, owing to a dispute which had arisen over the payment of war bonuses to apprentices. The trouble concerned an award of the Committee on Production, and it was agreed to submit the points at issue to Mr. L. Tate, secretary of the National Federated Electrical Association. He decided in favour of a bonus of 6s. 6d. per week for youths under 18 years of age, and 10s. 6d. per week for those over that age, to date from May 24th last. This bonus was not paid, however, and, following a fortnight's notice, the men downed tools. The employers consented to pay the bonus, with a further 1s. 9d. per week to all apprentices from August 10th, and the men returned to work on Monday morning.

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Static Electricity—According to *Indian Engineering*, an electric neutraliser has been invented that does away with the static charges experienced in printing operations. By means of a small motor-generator, A.C. current is supplied at about 70 volts pressure. This is transformed up to a high voltage at low current for delivery to the paper through distributing bars on the printing press. These bars are composed of a number of fine metal points set in porcelain insulators. A bar is located near the cylinder and drop guides, and, if necessary, one is attached to the delivery. As the sheets pass under a bar, the charge of static electricity is neutralised.

The Schoop Metal-Spraying Process.—From Zurich comes the news of another improvement in the Schoop process, says *Engineering*. Instead of melting the metal, which is generally applied in the shape of a wire, by the oxy-hydrogen flame or the blowpipe, electric fusion is now used, and is said to be both simpler and cheaper. The pistol apparatus is used as before; but two ends of the wire are placed in the pistol, instead of one, and they are approached to one another as electrodes of an electric circuit. When the arc strikes, the wire fuses, and the air current tears the fine metallic particles away. Zinc sprays in particular have been produced in this way, according to Kasperowicz (*Zeitschrift für Angewandte Chemie*, July 23rd, 1918). The electric heating may be simple, but the prevention of the oxidation of the sprayed metal will probably be as difficult as before.

Electric Furnace for Melting Alloys.—A brief account of a Heroult furnace for the preparation of nickel alloys, in the August 17th issue of the *Electrical World*, by W. H. Easton, gives a capital idea of the special applications of electric heating which are coming rapidly into use. A furnace of this sort requires comparatively small energy at the start, but a large and fluctuating quantity when the melt is well under way. At this point the changes in furnace resistance are great and rapid, including many momentary and some persistent short circuits. High momentary overloads are characteristic of this kind of electric furnace work and require exceptionally good regulation to keep the variations of load within bounds. In this case a very ingenious Thury regulator has been installed to maintain automatically as nearly as possible a constant current at the electrodes. Each electrode is regulated separately, being provided with a motor to raise and lower it. Whenever the current from the electrode exceeds the limit set, a momentary contact starts its motor and withdraws the electrode slightly, repeating the operation step by step until the current is down to its proper limit. With a current too low, the electrode is in a corresponding fashion pushed in to the required point. Series transformers in the main high-tension circuit furnish power to the solenoid control for the regulator. There are two 400-K.V.A., 2,200/110-volt transformers of the oil-insulated, self-cooled type. They are T-connected so that they change the high-voltage two-phase current into low-voltage three-phase current, one phase for each of the three electrodes of the furnace. Special construction is necessary to withstand the overloads. These overloads are of such short duration that their heating effect is negligible, but they tend to force the coils apart. Hence the coils are very firmly braced and are capable of withstanding momentary overloads fifteen times greater than the normal load. The regulating motors for the electrodes are operated by direct current, by reason of the delicacy of the control thereby obtained, a small motor-generator set furnishing the necessary power. Each electrode motor is equipped with a controller for manual operation if necessary.

Electric Cooking in America.—The Southern California Edison Co., which, by the way, has more electric ranges on its lines by over 1,000 than any other central station in the United States, sold over 3,000 electric ranges in the period of 2½ years ended May 1st, 1918, an average of 100 ranges per month. Owing to the changed conditions on account of the war, it became necessary to analyse closely all classes of business development and to discontinue any that might be termed experimental or unprofitable. With this in mind, a canvass was made of the electric cooking situation and the value of the load.

Recently a list of questions was sent to each district agent regarding electric range installations and service, and some of the replies received are as follows:—

(*a*) "What percentage of consumers using electric ranges in your district are satisfied with the service? This, of course, means the utility of the range and the size of the bills." The replies indicated that over 95 per cent. of electric range consumers were satisfied.

(*b*) "As a result of your experience, what do you consider are the strong points in the use of the electric range—that is, what commends the electric range to consumers?" Replies mentioned the following points, given in the order of importance:—Cleanliness, convenience and ease of operation, absence of heat in summer, safety, saving of food and retention of flavour, automatic feature, no smoke, cost of operation, hygiene, accuracy.

(*c*) "What do you consider are the weak points in the use of the electric range—that is, what features are a trouble or annoyance to consumers?" Replies given in order of importance:—Burn-outs of elements, burn-outs of fuses, slow top-burner heating, bricks cracking, broken switches, discoloration of oven linings, replacements too slow, unreliable thermostats, leaky oven doors.

(*d*) "Have you any suggestions to make which might tend to improve the utility of the electric range?" The suggestions were numerous, and those from different parts of the system were remarkably similar. Some of these were:—More heat in at least one top burner, plenty of replacements on hand, non-rusting ovens, extra simmering burner, pilot light, units more rugged and reliable, steam vents.

Of the total number of electric ranges sold on the Edison system, only 155, or about 5 per cent., are installed in apartment houses. Experience has demonstrated that, while the apartment-house load can be satisfactorily handled, it causes the company probably four times as many troubles per range in use as do installations in private houses. Apparently the average tenant in an apartment house does not take so much interest in keeping the range in good order as does the owner of a private house. Further, the apartment house occupants frequently come and go, and, as, a rule, they do not study electric cooking sufficiently to get the best results. Consequently, the trouble-man and the demonstrator have to make frequent visits to apartment-house installations.

The reports concerning the operation of 3,000 electric ranges on its system have demonstrated to the Southern California Edison Co. that (*a*) the electric cooking load is a desirable load if the rates for service are equitable; (*b*) the electric range is satisfactory to its consumers; and (*c*) electric cooking service is along the lines of conservation of both food and fuel.

The prospective expense is by no means overlooked by new consumers, but most of them know what it is actually costing some friend or neighbour. Then, again, the knowledge of the compensating advantages of electric cooking is spreading. Gas may be a cheaper means of lighting than electricity, yet in most localities the public insists on electric lighting where it is available. There are strong indications that the same preference will be developed for electric cooking.

Under normal conditions the Southern California Edison Co. would have sold 2,000 electric ranges in 1918, and could have accomplished this task more easily than it could have sold 500 ranges two years ago. Satisfactory progress has been made in building up a cooking load on the company's system, and under more favourable conditions every reasonable effort would be made to increase the load as rapidly as possible. Until conditions change the business already connected will be nursed and cultivated, so that when the right time arrives there will probably be an insistent demand for electric ranges resulting from the advertising done by present installations.—*Electrical World*.

Electrical Power Engineers' Association.—This Association, which is the recognised protective organisation for staff engineers engaged in the generation, distribution, or utilisation of electrical energy, has been compelled, owing to the influx of new members, to sectionise further the Southern Division. During the past week there have been inaugurated the following Sections:—South Coast Section, to meet at Brighton; hon. sec., Mr. W. G. Gibbons, 8, St. Andrew Road, Portslade-by-Sea. London Central Station, to meet at King's Cross; hon. sec., Mr. E. N. Christmas, 55, Calabria Road, N. 5. London South-Eastern Section, to meet at New Cross; hon. sec., Mr. E. W. Martin, 169, Well Hall Road, S.E. 9.

MANCHESTER AND DISTRICT SECTION.—A new Committee has been elected for this Section, and the following officers have been appointed:—Chairman, Mr. A. L. Lunn, of Manchester, president of the Association; vice-chairman, Mr. E. H. L. Dickson, of Salford; hon. secretary, Mr. E. B. Pansey, 5, Newhall Road, Jericho, Bury; hon. treasurer, Mr. G. Fry, 25, Powell Street, Old Trafford, Manchester.

A smoking concert will be held at the Grosvenor Hotel, Deansgate, Manchester, on October 3rd, at 7 p.m., to celebrate the anniversary of the inaugural meeting of what is now the E.P.E.A. at Manchester. The Committee cordially invites all members and possible members to be present.

A general meeting of the members of the West Yorkshire Section was held at Leeds on Saturday, the 21st inst. Mr. J. E. Ellis, of Morley, was in the chair, there being 70 members present, including the full Committee, the president (Mr. A. L. Lunn), and one of the vice-presidents (Mr. R. C. Atkinson). A general review of the progress of the Association was given, also a detailed account of the activities of the West Yorkshire Section since its formation. It is intended to hold during the winter session a series of meetings for members, and a programme drawn up by the Sub-Committee was submitted.

Electric Industrial Trucks.—In an article on industrial electric trucks in the *Textile Recorder* of September 14th, Mr. R. Douglas-Vickers says that we have to recognise that the field for development is an immense one, and that whatever may be done in the way of converting to industrial electrics during the war will still leave a big area untouched. The difficulty in getting adequate supplies constitutes one factor in the limitation of expansion, but wherever they are put in they are rapidly proving their utility and economy. As a means of easing the labour situation, German factory owners have for a long time been making use of the industrial electric truck and tractor. That they have been doing so upon an extensive scale is clear from references which have, from time to time, appeared in their technical Press. There is little doubt that the old methods of inter-shop transport, with their many disadvantages, especially their labour wasting propensities, are being eliminated in most up-to-date establishments. The author briefly describes the "Hunt" range of industrial trucks and tractors, which are equipped with either Edison or Ironclad Exide storage batteries. These outfits are built by the C. W. Hunt Co., of New York City, and are marketed in the United Kingdom by Messrs. Irwin & Jones, Ltd., London House, New London Street, London, E.C.3. They are made in three types, but they are all of the same carrying capacity—two tons, which should be adequate for every factory's internal transport requirements.

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Educational.—THE POLYTECHNIC, Regent Street, London.—We have received particulars of the courses of instruction for the coming session, which commences on Monday, September 30th. Mr. W. Hibbert, A.M.I.E.E., is at the head of the department of Electricity, Electrical Engineering, and Physics. Special courses are provided in Telegraphy and Telephony.

Electromedical Progress.—*The Times* mentions that 1,818 military cases were treated in the new electromedical department of Willesden Cottage Hospital, last year, as compared with 123 in 1916.

Inquiry.—A correspondent asks for the makers of "Zyrolite" insulating material.

Irrational Regulations.—In a letter to the *Times*, headed "Ration Regulations," a lady correspondent says :—

A short time ago a printed paper issued by the Ministry of Food, "F.S.B. 26, August, 1918," entitled "Housekeeping under the Fuel Rations," was sent to me, wherein I read the following :—

"It is unnecessary to use electric light for passages, bathrooms, or bedrooms. A candle would be amply sufficient, or a nightlight where continuous light is not needed."

In the *Times* of Monday, September 16th, I read the following :—"The Food Controller wishes to point out that the use of candles and lamps in bedrooms and other parts of the house where there is gas or electricity is an unpatriotic action. If this growing practice is not stopped, there will soon be a famine in paraffin and candles." I am honestly most anxious to carry out the directions issued to us by the authorities. But I confess that I find a difficulty in complying with both of the above requests at the same time.

Patents and Alien Enemies.—The Board of Trade has granted licences in respect of Patents Nos. 9,650/08 (Woerner) and 22,857/10 and 23,251/10 (Bosch), to the London and North-Western Railway Co.; and in respect of Patent No. 563/10 (Sauter) to Messrs. Davy Bros., Ltd.

Appointments Vacant.—Electrical engineer and manager (£300) for the Darwen Corporation electricity undertaking; shift engineer (65s. + 12½ per cent.) for the Leigh Corporation electricity works; charge engineer (73s.8d.) for the Wakefield Corporation electricity department. See our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Central Station and Tramway Officials.—Hull Corporation Electricity Committee has decided to advance the salary of Mr. MAGORIS, the acting engineer, who has completed four years' service in the absence of the engineer (Mr. Bell) on military service, from £425 to the figure normally attached to the position that he has been occupying, namely, £700.

Hackney B.C. Establishment Committee recommends that the increase of salary due to Mr. J. F. HEATHMAN, chief clerk in the Council's electricity department, in 1919, be paid as from September, 1918.

Mr. T. CLAY, inspector on the York Corporation tramways, who has joined the R.A.F., has been presented by the staff with a hanging clock.

The South Shields Council has recently increased the salary of Mr. HARRY T. ELLIS from £550 to £700 per annum by one advance of £150.

At the Willesden Electricity Committee, the electrical engineer reported that, at the request of the Coal Controller, he had nominated Mr. C. C. BUTLER, as representing the electricity department, to co-operate with the Fuel Overseer under the provisions of the Fuel Order. The electrical engineer had, at the special request of the Coal Controller, agreed to assist him in the coal economy campaign with reference to factories in the district.

Hammersmith B.C. Electricity Committee recommends that Mr. G. G. BELL, the borough electrical engineer, be allowed to act as district engineer to assist the local technical representative in the coal economy campaign.

Mr. DUFFY, of Wolverhampton, who had been appointed temporary engineer-in-charge at the Hammersmith Council's electricity works, has decided not to take up the appointment.

Mr. F. SWARBRICK, electrical engineer and manager to the Leek U.D.C., has been appointed district engineer to the Board of Trade (Coal Mines Department), in connection with the coal economy campaign.

The Heston and Isleworth E.C. has appointed Mr. E. BROAD, senior engineer in charge, to the post of assistant station superintendent, and empowered the manager to appoint a shift engineer in the place of Mr. Broad, at £3 7s. 6d. per week.

General.—It is announced that, owing to the condition of his health, Dr. E. K. MUSPRATT has resigned his position as chairman of the British Insulated & Helsby Cables, Ltd., and Mr. James Taylor has been elected chairman in his stead. Dr. Muspratt will remain as an ordinary director, and Sir Alexander Roger has been elected to the board.

Barnsley Higher Education Committee has appointed Mr. W. B. STEELE, as instructor in mine electrical work at the technical school.

Lieutenant F. W. MOZLEY, R.E., son of Mr. Mozley, Burnley tramways manager, has been promoted to the rank of captain.

Mr. A. M'KINSTRY, who has been appointed a member on the Australian Directorate of Munitions, was general manager in Australia of the British Westinghouse Electric and Manufacturing Co., Ltd.

Mr. GEORGE SUTTON, of Beckenham, chairman and managing director of W. T. Henley's Telegraph Works Co., Ltd., has sent to the President of the Dickens Fellowship £5,000 in 5 per cent. War Loan bearer stock to be applied to the endowment of the Charles Dickens Home for Blinded Soldiers and Sailors.

The *Electrical World* states that Colonel GUY E. TRIPP, recently chairman of the board of the Westinghouse Electric and Manufacturing Co., who was given leave of absence by the directors of the company in order to devote himself to the U.S. Government service for the duration of the war, has been appointed Brigadier-General. From chief of the production division of the Ordnance Department of the Army, General Tripp has just been promoted to be assistant chief of the Ordnance Department.

Roll of Honour.—Second-Lieutenant W. S. THAIN, Royal Warwickshire Regiment, who was accidentally drowned in France on September 15th, was in the service of the General Electric Co., Witton, for seven years, and was in charge of the electrical laboratory of the Midland Railway, at Derby, for about a year before enlisting in the R.E. in 1915.

Sergeant H. WRIGHT, Essex Regiment, who has been killed in action, was an inspector on the Colchester municipal tramways.

Private J. W. CASEY, Machine Gun Corps, who has died of wounds, was on the Croydon municipal electricity staff.

Drummer R. LANDERS, Manchester Regiment, killed in action, was employed by Messrs. Ferranti, Ltd., Hollinwood.

Corporal G. BOWDEN, Lancashire Fusiliers, killed in action, was an apprentice with the British Westinghouse Co., Trafford Park.

The death is reported, from wounds received in action, of Second-Lieutenant JOHN A. MOFFAT, R.E., who was an electrical engineer, and well known in electrical circles in Scotland, he having been for some years prior to the war Scottish representative for Messrs. Ferranti, Ltd.

Gunner W. MOXON, R.G.A., who was in the electricity department of the Rotherham Corporation, has been dangerously wounded.

Mr. F. A. BASSETT, of the Merchant Fleet Auxiliary, who has been accidentally killed on service, was a senior electrical engineer on the Tyne.

Corporal T. JEMSON, L.N.L. Regiment, killed in action, served his apprenticeship with Messrs. Dick, Kerr & Co., Preston.

Private J. E. LITTLER, East Lancashire Regiment, who has fallen in his 23rd year, was employed by the B.I. & Helsby Cables, Ltd.

Private T. R. CROWCROFT, K.O.Y.L.I., who has been severely wounded, went at the outbreak of war from his post at the Scarborough electricity works to rejoin his old regiment. He has been mentioned in dispatches for the Military Medal.

Wireless Telegraphist RICHARD HOLDSWORTH, R.N.V.R., lost his life in endeavouring to save Lieutenant H. Law, R.N.R., during the sinking of His Majesty's trawler *Achilles II* in June last. The *Achilles II*, while mine-sweeping, struck a mine and sank in a few minutes, the captain and 12 members of the crew losing their lives. Just after the explosion Holdsworth found Lieutenant Law in a dying condition near the winch, and at once endeavoured to get him to the side of the vessel in the hope of obtaining assistance. Twice the telegraphist was told to leave the ship and save himself, as it was then apparent that the lieutenant was dead. He was, however, persisting in his endeavour to remove the body when the vessel sank. Holdsworth, who by his devotion to the officer, had not had time to put on his lifebelt, was drowned, after having sustained injury.—*Daily Telegraph.*

Obituary.—MRS. B. BRYDEN.—Electrical readers of the *Times* for September 20th will have noted the following with feelings of deep sympathy and regret :—

BRYDEN.—On September 12th, 1918, lost from the torpedoed liner *Galway Castle*, Beryl, the dearly-loved wife of Charles Lumsdaine Bryden, head of the electrical department of the Victoria Falls and Transvaal Power Co., Johannesburg (and younger daughter of Major-General Isaac Ketchen, Royal Artillery), aged 40 years; and also their younger daughter, Cecil, aged three years and nine months.

DR. B. W. FEDDERSON.—The death recently occurred at Leipzig, at the age of 87 years, of Dr. Berend W. Fedderson, a leading German electrician, who is claimed to have laid the foundation for all subsequent research of the subject of electrical oscillations between 1857 and 1866.

DR. F. BRAUN.—The death has recently occurred in the United States, whither he journeyed early in 1915, of Dr. Ferdinand Braun, formerly Professor of Physics in the University of Strassburg, Germany. He had devoted considerable attention to the development of wireless telegraphy.

Will.—Mr. HAROLD A. JACKSON, of Blackburn, dealer in electrical accessories, who died in July, left £8,084 gross, and £8,027 net personalty.

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A REVIEW OF ELECTRICAL ENGINEERING PROGRESS.

MR. E. W. RICE, Jun., president of the American I.E.E., delivered an address at the annual convention of the Institute on June 26th last, of which the following is an abstract from the *Journal*, Vol. 37, No. 8.

In the early days the progress of electrical science and arts was so rapid that it was relatively easy to find each year plenty of material for a review. Progress has continued, and will continue, but naturally a decided tendency to saturation is shown in many directions. In some instances, this saturation is due to the fact that limits of perfection have been so closely approached that little remains of possible accomplishment. In other instances the slowing up is due to lack of knowledge, or, especially at the present time, to lack of workers, such workers having been diverted to war work. The efficiency of conversion of mechanical into electrical energy, or the reverse, of electrical into mechanical energy, is still about 90 per cent. in the average case, under practical conditions of operation; the efficiency reaching as high as 97 per cent. or 98 per cent. in the most favourable cases, with the large units, and falling below 90 per cent. in unfavourable cases, or in the small units. The efficiency of conversion of electricity from high to low potential, as in transformers, also remains substantially the same, reaching as high as 98 plus per cent. in the largest units. It is obvious that no material change can be expected where such practical perfection has been reached.

The conversion of the mechanical power of falling water into electrical energy by our water-wheels and electric generators has increased from about 87 per cent. to 90 per cent. in the largest units of 40,000 H.P. This represents about the limit which may be exepcted.

In the field of thermodynamic engines, represented largely by the steam turbo-generator unit, some improvement has been obtained. Rankine efficiency to the extent of 75 per cent. had been obtained in some large modern steam turbo units in 1915. This has now been increased to about 80 per cent. in the largest units of 35,000 to 40,000 KW. and 75 per cent. is quite common practice even in such moderate-sized units as 10,000 KW. This improvement, while not large, is doubly important because of the great increase in the cost of fuel. It has been realised mainly by bringing the practical design more nearly in accord with the theoretical, by increasing the number of stages or processes of steam extraction, reducing various losses, and by improving many details which, when properly looked after make in the aggregate, gains of practical importance.

Increase in the initial pressure of steam and lowering of terminal pressure, by better condenser arrangements, have also contributed to improvement, as it enables an increase in the range of temperature to be utilised. This makes possible better thermal efficiencies, even with the same per cent. of Rankine efficiencies.

The following table illustrates the improvement in efficiency of turbo-electric units from 1903 up to the close of 1917 :—

Year.	Size, KW.	Steam conditions.			Lbs. per KW.-hour.	Per cent. of Rankine efficiency.
		Steam pressure.	Superheat Fahrenheit.	Back pressure.		
1903	5,000	175 lb.	0	2 in.	24·00	37·8
1908	14,000	200 lb.	125°	1½ „	13·50	66·1
1911	20,000	235 lb.	100°	1½ „	13·20	67·0
1913	20,000	200 lb.	200°	1 „	10·74	75·9
1916	20,000	250 lb.	250°	1 „	10·00	76·5
1917	35,000	230 lb.	200°	1 „	10·14	78·7

A percentage of Rankine efficiency of approximately 80 has been reached, which reflects great credit upon the designers of turbo-electric machines, and is a record of achievement found only in electrical development.

Concurrently with this improvement in the turbo-electric machines, great advances have been made in the design and operation of steam-producing devices—the boilers, and in auxiliaries and other features of the modern power station. As a result the thermal efficiency has been rapidly improved. This thermal efficiency may be stated as the ratio of the total energy produced at the terminals of the generator, to the total energy in the fuel burned—expressed as a percentage. It takes account of all losses from the coal under the boiler to the energy at the dynamo terminals. It is the ratio of the heat units equivalent to one KW.-hour, divided by the similar heat units in the fuel consumed to produce 1 KW.-hour at the generator terminals. This thermal efficiency is, after all, to the electrical engineer, the most important measure of progress. It measures the advance in station fuel economy, and as stated, many factors in addition to the improvement in turbo-generators have contributed to the result. Thermal efficiency may obviously be used to express the results of a single unit, consisting of turbo-generator, with its bank of boilers and other accessories, or it may be used to designate the combined result of all the units in a given power station.

The progress in the case of a combination unit, *i.e.*, turbo-generator, with its boilers, auxiliaries, &c., has been as follows :—

Year.	Size of unit KW.	Thermal efficiency, per cent.
1903	5,000	10·15
1908	14,000	15
1913	20,000	18
1917-18	35,000	21·6

For comparison, large gas engines in steel mill practice under best test conditions, show 25 per cent. thermal efficiency, but in actual operation, an efficiency higher than 18 to 20 per cent. is rare. Engines of the Diesel type, driving electric generators, realise 25 to 26 per cent. thermal efficiency when new, but are difficult to maintain at such efficiency.

The figures given must not be confused with the much higher thermal efficiencies often quoted for gas and oil engines, which refer to indicated horse-power and not to electrical output.

The steam turbo-electric unit has not reached its limit of thermal efficiency. Calculations show that, with pressures of the order of 500 lb. gauge, a thermal efficiency of 26 per cent. should be easily realised. While the efficiency of electrical units reached about its limit some years ago, progress has been made and is still possible in the generation, transmission, and utilisation of electrical energy. The struggle for improvement in efficiency has been transferred from the unit to the aggregate, called the system. Individual units of highest efficiency do not, of themselves, ensure that the system upon which they are used will be of the highest efficiency. To obtain the highest efficiency in practical operation, the element of time enters as a powerful factor. Our conception of efficiency should not be limited to a consideration of the relation between the instantaneous value of available heat units in coal and the electrical units produced at the point or points of consumption, but should consider the relation between the total number of heat units in fuel consumed in a given time, say 24 hours, to the total number of electrical units produced and used in the same time. The attempt to improve the efficiency of the system has shown the necessity for utilising the generator units and transmission and distributing systems, for the maximum possible time.

This has led to the study of such questions as load factors of generators, of stations, and of the system as a whole, to the study of the diversity factor, to the reduction of idle currents in alternating-current systems by the use of synchronous condensers, and to means for the reduction of the constant and no-load losses in all machinery, in transformers, &c. The resulting improvement has been effected, not only by changes in designs of the units themselves, but also by their method of use, based upon the recognition of the fact that the elimination or reduction of the losses at light load will greatly improve the total efficiency, especially when the time of use of the apparatus under load is a small part of the total time.

Automatic sub-stations for transformers and synchronous converters have come into existence; different power houses of the same system have been tied together electrically; transmission lines of different systems have been interconnected, so that the units may be usefully employed for the maximum period, or lie idle or unloaded for the minimum time. This general development has led to marked improvement in total energy efficiency, represented by the amount of fuel burned per electrical unit sold or utilised, and has also reduced cost of operation and charges for investment. There is still room for continued improvement in this direction, and the progress will be rapid, due to the pressure for maximum efficiency in the use of coal and of existing investment at the present time.

Many interesting examples of the methods and devices adopted to improve station and system economy and efficiency may be found. Large electrical systems have been arranged to be tied together electrically, for exchange of power. In Montana, eight hydro-electric plants successively use the same stream flow, the total effective head amounting to 600 ft., and not only is the natural flow of the stream thus successively utilised, but all the storage water is effectively used by each plant in series. In this same system, the yearly load factor is stated to reach 75 per cent. and the mean monthly load factor to reach 80 per cent. The interconnection of hydro-electric plants brings about another extremely important saving, based upon the variation of rainfall in amount and time on the different watersheds which are thereby brought to serve a common system. It frequently happens that there will be plenty of precipitation on one watershed, while another watershed may suffer from long continued drought. This condition varies not only in the same year but in different years. Interconnection serves to eliminate these variations by a process of averaging, and where the interconnected system covers a sufficiently wide area, a remarkable increase in total useful power is made available.

It has been estimated, and it seems a conservative estimate,

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that through the saving in reserve equipment, improvement in load factor, and the diversity of different loads, the useful output of groups of large systems may through interconnection, be increased about 25 per cent.

Electric regeneration of power, that is the utilisation of the weight of trains running on a down grade due to the force of gravity to generate electricity which is fed back into the electric system to help other trains up grade, is an illustration of the same important improvement in the system efficiency.

It is desirable to call attention to the improvements obtained in system economy or efficiency because of the important savings in investment, in coal, in transportation, in labour and material, which in the aggregate, have already been realised. It illustrates the wonderful flexibility, value, and economy of a general system transmitting energy by electricity, compared with any other possible method.

The Standards Committee of the Institute has been of inestimable value to the profession and to the industry. The standards adopted have been flexible enough to ensure progress, and yet to discourage variations which were valueless. The standards have been cheerfully followed, and I am convinced that, as a result, the cost of electrical apparatus to the consumer has been greatly reduced over a number of years, and the quality has been improved. I consider that the money value of the work so done could be conservatively placed at many millions of dollars.

The relative growth of 60-cycle as compared with 25-cycle systems is reflected in steam turbine installations. In 1910 about 60 per cent. of the steam turbine-electric energy of the U.S. was supplied from 60-cycle units; in 1917 this had risen to approximately 75 per cent. This is an instance where standardisation is desirable and economical. It will hasten the time so often predicted, when a network of transmission lines, carrying electrical energy, will cover the country. These will be fed by super-power stations, suitably located with respect to cheap, reliable supplies of coal for fuel, and water for condensing purposes, and into the same network will also be fed energy from the various hydroelectric installations.

Marked advances have been made during the past year in the application of electricity to the electric furnace. It is estimated that the number of electric furnaces in the U.S. has been increased about 40 per cent. in the past year, and that there are now in operation over five times the number that existed five years ago. The world's output of steel from electric furnaces has now grown to approximately four million tons per annum.

Experience has demonstrated that electric furnaces can utilise the cheapest and most inferior raw material to produce steel of the most uniform and highest quality, with the greatest regularity. It is now possible to produce electric steel at substantially the same cost as that produced by the open-hearth method. This result has been brought about partly by the increased cost of the open-hearth method, but largely by a reduction in the cost of electric furnace operation. The marked change which has taken place in the reduction of the cost of operating electric furnaces is based upon greatly increasing the rate at which energy is delivered to the metal, both during the melting and the refining period. As a concrete example, I mention the history of a five-ton furnace. It was originally supplied with 800 K.V.A. at 80 volts. This was increased to 2,000 K.V.A. at 150 volts for the melting period, and about 1,400 K.V.A. at 100 volts for the refining period. The time for the heat was reduced from six to three hours, power consumption was reduced from 877 KW.-hours to 588 KW.-hours per ton, and the number of heats per 24 hours was increased from three to five, increasing the net output from 15 to 25 tons.

Electric resistance furnaces of large sizes, for special heat treatment requiring unusual exactness, are being extensively used, producing results greatly superior to oil or gas fire furnaces.

Electric welding, both by the arc and incandescent method, is being rapidly extended, and is destined to greater development in shipbuilding and similar operations.

Electrical engineers have been devoting much time to the solution of many war problems. It is not desirable or possible to review such work at present, but when the veil is lifted, we will all be gratified with the result.

In my address at the opening of the mid-winter convention of the Institute, in February, 1918,* I called attention to the advantages which it seemed to me would follow a more general electrification of the steam railroads of the country. I merely repeat at the present time that electric locomotives can meet in the most efficient and adequate manner the transportation problems confronting the country, and offer better results than are now obtained, or seem possible, with steam locomotives. There can be no question that railroad electrification is not only economical but imperatively needed to improve the present standards of steam operation. The electrified divisions of the steam roads have been free from troubles during the past severe winter, and I repeat that the coal famine which the country suffered last winter could have been largely avoided if the steam railroads had been electrified. Moreover, it should not be forgotten that steam locomotives burn about 25 per cent. of the entire coal mined in the U.S., and that 12 per cent. of the entire ton-mileage movement of freight and passengers carried over our railroad tracks is represented in cars and tenders required to haul coal to supply steam for the locomotives.

It is a truism that war requires the mobilisation of the nation's industries and their devotion to essential work. To operate these industries, it has been necessary to mobilise to the fullest extent available material and labour, which can only be converted into war work by the application of power. This power, in view of its great economy and flexibility, must be electrical. It is vitally important that the great electrical power-producing companies of this country should be helped in every way to meet the heavy demand which is placed upon them. It has been demonstrated that the quickest, most efficient, and altogether best way to meet the demand for power is through the expansion of such existing organisations and installations.

Fortunately, there is general appreciation of the fact, and comprehensive schemes are under consideration which will provide for the erection of large steam electric power stations in the mining regions. Favourable locations exist which are within reach by transmission lines of electric power stations now serving large industrial areas. By interconnection, present investment and machinery will be better utilised, and a large amount of additional electric power made available, without making any increased demand upon our congested railroad facilities.

I would say, in conclusion, that the saving in fuel, by such improvements as I have mentioned in various parts of my address, amounts to many millions of tons every year; the saving in material and investment represents millions of dollars, which manifestly represent service of the highest value to the industry and to the country. Such work is just as much the province of the electrical engineer as improvements in the design and efficiency of the electrical units, and requires the same scientific ability, vision and industry. I think that in no other field of engineering has there been such a remarkable improvement and a condition which so nearly approaches, in the matter of efficiency, to 100 per cent., as has been shown in the field of electricity. This phenomenal record is not the result of accident. It has been due to the enthusiastic devotion of the scientist and engineer and executives to their work.

*Elec. Rev., April 12th, 1918.

NEW COMPANIES REGISTERED.

Leeds Flint Glass Co., Ltd. (151,461).—Private company. Registered September 18th. Capital, £10,000 in £1 shares. To take over the business of electric lamp bulb and tubing manufacturers carried on by the Yorkshire Incandescent Electric Lamp Co., Ltd., at Belle Vue Glass Works, Old Mill Lane, Hunslet, Leeds, as the Leeds Flint Glass Co. Agreement with Yorkshire Incandescent Electric Lamp Co. The subscribers (each with one share) are:—H. F. Dowell, "Rosslyn," Knaresboro' Road, Harrogate, company director; W. Plews, "Woodlands," 51, Cardigan Lane, Leeds, merchant. The first directors are: H. F. McDowell and W. Plews. Registered office: Old Mill Lane, Hunslet, Leeds.

Yorkshire Battery Manufacturing Co., Ltd. (151,470).—Private company. Registered September 18th. Capital, £10,000 in £1 shares. To take over the business of electric battery manufacturers carried on by Yorkshire Battery & Manufacturing Co., Low Field Mills, Leeds. The subscribers (each with one share) are:—H. F. McDowell, "Rosslyn," Knaresboro' Road, Harrogate, company director; W. E. Farr, Central Bank Chambers, Leeds, solicitor. The first directors are: H. F. McDowell and W. Plews. Registered office: Low Field Mills, East Street, Leeds.

British Gauge Manufacturers' Assn., Ltd. (151,442).—Registered September 17th, limited by guarantee, with 100 members each liable for £5 in the event of winding up, to encourage, protect, and promote the British gauge manufacturing industry. The first members of the committee are:—W. C. Pitter, Upper Market Street, Woolwich, S.E.; W. J. Bassett-Lowke, Kingswell Street, Northampton; S. H. Jones, 84-6, Commercial Street, Newport, Mon.; S. A. Hartzsmann, James Street West, Bath; A. L. Pailthorpe, 115, Whitehorse Road, Croydon; P. A. Bartley, 140, Queen's Road, Clarendon Park, Leicester; L. H. Hounsfield (Trojajn, Ltd.), Vicarage Road, Croydon. Registered office: 44, Caxton House, S.W.1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Wigan Electro-Metallurgical Works, Ltd.—First specific charge and loan agreement on freehold land and works at Wigan and the company's undertaking and property, present and future, including uncalled capital, dated September 2nd, 1918, to secure sums up to £7,500. Holder: Minister of Munitions.

Omega Lampworks, Ltd.—Particulars of £1,000 debentures, created July 6th, 1918, filed, the amount of the present issue being £400. Property charged: The company's property, present and future, including uncalled capital. No trustees.

CITY NOTES.

A Dutch Indian Supply Co.

The Algemeene Ned-Ind. Electriciteit Mij, which owns lighting stations in the Dutch East Indies, reports that notwithstanding the circumstances which hamper the normal course of business, the directors were satisfied with the development which took place in 1917. The monthly receipts for supply for lighting and power purposes increased month by month, and were greater by

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£2,080 in December last than in the corresponding month in 1916. No large extensions were made in connection with the Soerabaja station in consequence of the great difficulties experienced in obtaining plant and materials; the mains were extended, but not to the extent desired, having regard to the constantly growing demand. In order to increase the reliability of the service it had been decided to lay a second high-pressure main to connect the power station at the Toentang with Semarang, and the materials had been ordered in, and were awaiting shipment from, the United States. It had also been resolved to order further Diesel engine sets, one of 600 H.P. for the Malang station, and one of 250 H.P. for the Pasoeroean station. The scheme for the connection of Salatiga and Ambarawa with the company's network had been modified owing to the circumstance that the concessions obtained for supplying Djoejakarta and Magelang had rendered necessary the preparation of a new project for dealing with various places in Central Java. The net profits amounted to £27,000, as compared with £22,000 in 1916, and a dividend at the rate of 7 per cent. has been declared on the ordinary shares, as against 8 per cent. in the previous year.

German Companies.

The directors of the *Isaria Zähler Werke, of Munich*, recommend a dividend of 15 per cent. for 1917-18, this comparing with 12 per cent. in the previous year.

The accounts of the *Deutsche Elektrizitats Werke, Garbe Lahmeyer & Co., of Aix-le-Chapelle*, permit of the payment of a dividend of 6 per cent. for 1917-18, being the same rate as in the preceding year.

The *Internationale Stickstoff A.G., of Wiesbaden*, whose works are leased to the Elektro-Chemische Industrie, of Cologne, reports a loss of £48,000 for 1917-18. It is proposed to extinguish the deficit by writing down the share capital to £48,000.

The report of *Brown, Boveri & Co. A.G., of Mannheim*, states that all departments were actively occupied in 1917-18, and the working expenses again increased. Concerning the company's investments, it is mentioned that the Turbinia Co. again yielded 20 per cent., the Castings Works of Frankenthal 8 per cent., and the Howaldt Shipbuilding Works of Kiel 8 per cent., whereas no distribution was made in 1917 by the Electric Power Supply Co. of Mannheim. After setting aside £62,000 for depreciation, as against £44,000 in 1916-17, the accounts show net profits of £89,000, as compared with £73,000, and a dividend of 15 per cent. is proposed on the ordinary share capital of £450,000, this contrasting with 12 per cent., 10 per cent., and 5 per cent. in the three preceding years respectively.

Russia.

The Petrograd (1886) *Lighting Co.*—The undertaking of the Electric Lighting Co. of 1886 was declared to be State property at the end of 1917, notwithstanding protests made in various quarters, and the works, both in Petrograd and Moscow, are being continued for the account of the State. The managers and other officials remain, and the works are said not to have been damaged, although nothing is known of the condition of the Lodz works. According to information received in Switzerland, the supply of energy from the Petrograd and Moscow works declined from 298,000,000 KW.-hours in 1916 to 254,000,000 KW.-hours in 1917; and the accounts for last year closed with a loss of £54,000, as compared with net profits of £809,000 in 1916. The expenses in 1917 included interest at the rate of 5 per cent. for the years 1914, 1915, and 1916, so that the total amount placed to the credit of the shareholders in dividends and interest was £1,236,000 at the end of last year.

To be Struck off the Register.—Unless cause is shown to the contrary within three months the following companies will be struck off the register:—

Dickson Corthesy Steam Turbine Developments, Ltd.
Harvey Electro-Chemical Co., Ltd.
High-Speed Printing Telegraph Co., Ltd.
Kentish Town Motor & Electrical Engineering Co., Ltd.
Mid-Sussex Electric Light & Power Co., Ltd.
North-Eastern Electric Smelting Co., Ltd.
Radium Electro-Emanation Co., Ltd.
Telephone Accessories Co., Ltd.

Norwegian Companies.—The Norske A.S. for Elektrokemisk Industrie has decided to increase its share capital from £791,000 to £1,592,000, so as to provide for future development of the company's water powers and mines. Two subsidiary companies—the Elektrokemisk Atlas of Christiania, and the Vestlandske Elektrokemisk Atlas of Bergen—are also raising their share capital, and a new concern has been formed under the title of the Elektrokemisk Oversoiske Handels Compani, which is to constitute the basis of existing and proposed sale companies.

Yates & Thom, Ltd.—Year ended August, 1917. Net profit, after providing for depreciation, debenture interest, and writing down investments to market value, £56,172, plus £25,573 brought forward. Dividend 10 per cent., less tax. £67,796 carried forward, subject to excess profits duty.

Southern Brazil Electric Co., Ltd.—For 1917 the profit was £4,838. This, together with £4,271 brought forward, is to be carried forward.

Direct Spanish Telegraph Co., Ltd.—Dividend of 10 per cent. per annum on the preference shares, and an interim dividend at the rate of 4 per cent. per annum, free of income tax on the ordinary shares, both for the half-year ended June 30th.

Bombay Electric Supply & Tramway Co., Ltd.—Interim dividend on the ordinary shares at the rate of 1¼ per cent. per annum for the half-year.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange business had been moving on fairly favourable lines until to-day, Tuesday, when the railway trouble took an unexpectedly acute turn, and had a pronounced effect upon every market in the Stock Exchange. In departments where anything like a bull account has been built up, the effect was particularly noticeable, because people hurried to take their profits and to stand from under while the position looked threatening. The extension of the strike to lines other than those immediately concerned would probably involve many of the industrial companies, the shares of which have lately been so popular, and therefore the speculative investor elected to get out where he could at a profit. The influence extended to Consols and investment markets, and home rails were, of course, especially flat.

Last week's so-called settlement of Labour disputes on the railways had the effect of making some of the stocks a little better, but the recovery did not go far, and it was very quickly lost on the unexpected outbreak of the Welsh and Great Western railwaymen. Amongst the Undergrounds, Metropolitans have fallen back to 25½, and Districts to 25, but the assented ordinary stock of the Central London has gained 2 points at 62½. Underground £10 shares have lost 2s. 6d., and the "A" shares are 1s. lower. At the same time, it is worth noticing that there is no falling off in the demand for pre-ordinary railway stocks, the majority of which show comparatively small returns, ranging from 5 to 6 per cent. on the money.

One of the most active markets for the week is that for Marconis. In the parent shares each successive wave of buying has encountered a fair volume of sales, but, in spite of the latter, the price has risen to 4¾, and, of course, is talked better (the "of course," incidentally, applies generally to any shares with a rising market, since nobody foresees a reaction so long as prices are going up). Considerable animation prevails also amongst the subsidiaries, of which the most prominent during the past day or two has been the American Marconi. The price of the shares is now 32s. 6d., while Marconi Marines further advanced to 67s. The Canadians lag a little behind the rest of the group, remaining about 14s. 6d.

Victoria Falls ordinary shares have thrown off some of their recent stagnation, and are quoted better at 20s.; the preference keep steady at 23s. 9d. If the South African mines are to obtain the expected relief in the shape of what will amount to subsidies to gold-producing companies, this will give a fillip to the industry, and reinvigorate mining as a whole, with consequences that should prove favourable to the Victoria Falls undertaking. Thus, at all events, runs the argument of those who are buying the shares now. Other Colonials which have improved include several of the Canadian power companies engaged in making munitions, and whereas these for some time past have been under a cloud, they are now beginning to develop strength and enhanced prices. The buying of American electric power shares is checked by the uncertainty that prevails with regard to the manner in which the new excess profits duty in the United States will work out, and its effect upon balance sheets, although, as a Stock Exchange factor, the experience of the London market is that excess profits duty carries little weight when the public are bent upon buying shares in companies affected by it.

Brazilian Tractions have taken a turn for the better, and are up to 49. The Anglo-Argentine group is also harder, the first preference shares and 5 per cent. debenture stock improving. British Columbia Electric Deferred put on ¼ on the assumption that the recent heavy fall was a little overdone, and that with the prosperous conditions now prevailing in Vancouver this company should be able to take full advantage of the increased trade that is doing. Amongst Mexicans, there is nothing much going on. If anything, sentiment is not quite so good as it has been lately, but attention is turned to other things at the moment, and therefore prices tend to droop, though Mexican Light & Power preferred is 2 up.

London electric lighting shares are steady. Westminster ordinary and County preference are both ¼ harder. It is claimed in the market that holders are mostly investors who, having retained their shares during the bad times through which the lighting industry has passed, are prepared to hang on until the end of the war, undeterred by lighting restric-

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tions, coal shortage, or anything else. As before noted, it is thought quite likely that there may be reductions in dividends in respect of the current half-year. Gas stocks are equally steady. Amongst the electrical manufacturing shares business ruhs quietly. British Aluminiums have picked up after their slight decline on the dividend disappointment, and are now 38s. 9d. again. Ediswans are a little dull at 15s. 9d., while Cromptons and other manufacturing shares of similar kind are holding their prices. General Electric preference gained ¼. The telegraph manufacturing list is equally steady. Western Telegraphs have strengthened. Anglo-American preferred rose 1. The time has been extended for presentation of the fifths in the Oriental Telephone Co. The price is 12s. to 12s. 6d. per fifth.

Something of a sensation was caused by a violent rise in Vickers upon the reiterated statement that when the accounts are at length published the figures disclosed will be startling. Vickers have been singled out for particular attention, other armament shares being overlooked in the activity that has centred round the favourite for the moment. The rubber market derived a little assistance from the decision of the Straits Settlements Government to support the industry by making loans against the raw produce, and by other expedients, though this has not done much towards reviving business. A boomlet occurred in the shares of the British Platinum Co., the prospectus of which appeared in the summer time, when the £1 shares were offered at a premium of 2s. 6d. per share. No great rush occurred at the time, but within the past week the price has doubled in value, and the shares, now 10s. paid, were run up to 23s. 9d. before reacting to 18s. 9d. Amongst tin and copper shares, nothing worthy of note has occurred.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Sept. 24, 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6⅝	—	£7 17 0
Charing Cross Ordinary	5	4	3½	—	6 8 0
do. do. do. 4½ Pref.	4½	4½	3½	—	6 18 6
Chelsea	3	5	3⅜	—	7 16 10
City of London	8	8	11½	—	7 2 3
do. do. 6 per cent. Pref.	6	6	9⅜	—	6 8 1
County of London	7	7	9¼	—	7 1 0
do. do. 6 per cent. Pref.	6	6	9⅜	+ ⅛	6 8 1
Kensington Ordinary	6	7	5⅝	—	6 17 7
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	4	5	3½	—	7 18 10
Metropolitan	8	4	3⅜	—	6 10 7
do. 4½ per cent. Pref.	4½	4½	3½	—	6 18 6
St. James' and Pall Mall	8	9	6½	—	6 18 6
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	6⅜	+ ⅛	7 7 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	98½	+1	6 2 0
do. Def.	1½	1½	23⅝	—	6 7 8
Chile Telephone	8	8	7⅝	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	15⅝	+ ⅛	*5 2 5
Eastern Tel. Ord.	8	8	158½	—	*5 1 0
Globe Tel. and T. Ord.	7	7	14½	+ ⅛	*4 16 5
do. do. Pref.	6	6	10½	—	5 17 1
Great Northern Tel.	24	22	88	—	5 15 9
Indo-European	18	—	57½	—	5 12 6
Marconi	15	20	4¾	+ ⅛	4 4 3
Oriental Telephone Ord.	10	10	5⅛	—	3 4 0
United R. Plate Tel.	8	8	7⅞	—	*5 3 3
West India and Panama	6d.	1/3	1⅞	—	*3 6 8
Western Telegraph	8	8	15⅝	+ ⅛	*4 16 3
Home Rails.					
Central London Ord. Assented	4	4	62½	+2	6 8 0
Metropolitan		1	25½	— ½	3 18 5
do. District	Nil	Nil	25	— ⅜	Nil
Underground Electric Ordinary	Nil	Nil	9⅜	—	Nil
do. do. "A"	Nil	Nil	7/-	—1/-	Nil
do. do. Income	6	4	83½	—	*4 16 3
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅜	+ ⅛	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3⅞	+ 1/16	—
do. do. 2nd Pref.	5½	—	2½	—	—
do. do. 5 Deb.	5	5	68	+1	7 7 3
Brazil Tractions	—	—	49	+2	—
Bombay Electric Pref.	6	6	103	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	58½	—	8 11 0
do. do. Preferred	Nil	Nil	41½	—	Nil
do. do. Deferred	Nil	Nil	85⅝	+ ½	Nil
do. do. Deb.	4½	4½	57⅝	—	7 7 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	49	—1	Nil
do. 6 per cent. Bonds	Nil	Nil	42	—	Nil
Mexican Light Common	Nil	Nil	28	—	Nil
do. Pref.	Nil	Nil	42	+2	Nil
do. 1st Bonds	Nil	Nil	61	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅛	— 1/16	3 18 9
British Aluminium Ord.	10	10	1⅛	— 1/32	5 3 0
British Insulated Ord.	20	20	2	—	4 6 6
British Westinghouse Pref.	7½	7½	2¾	—	5 9 1
Callenders	20	25	10½	— ½	5 19 1
do. 5 Pref.	5	5	4½	—	5 11 1
Castner-Kellner	22	20	3⅜	—	5 10 4
Edison-Swan, "A"	—	—	1/4	—	Nil
do. do. 4 per cent. Deb.	4	4	75⅜	—	5 6 0
Electric Construction	7½	10	1⅜	—	7 5 6
Gen. Elec. Pref.	6	6	10½	+ ½	6 3 10
do. Ord.	10	10	18½	—	*5 8 1
Hanley	25	25	2¼	—	5 11 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	—	*5 16 9
Telegraph Con.	20	20	47⅜	—	*5 1 0

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 25th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£100	..
a Ammonia, Muriate (large crystal)	,,	£77	..
a Bisulphide of Carbon	,,	..	..
a Borax	,,	£43	..
a Copper Sulphate	,,	£64	..
a Potash, Chlorate	per lb.	3/4	..
a ,, Perchlorate	,,	2/-	..
a Shellac	per cwt.	£17 5/-	..
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	,,	£36	..
a ,, Lump	,,	£28	£3 inc.
a Soda, Chlorate	per lb.	1/1	..
a ,, Crystals	per ton	170/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 3" to 12" basis)	per lb.	..	..
c ,, Tubes (solid drawn)	,,	..	..
c ,, Wire, basis	,,	..	..
c Copper Tubes (solid drawn)	,,	1/8½ to 1/9	
g ,, Bars (best selected)	per ton	£161	..
g ,, Sheet	,,	£161	..
g ,, Rod	,,	£161	..
d ,, (Electrolytic) Bars	,,	£137	..
d ,, ,, Sheets	,,	£161	..
d ,, ,, Wire Rods	,,	£145	..
d ,, ,, H.C. Wire	per lb.	1/5½	..
f Ebonite Rod	,,	3/-	..
f ,, Sheet	,,	2/6	..
n German Silver Wire	,,	2/6	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	3/4	4d. dec.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£37	..
g Lead, English Pig	,,	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	6d. to 8/-	..
e ,, ,, medium	,,	3/6 to 6/-	..
e ,, ,, large	,,	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/10	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	,,	..	..
n ,, Wire, Nos. 1 to 16	per lb.	5/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Electric Vehicle Progress.—It is interesting to note that according to the *Light Car and Cycle-Car* great strides have been made in Switzerland in the use of electric vehicles, and not only are big three-ton lorries for use in road construction and watering carts for use in town seen frequently, but also mail cars, omnibuses for hotels, and private cars for doctors and others. This speaks well for the "electric" when it is remembered that Switzerland is not by any means a flat country. An interesting point in connection with the charging of batteries is mentioned; the method entails the minimum amount of trouble. A contact is arranged in the garage, and, before leaving the car for the night, the driver merely pushes in the plug connection and the current does the rest. When the car battery is fully charged the current is automatically cut off. The use of "electrics" in Switzerland for invalids is not overlooked, and, as a result, a very neat and comfortable electrically-propelled bath chair has been produced.

The Electrical Poultry Farm.—An ingenious New Hampshire poultryman feeds his 1,500 hens with one-tenth the labour this work entails on other commercial poultry farms of similar size, says the *Scientific American*. This result is accomplished with six electric feed distributors, each of which has a capacity of 22 bushels of mixed grain. An electric time clock is set to operate the feeder five times a day, at which times grain is scattered automatically over 4,526 sq. ft. of floor space. The grain hoppers hang within 1 ft. of the floor; the time clock sets in operation an electric motor, mounted on a short vertical shaft, and opens the outlet. As the grain drops a revolving paddle scatters it around. Other devices used on the farm include electrically driven food and grain mixers, and an electric fence which was erected to prevent thieves, foxes, &c., stealing the poultry. The fence is double, the inner one being of ordinary chicken wire to protect the chickens from the outer wires, which are kept charged at 220 volts. Signs posted at frequent intervals announce the fact. The fence is set 4 ft. within the boundaries of the property. Thus the owner is within his legal rights, as any person coming in contact with the fence has already trespassed. It is stated that the fence has many times justified its cost.

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THE MUNICIPAL TRAMWAYS ASSOCIATION (INCORPORATED).

Annual Conference at Leicester.

YESTERDAY the 17th annual Conference of the Municipal Tramways Association was to be opened at the Town Hall, Leicester. After a reception had been held by the Mayor (Alderman North, J.P.) and the Tramway Committee, the presidential address was to be delivered by Alderman S. Flint, J.P., chairman of the Corporation Tramways Committee, Leicester. Welcoming the members to Leicester, the president remarked that this was the first time the annual conference had been held there, and gave some interesting particulars regarding the history of the town, which for over 1,000 years enjoyed the distinction of being called a city. He emphasised the enormous amount of work that had been done by the Executive Council during the past year, and the burden placed upon the secretaries—first Mr. Fearnley, then Mr. Spencer, the present secretary. Mr. Hamilton and Mr. McElroy had also rendered signal service to the Association during the year.

Referring to the more important matters that had arisen since the last Conference, Ald. Flint mentioned the questions of Coal Conservation and Electric Power Supply, and of the creation of Joint Industrial Councils as suggested in the Whitley Report. On the last-named subject they had had several conferences with the men's representatives, and the outlines of a scheme would be submitted to the members for consideration at an early date.

The continued advances in wages and materials had placed heavy burdens on many undertakings, necessitating further increases in fares. The Association had conferred with the Tramway and Light Railway Association on this matter, and with the Board of Trade, with the result that Parliament had given authority to the Board to raise the statutory limits, under certain conditions.

An application for a further increase of bonus of 12½ per cent. was put in by the National Transport Workers' Federation on behalf of the Amalgamated Association of Tramway and Vehicle Workers. The claim was submitted to the Committee on Production, and after a long hearing, during which the case was put forward elaborately for both sides, the men were awarded 5s. per week increase of bonus, whilst the claim on behalf of the women was dismissed. To their surprise, an appeal was made against the award as regarded the women, and although this part of the case was fully argued and considered before the award was given, the Committee on Production, after further consideration, granted the 5s. extra bonus to the women, thus reversing its former decision, in spite of the fact that it was clearly proved that it cost much more to run the cars by women than by men. This raised a very serious question. If one side to an arbitration were allowed to appeal against an award, then the other side might claim the same right, and that might lead to serious results.

Another matter of considerable interest was the appointment of the Tramways (Board of Trade) Committee.

All the indications were that they would have to carry on under greater difficulties than any they had yet had to face, while most of them had private difficulties and sorrows to meet. Meanwhile, let them do all they could, individually and collectively, to assist the Government in carrying on the war to a successful issue.

The next item on the agenda was a paper by Mr. Ernest Hatton, engineer and general manager of the Newcastle Tramways, of which an abstract follows.

The Post-War Position of Electric Power Supply.

BY ERNEST HATTON.

(Abstract of paper to be read before the MUNICIPAL TRAMWAYS ASSOCIATION *at Leicester, September 26th.)*

INVESTIGATIONS into our past efforts have produced two reports on electric power production, which, whilst condemning us for our apathy, contain many valuable suggestions.

Electric power and most other commodities can be produced very cheaply in large quantities with proper facilities in most large commercial centres in this country, but it is the economical distribution of such commodities which ultimately determines the price of any article. The cost of electricity as between producer and user is therefore largely influenced by the charges on capital outlay in bringing the product or supply to the user.

The reports above mentioned insinuate that we have only in the past been dealing with the subject in a playful mood, and that if we do not now alter our methods we shall be hopelessly left behind by other nations. Criticism, however, on our past conduct does not get rid of our annual charges on existing undertakings, and these charges, coupled with the new annual charges on capital account on the proposals in these reports, will ultimately be the measure of our future success and charges for electric power, reduced of course in proportion by the influence that increased output will have if these schemes are developed. At present this is an unknown quantity, but must subsequently be very great. Even then, however, we must bear in mind that wages and everything which counts in the production of electric power will for many years be a determining factor upon cheap power supply, so that in some cases it may, even under the most favourable circumstances, be some time before we again get inclusive prices per unit which will compare with the charges made in 1914; but in the years to come, if the schemes or some modification of them as outlined in the reports are adopted, it must ultimately lead to a general reduction in charges, to the great benefit of the country.

Any scheme of general power supply if it is to be a success must within a reasonable period, by its more econominacl working and production on a large scale, be able to carry on its back the annual charges upon the plant which will be superseded or closed down by its adoption, and it seems to me that much of the plant which will be superseded in some areas under the proposed schemes could well be transferred to areas with lesser immediate demands, and be in the meantime used with advantage, or suitably disposed of, leading to great capital saving and consequently lower annual charges upon the accounts. The subject therefore in the first instance requires an impartial survey of the proposed areas, the plant requirements for the area and the best use some of the existing plant (which must make way for plant of greater capacity) can be put to in order that the new capital charges can be kept within reasonable limits. Where demands are heavy, of course, the existing plant will have to be kept in commission until the larger and more efficient plant decided upon for the several areas can be brought into operation, and therefore these matters should be decided without delay; a programme for each area could then be settled, and with a clearing house for making the best use of existing plant superseded under these schemes, the greatest economy in capital expenditure would be obtained.

If the authorities decide upon the electrification of the railways, the whole policy of the country with regard to electric supply will require to be treated from a wider standpoint altogether. The existing plant, whilst no doubt suitable for ordinary commercial purposes, would not, either in capacity or general location in many cases, be suitable for the larger purposes under review.

Take the case of an isolated town with its own power station working economically according to its present demands, located on the main line of any of our principal railways; should that main line subsequently be electrified, then rarely would it be advantageous to extend the small local power station to meet the larger demands unless it was most favourably situated in regard to the essentials for cheap power production on a large scale. Generally the most advantageous way of dealing with such a case would be to shut down this small local station as a generating centre and to make it a sub-station of the greater electric supply to the railway system passing through the town. It is therefore vital, to deal with this subject in its broadest and truest sense, that some declaration should be made by the authorities at the earliest possible moment.

If the railways are electrified, they will bring power supplies into almost every area in this country, since it is so well served by railways. Some areas will be able to produce power at lower costs than other areas not possessing the same advantages, and a question which should receive the closest attention of the authorities is whether standard rates and charges should eventually be set up. In the event of differential rates, the tendency will be in the future for intense development in some areas, as undertakings will gravitate to those areas supplying power at the cheapest rates, whereas I am of opinion that general development all over the country should be encouraged instead of intensive development in some areas. This would ultimately give the greatest benefit to the population, especially with regard to housing, &c., and food supplies.

Some areas will have the advantage of waste heat from certain manufactures and processess, and where possible the erection of works having a surplus of waste heat, which could advantageously be used in the generation of power, should be encouraged in areas not now enjoying these advantages. This is a matter that may require the parental control of the Government of the day.

I am of the opinion, having in mind the existing electric power developments of the North-East Coast, that an area embracing the North Riding of Yorkshire and the counties of

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Northumberland and Durham should be chosen, in the first instance, for a practical demonstration of the policy of general power supply operating over a large area under one authority, and the experience gained thereby would be of the greatest benefit to other areas of the country. The constitution of the power boards set up in the areas should in every case have a majority control of public representatives elected by the area, together with the representatives of large consumers.

All generating stations in the area, together with the main transmission system of the area, including the power supply to railways and all public bodies, should be under control of the board, but those localities or towns where preference is in favour of local distribution should, in the first instance, be allowed to act in that capacity only; but in any case the power generation and supply mains must for obvious reasons, be under the complete control of the power board.

(To be continued.)

AN ELECTRIC AMBULANCE.

Everyone has noticed the innumerable examples of vehicles of all conditions and sizes utilised in pre-war days of normal transport for trade purposes, which have during the last four years been turned to account to do duty with auxiliary hospitals or volunteer forces as emergency ambulances. The majority of such vehicles have been converted by the mere substitution of internal fittings embodied for trade purposes by stretchers and supports for them. This sort of improvision might answer the purpose if only slightly wounded men were to be carried, but for those more severely wounded it would leave much to be desired, unless the converted vehicle was a particularly smooth-running machine. Some makes of vehicles are naturally more adaptable to conversion for this class of duty than others, and it would seem to us that in this respect the electric vehicle would approach more nearly to the ideal than any other type. There we have a class of machine which possesses certain qualifications for ambulance work. It is simple to start, and is smooth-running in operation, not being subject to jerky gear-changing, as is its petrol consort.

Messrs. R. Walker & Sons, Ltd., the makers of Wolsey clothing, of Leicester, soon after the outbreak of hostilities converted a 2-ton Edison van for duty as an emergency ambulance. A solid-tired 2-tonner might be considered somewhat cumbrous for this delicate class of duty, the smooth-running of the vehicle, however, amply compensates this possible disadvantage. It strikes us as being a commendable emergency conversion.

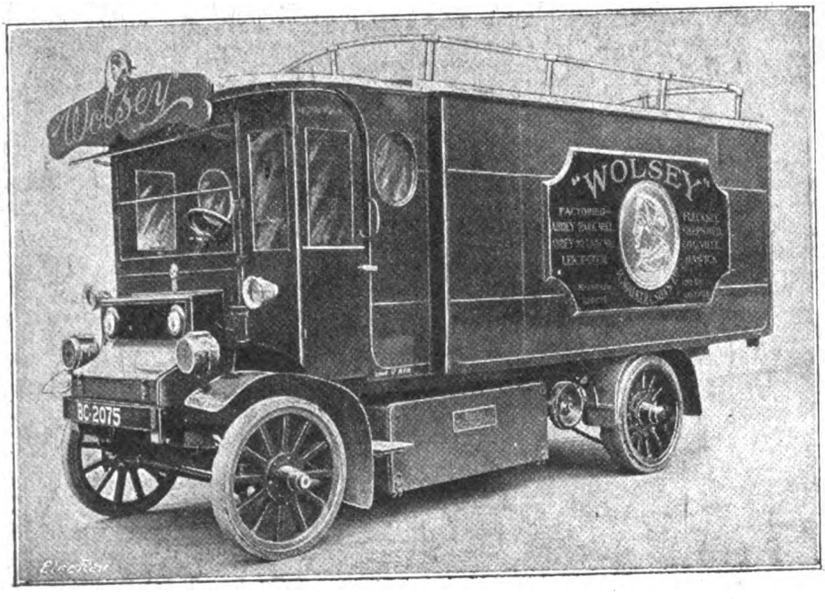

Fig. 1.—A 2-ton Edison Electric Emergency Ambulance.

The chassis of the vehicle referred to (fig. 1) is a 2-ton Edison electric Detroit model, fitted with a 5-h.p. motor with controller and Edison battery. A large covered body is fitted, being 12 ft. long inside, 6 ft. 9 in. wide at the top, and cambering to 6 ft. 6 in. wide at the bottom, while the roof is 5 ft. 3 in. high at the sides, and 5 ft. 8 in. in the centre. It is built of wood framing, with 3-ply wood for panels, and stained and varnished a medium oak colour, with red wheels, black wings, and white roof and rails. The cab of the vehicle is entirely covered in with hinged glass screens, there being a glass door at the near side, and a lowering glass light at the driver's side, enabling him to give the necessary direction signals when on the road.

Two large bronze plates are fitted, one on each side of the van, with a "Wolsey" head embossed thereon. The van has been in regular daily use since November, 1914, for the carrying of Wolsey underwear and other goods between the firm's various factories in Leicester, steam wagons being utilised for the carriage of goods between the country factories and Leicester. During the period of the war the firm has been almost exclusively occupied in the manufacture of hosiery goods for Army and Navy purposes, the van being consequently utilised for this purpose.

Since 1915 the local V.A.D. has made very considerable use of the van for ambulance purposes, for the carriage of wounded between the hospital trains and the local hospitals, calling on it for this purpose whenever the trains arrive. To meet this emergency the hinged doors of the van are made to lift off, so that a loose curtain on a rod may be installed. Inside the van skids are provided which can be quickly attached, enabling the stretchers to slide thereon. Eight stretcher cases are carried at once, there being four on each side arranged bunkwise, or four on the floor and four suspended from the roof, end on, leaving an alley-way down the centre for the orderlies.

The van is admirably suited for this class of work, not only owing to the number of stretcher cases which it carries at one time, but also due to its smooth running and freedom from violent acceleration, enabling the worst cases to be carried with comfort.

The owners assure us that they feel justified in saying that the van has done good service, and has proved very reliable.

THE METRIC SYSTEM.

The British Science Guild has invited the special attention of the Minister of Reconstruction to the importance of making every possible effort to encourage the introduction into the United Kingdom of the metric system of weights and measures, in connection with his endeavours to preserve and develop the trade and industries of the Empire. The subject has long engaged the attention of the Guild as a matter of vital importance to commercial and industrial prosperity. The Guild appointed a committee to consider the subject, and received a report, framed with a view to immediate preliminary action on the assumption that the expediency of the adoption of the system is generally recognised, and dealing mainly with the practicable methods for bringing it about.

The first step is to make it clear that the table of equivalents in the Schedule to the Order in Council of May 19th, 1898, may be adopted for all practical purposes, and the metre as therein defined taken as the standard. In schools and educational institutions attention should at once be more seriously directed to the use of the decimal system of calculating in simple units of length, weight, and currency.

The Guild considers it all-important that learners should not be allowed to look upon decimalisation and the metric system as an "extra" subject; a definite pronouncement, emanating from the Ministry of Reconstruction, to the effect that the prospects of the coming generation in all business careers will depend upon a thorough knowledge of the subject, may be of great value, and it should be clearly announced that it will be tested in all examinations for Government employment.

In actual trade and manufacture Government influence may be brought to bear with the aim of making the use of the metric system the practice before any attempts are made to enforce it by compulsion. If it were generally known that it would be made compulsory in, say, five years, there is every reason to believe that it would be voluntarily adopted within that time. In the meantime, Government Departments could take such steps to make it more convenient for the commercial and industrial community to accept and accelerate the change rather than to resist it. In this connection the report points to:—

(*a*) The adoption of metric standards in Government publications inviting tenders, &c., without giving equivalents in British standards, except such general indications as may be thought absolutely necessary as a guide. British merchants and manufacturers engaged in export trade have long had to accommodate themselves to dealing with such publications in conducting a large part of their business.

(*b*) The especial power of the Government at the present time to insist on the use of the metric system by the railway companies whenever required by the consignors. The refusal by these companies to accept consignment notes made out in the metric system has been one of the great obstacles in the way of manufacturers who have tried to use the system.

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Comparative tables should be prepared and distributed free of cost, or at a nominal price.

With a view to making an easy beginning in the process of displacing existing habits, it is suggested that an immediate start should be made with the currency, which involves only the decimalisation of an existing standard. For the same reasons the tables first circulated for practical use should be made as simple as possible.

The report of the Committee states that the metric system should not be regarded merely as an interesting alternative system for educational purposes, with a view to occasional practical application hereafter. Rather should it be taught as a fundamental system, and the standards now in use, with their multiples and sub-divisions, regarded as obsolescent variants which for practical purposes it is necessary to understand and apply under existing circumstances.

In actual business practice an abandonment of superfluous denominations occurring in the existing standards would be temporarily useful as a preliminary step. In America and in some of our Colonies the weights of railway wagons are expressed in lb., instead of using four columns for tons, cwt., qr., lb. Simplification of existing British practice by absolute abolition of such superfluity would be a good preparation for the eventual substitution of the single decimalised metric unit for the diverse units now employed.

The experience of the well-known firm of Kynoch & Co., Ltd., is cited in a letter dated February 2nd, 1917, from the chairman of that company, as follows:—

"We tried very hard to introduce the metric system into these works, but we had to give it up in most of our departments. We could get nobody to invoice to us in that system, and therefore everything had to be translated, which more than made up for the saving that the internal use undoubtedly achieved.

"An an instance of our difficulties, the railway companies refused to accept goods, consignment notes for which were made out in the metric system.

"The people who used it appreciated it very much, and we have retained it still in those shops that have no communication with the outside world.

"We consider that the universal adoption of the system would be an immense advantage and economy for this country, and we would suggest that the use of both systems should be legalised for some four or five years, after which the metric should be compulsory.

"If everybody knew it had to come, I think the change would, for the most part, be made within two or three years."

The adoption of the system in Government announcements, contracts, and communications, beginning with easily practicable cases, could be extended with increasing familiarity, and ultimately supplemented by an absolute refusal to receive tenders, invoices, and other communications expressed in any other system. Such a course would lead the way to legislation following the same lines, but not abruptly prohibiting old business habits. If contracts were made unenforceable in the Law Courts except in the terms of the metric system, and the expense of officially certified conversion into that system of the terms used in the contract were put upon the litigant party seeking relief, it would go a long way towards compelling universal adoption. At the same time it would not make people immediately liable to penalties, or render their dealings absolutely nugatory if they chose, at their own risk and for the present, to express their contracts in weights and measure more familiar to them. It would facilitate the introduction of compulsion within a reasonable time.

The decimalisation of the monetary unit would plainly bring advantages similar to those resulting from the decimal sub-division of the metre. The Committee, in conclusion, calls attention to the following publications of considerable importance:—

(*a*) A paper on "Great Britain's Interest in the Metric System of Weights and Measures," reprinted from the Electrical Review of March, 1918, and published by the Decimal Association.

(*b*) An article published in the Electrical Review of March, 1917, dealing (amongst other things) with the unfounded apprehension of merchants and manufacturers with regard to changes of machinery, tools, designs, patterns, &c., which they imagine to be involved in the adoption of the metric system, and with regard to the preparation and use of comparative tables.

(*c*) "Recueil de Coefficients pour la Conversion des Poids, Mesures, et Monnaies au Système Métrique, Decimal." Third edition, 1914. (Published in Rome by the Imprimerie de l'Instut International d'Agriculture.)

Cable Insulation.—It has been shown that cables insulated with mineral-base compounds have greatly reduced dielectric losses, compared with those insulated with vegetable-base compounds, says the *Engineer*. It has been further shown that cable ratings under some conditions were more than doubled, and, on the average, could be increased 20 or 30 per cent. when the mineral-base insulating compounds were used. A start has been made in America in the matter of preparing specifications covering dielectric losses in cables. Engineers of some of the principal cable manufacturers have agreed to co-operate.

THE UTILISATION OF WASTE HEAT FROM OPEN-HEARTH FURNACES.

By THOMAS B. MACKENZIE, M.I.Mech.E. (Motherwell).

(*Abstract of paper read before the* Iron and Steel Institute. *September*, 1918.)

In this paper the author gives particulars of experiments on the generation of steam by the waste heat from open-hearth furnaces. The first attempt was made 20 years ago with boilers of the Cornish type; the waste gas from the furnace was divided into three streams, each of which travelled once along the length of the boiler, reuniting again at the chimney end. Owing to the cooling effect on the gases, the draught of the furnaces was reduced to such an extent that their operation was slowed down sufficiently to compel this attempt to recover the waste heat to be abandoned. It occurred to the author that the placing of an induced draught fan beyond the boiler would be a solution, and an experimental boiler, economiser, and fan, on the lines he advocated, were attached to one of the smaller furnaces in the works.

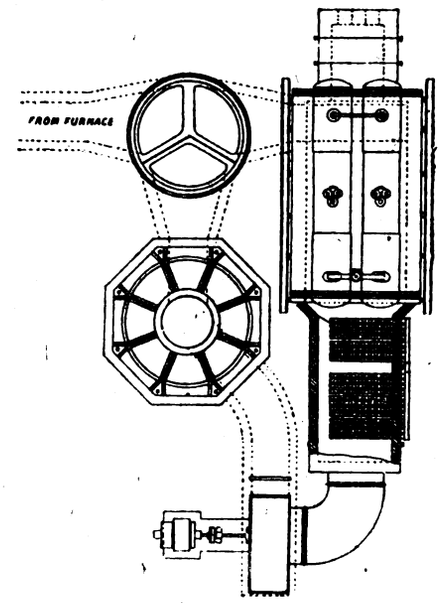

Fig. 1.—Lay-out of Plant.

The furnace was an acid-lined open-hearth furnace of 30 tons nominal capacity. The boiler was of the Babcock & Wilcox water-tube type, having a heating surface of 1,619 sq. ft. In series with the boiler was placed a Green economiser, having a heating surface of 720 sq. ft. The fan was of the Keith & Blackman type, having an impeller 20 in. in diameter driven by a variable-speed direct-current motor of 20 B.H.P. After some minor troubles had been overcome, the installation was got to work satisfactorily, and a test was made extending over a period of 111 hours, in order that a fair average from all conditions of the furnace would be arrived at.

The mean values of the observed data are as follows:—

Temperature of "products" entering boiler ...	504° C.
Temperature of "products" leaving boiler and entering economiser	254° C.
Temperature of "products" leaving economiser and entering fan	169° C.
Temperature of cold feed entering economiser ...	11·6° C.
Temperature of hot feed leaving economiser and entering boiler	117·8° C.
Steam pressure per sq. in. (gauge)	86·5 lb.
Weight of water evaporated per hour, actual ...	2,440 lb.
Weight of water evaporated per hour, "from and at"	2,800 "
Weight of water evaporated "from and at" per sq. ft. of boiler-heating surface	1·73 lb.
Natural draught of chimney with boiler, &c., dampered off	0·6-in. W.G.
Draught at base of chimney with boiler, &c., on fan running	0·8 " "
Probable volume of "products" at s.t.p. passing through boiler, economiser, and fan per hour	380,000 ft.³

Efficiencies.—Boiler, 35·55 per cent.; economiser, 14·48 per cent.; over-all, 37·80 per cent.

The fan absorbed 14·3 Board of Trade units of electricity per hour. The amount of steam generated was 1,084 lb. per ton of ingots.

If the steam generated per hour had been used in a modern turbine with a good vacuum to generate electrical energy, the amount generated would have been:—

		158·0 B.T. units.
Deduct amount used by fan	...	14·3 " "
Leaving a net amount of energy available for outside work of...		143·7 " "

Assuming boiler fuel to have a calorific value of 6,700 lb.-calories

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per lb., and that ordinary steelworks boilers have an efficiency of 65 per cent., the fuel equivalent of the steam generated was 357 lb. per hour, equal to 158·7 per ton of ingots.

If we divide the net amount of electric energy available for outside work by the rate of production of ingots, we obtain 63·86 Board of Trade units per ton, an amount which should be sufficient to roll the steel produced by the furnace.

These results having demonstrated that the author's arrangement was quite practicable, and did not in any way interfere with the furnace output, it was decided to provide a new smelting-shop in process of erection, and containing open-hearth furnaces of 45 tons nominal capacity, with similar equipment.

The equipment consists, for each furnace, of a Babcock & Wilcox water-tube boiler, having a heating surface of 1,827 sq. ft.; a Green economiser having a heating surface of 960 sq. ft., and a Keith and Blackman fan with an impeller 30 in. in diameter, driven by a variable-speed direct-current motor of 40 B.H.P.

This plant was finished and put to work shortly before the war broke out, so that no tests were made of its performance. Since the war the author has been jointly responsible for adding seven boilers and fans to old furnaces and ten to new furnaces, and it is unfortunate that the theory was not developed, as, had it been done, larger boilers would have been used and more steam obtained.

The results of numerous other tests are given in the paper in great detail, and are fully discussed by the author.

None of the boilers above referred to were provided with superheaters, but there is no doubt that such could be quite well applied with the advantage of obtaining steam containing a greater store of energy.

With regard to the actual setting of the boiler, economiser, and fan, it is important to keep the passages short and direct, avoiding all quick bends, also to do everything possible to prevent air leakage. There must also be provided plenty of explosion doors, which must be air-tight when closed. So important is the prevention of air leakage, that the author is of opinion that where waste-heat boilers are to be used the air valves of the furnace should be water-sealed, as the butterfly valves usually used for air are far from being tight.

A good lay-out of the plant is shown in fig. 1, from which it will be seen that a three-way water-sealed valve of the drum type is arranged to send the products either to the boiler or direct to the chimney, and that the fan discharges back into the chimney, as even at their low temperature, after passing over boiler and economiser, some pull could be got from the chimney to help the fan.

Collecting the more important results of the tests, the following table is obtained :—

Item.	Exp.	I.	II.	III.	IV.
Heat usefully employed in boiler, lb.-cal.	1,555,000	2,540,000	2,960,000	2,934,000	3,031,000
Weight of steam of dryness factor 0·95 generated per hour, lb.	2,440	3,792	3,728	4,616	4,736
Weight of steam per ton of ingots, lb.	1,084	949·3	855·3	1,252	796·9

The average of the above weights of steam per ton of ingots is 987·5 lb. As only one of the boilers in the above test was receiving all the waste products of combustion, and it was too small to real properly with the amount, and the others were only using about two-thirds of the products from their respective furnaces, there seems reason to believe that at least 1,200 lb. of steam per ton of ingots would have been obtained under more favourable conditions.

Experience has shown that in a steelworks making plates and bars, and in which the power plant is not particularly up to date, most of the mill engines being of the simple high-pressure type, the shears being similarly driven, and even some of the live roller racks being driven by small and wasteful engines, while the pipe ranges are of considerable length, the steam consumption works out at 3,200 lb. per ton of ingots. Even in such a case, therefore, the saving in boiler fuel which could be effected by the use of waste-heat boilers on the smelting furnaces would be 43·75 per cent. Another source of steam, not dealt with in the paper, is the waste heat from the re-heating furnaces. A very conservative estimate makes the saving, under the conditions named above, 50 per cent. in boiler fuel by using heat at present wasted.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

14,619. "Automatic switches, circuit systems, and operating methods." W. CROSS (HULFISH) & D. S. HULFISH. September 9th.

14,646. "Ignition mechanism." SPLITDORF ELECTRICAL CO. September 9th. (U.S.A., January 2nd.)

14,680. "Dynamo-electric machinery." E. GREENHALGH, LO-THERMO PATENTS, LTD., & B. LONGBOTTOM. September 10th.

14,703. "Signalling systems." T. W. CASE. September 10th.

14,704. "Variable resistances." T. W. CASE. September 10th.

14,705. "Light reactive resistance elements." T. W. CASE. September 10th.

14,715. "Electrical system for generating intermittent high-tension current impulses for ignition purposes." C. H. TOWER. September 10th.

14,731. "Electric arc-striking devices." H. B. RAWLINGS. September 10th.

14,738. "Terminal fittings of incandescent electric lampholders." G. F. COLSON. September 11th.

14,751. "Amplifying devices." E. S. HEURTLEY. September 11th.

14,767. "Means for securing shades to holders of electric lamps." H. F. WHEELER. September 11th.

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14,795. "Electric transmission of voices and music." M. TOCCHIO. September 11th.

14,806. "Electrical switches." C. H. LANDER. September 11th.

14,807. "Electrical generating machines." C. H. LANDER. September 11th.

14,815. "Electrically-operated pulley blocks, hoists, &c." H. MORRIS, LTD., G. A. ROBERTSON & N. W. WESTON. September 12th.

14,581. "Instruments for testing batteries, accumulators, motor dynamos, &c." A. A. PRICE. September 12th.

14,856. "Wattmeters." E. BJERKNES. September 12th.

14,857. "Electrodes for electric-arc welding." W. H. BOORNE. September 12th.

14,859. "Electrodes for primary and secondary batteries." FULLER ACCUMULATOR CO. & T. JONES. September 12th.

14,861. "Electric motor-control systems." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) September 12th.

14,932. "Electrical current-regulating apparatus." C. B. WATERS. September 13th. (U.S.A., July 2nd.)

14,943. "Method of electrical treatment of gases." L. BRADLEY. September 13th. (U.S.A., June 21st, 1916.)

14,944. "Apparatus for electrical treatment of gases." L. BRADLEY. September 13th. (U.S.A., June 21st, 1916.)

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15,002. "Sparking plug for internal-combustion engines." C. BLANDIN. September 14th. (France, September 29th, 1917.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

7,118. SPARKING PLUGS. J. A. Turner & A. Harms. May 17th, 1917. (118,292.)

7,329. ELECTRODES FOR ARC SOLDERING. A. B. Pescatore. May 21st, 1917. (118,296.)

10,365. ELECTRICAL HEATING ELEMENTS SUITABLE FOR COOKING AND SIMILAR HEATING APPARATUS. A. F. Berry. July 18th, 1917. (118,300.)

11,936. APPARATUS RESPONSIVE TO SUNLIGHT FOR COMPLETING AN ELECTRIC CIRCUIT FOR GIVING A SIGNAL OR FOR OTHER PURPOSES. O. Evensen & E. Johannessen. August 25th, 1916. (109,053.)

11,993. IGNITION DYNAMOS. E. C. R. Marks (Splitdorf Electrical Co., U.S.A.). August 21st, 1917. (118,318.)

11,996. ELECTRIC IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. F. Hird & H. W. F. Ireland. August 21st, 1917. (118,319.)

12,016. TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. (Automatic Electric Co., U.S.A.) August 21st, 1917. (118,320.)

12,035. SWITCHGEAR FOR STARTING AND CONTROLLING ELECTRIC MOTORS. J. A. Hirst & P. S. Brook. August 22nd, 1917. (118,324.)

12,123. PRODUCTION OF COLOUR MUSIC AND APPARATUS THEREFOR. A. B. Hector. August 31st, 1916. (109,263.)

12,165. ELECTRICALLY-OPERATED MECHANISM SUITABLE FOR DRIVING CLOCKWORK TRAINS OR THE LIKE. F. Holden. August 24th, 1917. (118,329.)

12,199. ELECTRIC SIGNALLING SYSTEMS, MORE PARTICULARLY FOR USE IN MINES. Automatic Telephone Manufacturing Co. & C. Remington. August 25th, 1917. (118,330.)

13,822. MINE SIGNALLING APPARATUS. Clay Cross Co. & J. W. Strong. September 26th, 1917. (118,354.)

13,884. ELECTROLYTIC CELLS, ADAPTED FOR THE MANUFACTURE OF CAUSTIC ALKALI FROM SODIUM CHLORIDE. N. Statham. September 26th, 1917. (118,355.)

13,956. ELECTRIC FURNACES. H. Wade (Booth-Hall Co., U.S.A.). September 27th, 1917. (118,357.)

16,722. MAGNETIC LOCKS OR FASTENINGS FOR USE ON ELECTRIC LAMPS OR OTHER APPARATUS. Fuller Accumulator Co. & A. P. Welch. November 14th, 1917. (118,370.)

16,915. METHOD OF ASSEMBLING UPON A BEDPLATE THE FIXED LAMINATED POLE PIECES IN MAGNETOS HAVING A STATIONARY ARMATURE. E. C. R. Marks (Soc. Anon. des Etablissements L. Bleriot). December 18th, 1916. (Divided application on 18,144/16.) (118,372.)

18,567. ELECTRIC SWITCH PLUGS. R. Crust. December 14th, 1917. (118,378.)

18,861. ROTARY FIELD MAGNETS. Aktiebolaget Ljungstroms Angturbin. December 19th, 1916. (112,442.)

1918.

261. FREE-RELEASE ELECTRIC CIRCUIT BREAKERS. G. Seligman & Allmanna Svenska Elektriska Aktiebolaget. January 4th, 1918. (118,380.)

616. ELECTRIC STARTING APPARATUS FOR MOTOR-VEHICLE ENGINES. H. Lucas and C. L. Breeden. January 10th, 1918. (118,220.)

1,075. VOLTAGE REGULATING DEVICES. J. Bethenod. April 24th, 1917. (115,226.)

1,277. ELECTRICAL STARTING AND LIGHTING SYSTEMS FOR AUTOMOBILE VEHICLES. J. Bethenod. August 11th, 1917. (118,221.)

1,328. RAILWAY SIGNALLING. McKenzie, Holland & Westinghouse Power Signal Co. (Union Switch & Signal Co., U.S.A.) January 23rd, 1918. (118,382.)

1,531. TELEPHONE DIAPHRAGMS. F. L. Hoyt. January 26th, 1918. (118,224.)

1,894. CONNECTIONS OR CONNECTORS FOR ELECTRIC CONDUCTORS. K-W Ignition Co. July 12th, 1917. (118,083.)

1,895. CIRCUIT-BREAKERS FOR IGNITION SYSTEMS. K-W Ignition Co. July 23rd, 1917. (118,084.)

1,907. SECONDARY OR STORAGE CELLS OR BATTERIES. J. Y. Johnson (Commercial Truck Co., U.S.A.). February 1st, 1918. (118,227.)

3,000. DYNAMO-ELECTRIC MACHINERY. J. W. Burleigh. March 2nd, 1918. (118,392.)

3,460. SUPPLY OF ELECTRICAL ENERGY TO FURNACES OR OTHER APPLIANCES. W. Travis & T. H. Watson & Co. February 27th, 1918. (118,233.)

4,017. MECHANISM FOR VARYING THE POINT OF IGNITION IN MAGNETO-ELECTRIC IGNITION APPARATUS. Brown, Boveri et Cie Akt. Ges. March 2nd, 1918. (114,829.)

4,039. ARMATURES FOR MAGNETO OR DYNAMO-ELECTRIC MACHINES. Compagnie Generale de Magnetos. May 11th, 1917. (116,895.)

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EFFICIENCY IN MANUFACTURE.

IN another column we give a short account of the proposals recently made by Mr. Ben H. Morgan, primarily for the more efficient utilisation of skilled and other male labour, and ultimately for the improvement of the general standard of efficiency in engineering manufactures. They have already been considered at three meetings of the Institution of Mechanical Engineers, and elsewhere have attracted considerable attention among manufacturers. As yet, however, they do not seem to have led to the adoption of practical measures; and we refer again to the subject, because we believe it to be of fundamental importance to engineering industry, and in particular to those engaged in electrical engineering, who since the inception of the industry have ever been among the most progressive and reflective of engineers.

For the time being, indeed, the subject is even more important to the nation, as a whole, than to any trade or section of it. The war is a continuing catastrophe: the most appalling that can be conceived short of an indecisive Peace. The sacrifice that the country makes for each average day by which the war is prolonged, if it occurred in a single day of peace, would horrify the entire civilised world. The agony can be ended only by the concentration of man power and military resources in such overwhelming preponderance as to break down the enemy's means of resistance; and to such extent as the attacking force falls short of such preponderance the war is prolonged, and the day's awful sacrifice is made without equivalent result. Literally, therefore, as a matter of life and death, the country's military services need every man who can be spared; and the equipment and transport of these forces, and those of their Allies, are straining the fullest resources of engineering industry. Military demands must necessarily take account of the apparent limits to the men and equipment that the country can provide; and if through inefficient use of labour men are kept from the technical and other services of the Army, or ships and munitions of war are not supplied in such quantities as they might be, the demands of the military authorities will be artificially restricted through misapprehension of what the country could provide. If, either through such misapprehension or through failure of industry to provide what is asked for, the supplies of men, transport, and equipment provided fall short of what they might have been, the war is to that extent prolonged. That is the nation's interest in the efficient utilisation of labour.

The Government may or may not know whether the country's skill, man-power, and woman-power are being used efficiently, but the public clearly cannot know except by inference. The inferences that engineers can draw to-day are not encouraging. The shipbuilding industry, which must possess very many times the number of skilled shipbuilders that there are in America, is nevertheless unable to

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produce the same tonnage as the improvised yards of the United States. Manufacturers in all parts of the country complain that output in their shops is being restricted in defiance of the Munitions Acts. From time to time accounts are published of bargains made with Trade Unions, which reveal plainly that with an equal disregard of those Acts and of national necessities men and women are even now being restricted in the operations they may perform. Strikes occur, and more are threatened, even among workers who are making munitions of the utmost importance to the nation's Forces. And in face of these daily incidents in industrial life, the Government has often maintained an attitude of benevolent toleration, from which even men who wished to be correctly informed would have difficulty in concluding that such occurrences are the worst of outrages against their fellow-countrymen in the Services; that they should be repressed as such by the Government, whose business is to protect its protectors. All the indirect evidence, in fact, from which engineers can infer how far labour is being used efficiently, tends to suggest that it is not, and they are thus concerned to inquire more anxiously for direct evidence, such as would be given by such measures as Mr. Morgan proposes; to ask if skilled men who might be used in the technical or other units of the Army are being kept, or allowed to continue, on work that less skilled men could do, and if men, skilled or unskilled, are doing work that could be done by women, if women were allowed to do it.

The proposal that standards should be instituted is not new. Apart from the few standards of dilution that the Ministry of Munitions instituted while Mr. Morgan was in its service, it was suggested elsewhere nearly a year ago that if by no other means uniform standards could be set up for economy of skilled and other labour, use of woman power, designs, methods of manufacture, and materials, even a new Government Department, charged with the single function of instituting and introducing such standards, might be a less evil than the continuance of the deadly anarchy which up to then was impeding efficient production. It seems hard that a remedy which is open to obvious objection should be necessary, when all that is really required is that existing departments, with their administrations ready made, should get together and agree, and that they should be supported by a firm and consistent Government policy. But whatever course is taken, Mr. Morgan's proposals must have immediate importance, because, on the one hand, they appear to be the only constructive suggestions in the field; and, on the other hand, their adoption would give an assurance that labour was being used with something like the utmost efficiency. In their details, doubtless, they may be open to revision. To adopt, for instance, the product of a production-efficiency and a dilution-efficiency as a figure of merit of works for war purposes, is to assume that the nation is equally short, on the one hand, of labour of all sorts, including women and men unfit for military service, and skilled men needed for use in industry, and, on the other hand, of skilled and other men of military fitness for use in the technical and other branches of the Army. It may well be that, for immediate war purposes, the country is shorter of one class than of the other; that, for example, it has more than enough skilled men for industry, if all the dilution were practised that is possible, but less than enough skilled and other men, if the Army is to have all the men it can use. If that were the case, a firm's true figure of merit for immediate purposes would not, as Mr. Morgan proposes, take as much account of its productive efficiency as it would of its dilution efficiency. Apart, again, from the bases on which standards were worked out, much of their practical utility would depend on the care with which data were obtained, and the uniformity with which results were applied. To be successful, in fact, Mr. Morgan's proposals would need the careful and sympathetic scrutiny of practical men in the industries and departments concerned, and a firm and consistent application of whatever principles of action might be agreed upon. But this is no more than is required by any practical reform; and, for the time being, no national need can be greater than that due and immediate attention should be given to these urgent, important, and practical suggestions.

It must not, however, be thought that the arrival of Peace will remove the need for standards. It will, indeed, remove some of the abnormal conditions of war work. Whatever may be the case for war purposes, it is unlikely, for instance, that in peace time efficiency of production can be of less consequence than efficiency of dilution, as for war purposes it well may be. But although the sanction by which efficiency will be demanded in peace times may be less terrible than what is now felt, it will be as irresistible, and may rapidly become even more evident. The hugely indebted nations will have been living for years at a rate of some ten times their normal expenditure, paying their way not by what they have been producing but by what, in the form of national loans, they will have been promising to produce. When Peace comes, those promises of production will begin to fall due for payment, and in this country at least, further earnings will be required to prevent the standard of life that the war has begun to establish for industrial workers from being impaired, or, indeed, to enable it to be raised still higher. The fulfilment of national promises, like the realisation of industrial hopes, will depend on production. At best it will be a hard task to bring production to the required level; it may be impossible if production is at less than its highest efficiency, or if less than the best possible use is made of all the labour that can be recruited. Standards of production, alike in methods, designs, and materials, and of utilisation of labour, both male and female, skilled and unskilled, are necessary now in order to save life; they will be no less needed after the war in order to earn a living. It will be full late to improvise them when the floodgates of international competition are opened again and wider than ever before. Engineers of all countries may, indeed, be seeking not so much what they may grab of markets already acquired by others, as what new markets may be created or satisfied. Between allied nations bounds not previously known may be set to competition, and industries may see that more is to be made by developing new markets than by squabbling for old. But understandings so enlightened and mutually advantageous will reinforce, and not supersede, the old doctrine of effective occupation. The condition on which a market will be left to producers in a given country will be that they hold it effectively; and for this the first condition will be efficient production.

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Industry Must be Free.

The warning to which the chairman of the Mond Nickel Co., Ltd., gave expression at the annual meeting of that concern will be endorsed by large numbers of industrial authorities. Few besides those in actual command of our manufacturing works know what Government control has really meant during the past few years. The burden has been borne as cheerfully as possible as a measure of absolute necessity forced upon the nation by the exceptional circumstances of the situation. Unessential operations have had to be avoided, labour has had to be simultaneously pacified and placed under pseudo-control, raw materials have had to be diverted as varying demand for certain requirements has dictated, imports and exports have had to be directed for reasons which are obvious to all, though the manner of controlling departments has sometimes been less comprehensible. There is an accumulated experience of Governmental control which, while to some it may be an asset, will be to others an object lesson in what should be avoided in the future. The Prime Minister has notified his concurrence with the conviction of traders and manufacturers that control must be relaxed as speedily after the war as the national requirements will permit. Sir A. Stanley, the President of the Board of Trade, and Dr. Addison, the Minister of Reconstruction, hold the same view. The Mond Nickel Co., as we judge from Mr. R. Mond's statement, is one of the concerns that would have been enabled to make much more rapid progress during the last four years had not Government restriction confronted it with immense difficulties on every side. Hundreds of other industrial companies would, doubtless, say just the same thing. What is so necessary to-day, when sections of the community are agitating for continued "control," is that we should remember the lessons of this period of practical experience and recognise the great unwisdom that there will be in putting an unbearable yoke about the neck of industry in times when the situation throughout the world will call for the fullest possible freedom of enterprise. The bit and bridle are needful in controlling an unruly beast; but in the race for life upon which British industry will enter, a free rein will be essential. "When the boys come home," we shall have thousands of first-class men available who will want to enter with spirit and daring into rapid and thorough re-establishment of British industry and trade in all parts of the world. For their own sakes, for the sake of their families, for the sake of those who fought with them, they will want to do it, and if in order to pacify those possessed of Utopian dreams a halter is put about the neck of industry, the nation will be acting traitorously toward those who have fought for freedom. Mr. Mond observes, even to-day, when the war situation is clearing, a continued and increasing tendency on the part of Government authorities to interfere with the management of industrial concerns and to put restrictions upon a reasonable freedom of trade, and we believe that there are among our readers large numbers of careful observers who will fully agree with him that every attempt either by legislation or by regulation to perpetuate this Government control of industry should be carefully examined by traders and manufacturers, and any proposals brought forward with the object of retaining such control, *unless dictated by national necessity*, should be strongly opposed. "British trade had hitherto progressed, and held its own against all comers, without Government support or interference, and he was convinced that it would do so in the future." Earlier in his speech Mr. Mond had recognised that there were such things as "key" industries which were of vital importance, and we do not think that when he refers to the success of the past "without Government support" he was suggesting that such industries should again pass through experiences such as nearly brought about our ruin in the first days of the war. He is quite justified in demanding that if Government officials think control to be necessary, they must make out a clear and convincing case. They can do so with ease in the case of actual "key" industries—indeed, we believe that all political parties that count are entirely at one in the intention to safeguard the security of these. Reading between the lines, we judge that what Mr. Mond wants is freedom to get ready for the future by establishing plants and facilities, and we trust that the Government will not hold its restricting hand upon our industrial authorities in these matters a day longer than is vitally necessary. We do not want to revert to just that state of things that existed in 1914—surely nobody does—but we do want, as rapidly as ever we can, to restore and re-adjust our manufacturing facilities, and our labour and raw material positions. We trust that the thousands of Government officials, the high and lifted-up as well as the rank and file, will see this imperative necessity, and will facilitate the coming of the new conditions with every expedition, sacrificing patriotically in the interests of workers who earn their bread by the sweat of their brow and will want the assistance of accelerated industrial enterprise to give them the opportunity, any characteristic disposition to "hang on" to office.

When the thunder of ten thousand guns is silenced, and Peace enfolds the earth wherein lie those who gave their all to win her, a marching host of warriors will return with the spirit of victory coursing with their blood. Khaki no longer! Reunion, rest, and recreation for a while—but only for a while—and then? For some a little plain talk to those who stayed at home and should not. For others a thirst for enlarged opportunity—in fettered industries?—God forbid! The bonds must be torn away, and leave the limbs and muscles of the entire industrial body free for legitimate endeavour. Only the wise direction essential for the prevention of chaos can be permitted to remain.

The M.T.A. Meeting.

Despite the difficulties of the times, including the railway strike—which, fortunately, collapsed at the critical moment—there was a very good attendance at the "business meeting" of the Association last week, and the proceedings were both interesting and profitable. The chief deduction to be drawn from the discussion on Mr. Hatton's paper—and from the paper itself—is, we think, that municipal tramway engineers and managers, on the whole, have given a cordial and patriotic welcome to the national scheme of electric power supply, as embodied in the report of the Board of Trade Committee, though they are naturally desirous of examining the details of the Bill which is understood to be in course of preparation. A remarkable variety of what we may call side issues cropped up during the discussion, and there was a certain amount of opposition to the claim that a large economy of fuel could be effected, at any rate in particular localities, while the high cost of transmission and distribution over considerable distances was pointed out again; but the right note was struck by Mr. Stokes, of Bexley Heath, early in the discussion, and again by Mr. Furness, of Blackpool, towards the close, the former emphasising the fact that the utilisation of our fuel resources to the utmost possible advantage was the essence of the matter, and that all other considerations were of minor importance.

It is curious how the impression persists that the national scheme contemplates the wholesale scrapping of existing plant, with the consequent waste of capital; there is no ground for this supposition, and the time that has been spent at various meetings in condemning the imaginary orgy of scrapping has been wholly wasted. Only inefficient plant is to be put out of use, and what engineer would be prepared to advocate its retention in service? If the scheme is not to be carried out on common-sense lines, it were better to leave the thing alone. Elasticity is essential to success; every district possesses features peculiar to itself, and should be dealt with in the light of those local conditions—in some cases a huge all-embracing organisation may be desirable, in others a comparatively small concatenation of undertakings will attain the end desired.

The election of Mr. T. B. Goodyer to the office of President was a justly popular one, and in view of the work that has been accomplished by him in the interests of the tramway services, the distinction has been well earned. As a matter of fact, his reward will take the shape of an increased burden of labour, for his year of office will be a very busy one; but that he will cope with it successfully goes without saying, and we congratulate both Mr. Goodye and the Association on the appointment.

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HE EFFICIENT UTILISATION OF LABOUR IN ENGINEERING WORKS.

The paper under the above title, recently read by Mr. Ben H. Morgan before the Institution of Mechanical Engineers, consisted in part of an historical summary of the means by which labour had been found during the war to meet the demands of the services. No one could discuss this aspect of the subject with more authority and insight; and it is not surprising that in the three separate meetings of the Institution in London, Birmingham, and Manchester at which the paper was read, the speakers were concerned more to compare notes of their experience of the work of women and discharged soldiers than to discuss the part of the paper in which constructive proposals were made for present and future working. Valuable as is a record of women's work in the war by one who has taken an eminent part in promoting and guiding it, the attention given at the Institution meetings to this aspect of the subject would have been better bestowed on discussing the measures suggested for assuring efficiency in the immediate and ultimate future. We comment on these proposals in another column; and for the convenience of readers who may not have appreciated them already we give here a short abstract of what they are.

Their primary object is to provide for the service of the war. As far back as June, 1915, it was recognised that all the skilled engineers in the country and the Services could not produce the munitions that were required, if they had to be made with the proportions of skilled labour that had been habitual. It was, indeed, questioned whether even at that time there was enough male labour for the purpose, skilled or unskilled; and when military service became a universal obligation, it was clear that no fit man of military age could be retained in industry honestly or safely if by any means he could be replaced on any work of national importance that he was doing. Accordingly, unskilled men had to be upgraded to eke out the insufficient supply of skilled men, and women had to be introduced to supplement and replace men.

These changes involved not only initial expense, but also, what engineers could spare even less easily, considerable trouble. The experience of firms who have faced the difficulties goes to show that, economically, the dilution of skill and of man-power has on the whole been beneficial; but probably most firms regarded it as in itself an evil, to be accepted only if it were unavoidable. Accordingly, the widest inequalities were found in the extent to which dilution was practised in works of the same trade, and even in the same town: and the worse diluted firms not only increased the needless use of skilled and other male labour, but also discouraged other firms from economising it where they might have done so if economy had been general. This state of things has continued to the present day, and, indeed, "as dilution has progressed since June, 1915, the disparity of effort has become more and more pronounced throughout the country." In certain classes of work, such as shells and guns, the Ministry of Munitions set up standards of dilution for the proportions of skilled, semi-skilled, unskilled, and women's labour that should be employed either in works making the products in question, or in the several groups of operations by which the products were made; and the fundamental suggestion of the paper is that some system of standards should be applied to all manufacture involved in the munitions programme, and might be invaluable as a permanent institution throughout the engineering trades.

The problem may be stated very simply. The nation has only a limited supply of skilled workers, and has an urgent need in the military services for all male workers, skilled or unskilled, who are not indispensably required for its munitions programme. Of the work to be done a part requires skilled and male labour; but in most shop practice more than that part has been done by skilled and other men. Accordingly, work so produced costs more in skilled labour and man-power than it would have cost if skilled and other men had done only what less skilled or unskilled men or women could not do. Many causes may contribute to this extravagance of skilled and other man-power. On the one hand, the work may not have been so subdivided as to separate the skilled part from the unskilled. The plant may not originally have been convenient for use by unskilled workers or women, or may not have been made suitable when, by proper additions or alterations, it might have been. The products of a works may have been too various to facilitate subdivided production. Even mere inefficiency of management or methods of manufacture may have had an exactly equivalent effect in promoting extravagance of skilled and other male labour, requiring more labour, and therefore presumably more skilled and other men, for producing a given article than would have been necessary under efficient methods. Such sources of extravagance may be grouped broadly as inefficient methods of production; and by the side of them is the more direct extravagance of using skilled or male labour on jobs which, in the circumstances of the works, could have been done by unskilled men or by women.

Through whatever cause the extravagance arises, the effect on the national skill and man-power budget is the same; and, in Mr. Morgan's view, each group of causes must be separately controlled. On the one hand, therefore, he proposes to set up standards for efficiency of production, measuring the number of labour-hours that should be allowed for each product; standards having the form of a figure of product per so many worker-hours, including a share of the management-hours. On the other hand, he would have standards of efficiency of dilution, being the ratio of the number of women and unskilled discharged soldiers to the total number of hands employed. The performance of each works would be compared with these standards. The ratio of their production efficiency, measured similarly in product per worker-hours, to the standard efficiency, would be their production efficiency; the ratio of their dilution to the dilution standard would be their dilution efficiency; and the product of these two coefficients would be a "figure of merit" for the works, which should determine its priority in allocation of contracts, labour, tools, and material. Where a firm was making a variety of products for which the standards were different, the figure of merit should be the arithmetical mean of its figures on each product. Both the standards and the figures of merit of the works would be reviewed periodically as fresh information became available.

To institute such standards, which should be applied to all possible contracts, close official estimates of the worker-hours involved would be necessary: and these would have the advantage of displacing the wasteful "time and line" basis. They might initially be based on the best practice attained in individual works, and, little by little, might be revised by introducing into the practice on which the estimate or standard was based methods practised in other shops, but as yet not in the shop that was best on the whole. Particulars both of the standards or estimates and of the methods of manufacture on which they were based should be communicated to each works. Their adoption would not be compulsory; but, as both orders and facilities for executing them would depend on the efficiency of the works in production and in dilution, the best methods and tools would be likely to be increasingly used.

Measures such as these should lead to standardisation of the best manufacturing methods, including output and sub-division of work; and to amplify the data on which they should be based, and facilitate their application to industry after the war, Mr. Morgan suggested that the Institution should set up a committee "to study and report on the best methods in each engineering industry of introducing women into works, the best way of training discharged soldiers, with special reference to methods and appliances for employing maimed men, the upgrading of workers, the best methods of training male and female labour, and cognate matters."

Japanese Exports of Electric Wire.—Electric wires to a value of £4,900 were exported from Japan during the five months ending May last, as compared with only £2,900 in the corresponding period of 1917.

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AN ELECTRIC WORLD GIRDLE.

[COMMUNICATED.]

In the *Times Trade Supplement* for September is an article entitled "An Imperial Cable," contributed by Mr. Wm. Llewellyn Preece, M.I.C.E., M.I.E.E.

We first give particulars of the scheme suggested as explained in the article, reserving our comments and criticisms.

Mr. Preece says:—"The most economical system would be one long electric girdle round the globe, starting from Nova Scotia, touching at Cornwall, West Africa, South Africa, Mauritius or Rodriquez, West Australia, the East Coast of Australia, or Tasmania, New Zealand, Fiji, Fanning Island, and Vancouver."

"A separate cable would connect India with Mauritius, and a landline across Canada would complete the ring from Vancouver to Nova Scotia."

"The girdle would contain 27,000 miles of submarine cable and 3,000 miles of landline."

"There would be 12 stations, the principal being in Cornwall, South Africa, Australia, New Zealand, and Canada."

"Such a system could only be installed by the joint Governments."

"We may assume that each principal station would be connected up with the telegraph system of that country, and that this system would collect all messages and transmit them to the cable station."

"In addition, it would probably be desirable to call into existence a special Press Agency in each country, which would collect all news and transmit it to the cable station, and also receive all incoming news and distribute it to the newspapers."

"With such an arrangement the staff of this system would only be employed in the cable stations, and no other office would be required except the head office."

"Under these circumstances the capital outlay for a new ring should not exceed £7,000,000; but as there is no apparent reason why the Pacific cable should not form a section of the ring, the actual expenditure should not exceed £5,000,000, including two additional ships.

"The annual cost of working would be approximately—

Maintenance, renewals, and working of 12 stations and three ships	£300,000
Rent of landlines	10,000
Interest and sinking fund for paying off capital in 50 years	350,000
Renewal of cables, &c.	70,000
	£730,000
(say)	750,000

"This one continuous ring round the world would serve six stations, one in each country, and would, when worked duplex, be capable of transmitting at the rate of 100 words per minute—*i.e.*, 50 W.P.M. in both directions.

"If each country supplied all the other five with 10,000 words of Press news per day this traffic could be transmitted in 10 hours."

"*E.g.*: England could send out in 3½ hours 10,000 words round the ring to South Africa, India, Australia, New Zealand, and Canada; and, at the same time, Canada could send in the opposite direction 10,000 words to New Zealand, Australia, India, South Africa, and England in 3½ hours."

"South Africa and India would then have possession of the ring for 3½ hours; and after that Australia and New Zealand."

"Each country would thus supply all the other countries with 10,000 words of Press news, so that each country would receive 50,000 Press words within 10 hours—say, 11 hours to allow for corrections, delays, &c."

"Leaving another hour for daily testing, the remaining 12 hours could be used for private messages."

"During the transmission of Press news the cable directly connecting the two countries transmitting could be used at such times for private messages; therefore, England and Canada, South Africa, and India, Australia, and New Zealand could each transmit to the other during 3½ hours 10,000 words, or 60,000 words in all."

"During the 12 hours it would be quite possible to work as follows:—For two hours each country could transmit and receive from its adjacent countries—*i.e.*, Canada and England, England and South Africa, South Africa and India, India and Australia, Australia and New Zealand, and New Zealand and Canada could intercommunicate, and each country would be able to send 12,000 words in two hours—*i.e.*, 72,000 words in all."

"For the next 2 hours:—

England and India; India and New Zealand; New Zealand and England would intercommunicate; S. Africa, Australia and Canada acting as relay stations; and for the following 2 hours—

Canada and Africa; S. Africa and Australia; Australia and Canada would intercommunicate, and each could transmit 12,000 words, so that in these 4 hours another 72,000 words could be sent."

"Finally:—England and Australia: then Canada and India; then New Zealand and S. Africa could each intercommunicate for 2 hours, and as these two countries would be connected together by two routes, they could each transmit 12,000 words in the 2 hours, *i.e.*, 72,000 words in the 6 hours."

"The total private messages would therefore be—

60,000 + 72,000 + 72,000 + 72,000 = 276,000 words in all.

Allowing 25 per cent. for calls and corrections, the total number of paying words would be approximately 200,000."

"If a charge of ½d. per word were made to the Press Agency of each country, each would have to pay £104 per day—a revenue of about £220,000."

"As at least on the average 20 papers would take this supply in each country, each paper would pay only £5 per day for all this news."

"If a charge of 2d. per word were made for private messages, the daily income would be £1,600, or approximately £580,000 per annum. The total revenue would thus be £800,000, against the above-mentioned expenditure."

"If it were possible to transmit private and Government messages at a flat rate of 2d. or 3d. per word, the cable system would be filled with traffic throughout the 24 hours, and real union would be attained."

Even assuming that the cables are working regularly according to the time-table during the 24 hours, the revenue anticipated does not represent sufficient inducement to embark on such a speculative and risky investment.

Mr. Preece thinks it "well within the realms of possibility that the speed of signalling over the cables may be increased, thereby permitting a larger amount of traffic to flow, and the extra money thus earned would be almost entirely clear profit." He suggests the possibility of 10 per cent., or even a 50 per cent., increase. This may, perhaps, be realised for cable working in the *future*, but it is not usual to base present revenue estimates on merely future possibilities; and even so, it will be the same for all cable companies equally; and it is quite as likely that we may hear of as important an increase in speed through competing wireless systems.

If the advantages of this low-rate circular system were so much appreciated, it would soon become necessary to lay another to meet the congested traffic, and the circular cable would become a still more powerful competitor against already existing cable companies.

Mr. Preece says: "Such a system could only be installed by the joint Governments" of the British Empire League.

This fact would, of course, place the old companies under a great disadvantage, and bring pressure on them to reduce their tariff, and their doing so would tend to reduce the revenue of the circular venture.

That such a performance could be regularly kept up during the times mentioned through such a system working duplex at 50 W.P.M. each way, and with from one to four relays at intermediate stations, without frequent delays and serious reductions of the words on which the revenue is based, cannot reasonably be expected.

The number of hours allotted to each country for transmitting and receiving messages is the same, and if not conformed to would upset the time-table for other stations in the ring. If, therefore, the number of messages to be received from or sent to some of the stations are insufficient or too many for the time allotted, waste of time would result on this account.

Whenever communication on any section becomes interrupted for any cause, the elaborate time-table would again be upset, entailing reduction of traffic.

In the course of years the cable will develop mechanical and electrical weakness. To meet the contingency of a breakdown, and consequent stoppage of traffic through some of the sections, which may happen at any time, the laying of a second cable will be imperative, otherwise these Government stations would have to divert their messages through the lines of those old cable companies whose interests they had so little considered.

We are not told how long it will take to construct and lay the 27,000 miles of heavy-core cable, and as the financial harvest expected when it forms a girdle round the world, cannot be fully realised until the last section is completed, the interest on the capital will for that length of time be very small.

The principal reason given why the joint Governments should favour such a gigantic undertaking is, however, not that it would prove a great financial success, but in order to "transform the British Empire into a true league of independent nations, and consolidate the Commonwealth for foreign affairs and defence." This, it is said, "can only be definitely attained by much cheaper telegraphy—so reasonable in cost that their messages shall be rapidly transmitted and immediately answered, and all occasions of misunderstanding, as forced the States of America to break away from the Mother Country, and to become independent, avoided." "If it were possible to supply each country daily with ample

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Press news from all the other countries at a cost of ½d. or 1d. per word, the principal newspapers would welcome the supply, and the people would read the news with interest." "Finally, if it were possible to transmit private and Government messages at a flat rate of 2d. or 3d. per word, the cable system would be filled with traffic throughout the 24 hours, and real union would be attained." "It is obvious that at such rates the whole Commonwealth would have a means of intercourse which would bind all together so closely that political means of consolidation would become a problem of secondary importance."

The advantages of increased intercommunication facilities, whether by cheaper and quicker means of travelling or telegraphy—and especially by cheap postage—are without doubt important, and likely to bind more closely widely separated nations speaking the same language and having so many interests in common; but that these interests would be so very greatly advanced by the extra means of communication provided by the circular cable in question, is very doubtful. Not only are the present conditions and facilities incomparable with those of nearly a century and-a-half ago, when telegraphy and cheap postage was unknown, but, with the alternative Atlantic cables to Canada and the comparatively cheap and high-speed land-lines across Canada, a much better guarantee of uninterrupted communication already exists as far as Vancouver. Thence to New Zealand we already have the Pacific Cable, which Mr. Preece thinks might be included in the suggested girdle.

Moreover, as the surface of the globe is traversed by alternative telegraph routes to all the countries of the British Empire—not to mention the continuously improving means of wireless telegraphy—the desirability of the joint Governments promoting such a tremendous and risky undertaking, in competition with existing cable systems, merely for the sake of another route, does not seem at all desirable.

Though not expressly so stated, it would appear as if this girdle is intended to serve as a strategic cable.

As in a great war our ships would be fully employed, the resources of even the British Navy would be unable to guarantee the safety of a cable encircling the globe; and, in fact, the strategic cable would be more likely to be intentionally broken by the enemy than any other.

A rupture in one or two places would dislocate the traffic and render the circular system unworkable.

Considering that a break or serious fault in very deep water often takes several months to repair—especially in the winter months—the annual revenue would be seriously reduced. This is a contingency which must be taken into account when considering the risks to revenue entailed by putting so many eggs into one basket.

For a submarine cable system of 27,000 miles instead of providing only three steamers in the estimate of cost, a small fleet would be necessary, so that one repairing ship may be stationed within a reasonable distance of its field of operations, unless it is contemplated—as when it becomes necessary to divert messages—to draw upon the kind offices of competing companies by asking them to lend their repairing steamers to meet the emergency.

As the core to give 50 W.P.M. each way through such abnormally long cables must be very heavy, it will not be a light type of cable easy to raise from great depths, and the cable tanks must be large, too, and the ships able to carry long lengths; consequently, small repairing ships would often not be serviceable even if available.

In the case of a breakdown is the large traffic, which it is expected will keep the circular cable busy during the 24 hours, to be suddenly diverted through the lines of competing companies—already doing a heavy traffic—who, owing to the serious competition, had been forced to lower their tariff per word? That this enforced lowering of tariff must react on the circular cable and reduce its annual revenue must also be taken into account.

If the 10,000 words daily of Press news is to be so greatly appreciated by the 20 papers in each country, would not competing telegraph companies find it advantageous to upset this monopoly?

Under present conditions very important news and stock quotations find their way, by telegraph, to most of the Dominion papers, so it may be questioned if the 10,000 extra words of Press news through the circular cable would be worth £5 daily to each of the 20 papers.

It is, moreover, even more doubtful if 10,000 extra words of Press news would make such an increase in the reciprocal good feeling of kindred and already closely allied nations as to call for the laying by their Governments of such an extravagant circular cable. If any such marked increase in mutual appreciation can be effected, it will surely be more realised through the medium of cheap postage and fast steamers bringing our kinsmen into closer personal intimacy than by short telegraphic messages, most of which would be restricted to Government and mercantile business; but if it be considered so important to increase the Press news, could not this be more equitably and cheaply done by inducing existing companies to send certain Press news at the low rate per word suggested, and indemnifying the said companies against loss for any difference below the usual tariff?

The precise meaning of "transforming the British Empire into a true league of independent nations" is not clear. If this league is intended to be a substitute for the League of Nations advocated by the Entente Powers as the guardians of the peace of the world against renewed aggression of the Central Powers, and guarantors of the freedom and independence of the smaller States, it is undesirable; because the larger the number of nations comprising that League the more powerful and effective will be their control. Instead, therefore, of the British Empire being exclusive, it should rather include all nations, small and large, willing to co-operate in upholding international law, liberty and equal rights. A League of only English-speaking nations, moreover, seems quite unnecessary, because their loyalty has already been put to the proof, and they have shown the world that in the cause of freedom and humanity they require no specially binding covenant, as they can be trusted never to fail to champion these sacred causes for their own sakes.

THE MUNICIPAL TRAMWAYS ASSOCIATION (INCORPORATED).

Annual Conference at Leicester.

(*Concluded from page* 310.)

The Conference, which was duly held at Leicester Town Hall last week, was favoured with fair weather, on the whole, and a very good attendance was recorded, the Council Chamber being filled to its utmost capacity. The Mayor of Leicester having greeted the visitors, Alderman Flint delivered his presidential address, and this was followed by Mr. Hatton's paper, of which an abstract appeared in our last issue. The discussion on this paper, which occupied the remainder of the morning session, is reported below.

At mid-day the Mayor (Alderman North, J.P.) entertained the members of the Conference at lunch in the Museum Buildings. The Mayor regretted the obviously unavoidable absence of the President of the Board of Trade, Sir Albert H. Stanley, but welcomed a representative of the Board in the person of Mr. J. Devonshire, chairman of the Board of Trade (Tramways) Committee, remarking that it was always advisable to keep on good terms with those holding the whip hand; he deprecated an excess of centralised control, but recognised that in moderation it was beneficial.

Replying to the toast, Mr. Devonshire referred to the rationing of coal, and the impression that tramway undertakings had been singled out for rationing; he said the Committee had acted under instructions, and assured the members that whilst they had been asked to economise because they were organised, the fact that they were organised ensured that they would not be starved for coal, in view of their importance in the national service.

Councillor Mayne proposed the "Town and Trade of Leicester" in a humorous speech, to which the Town Clerk, Mr. H. A. Pritchard, responded; and Alderman J. R. Freears, J.P., Deputy Mayor, proposed the "Municipal Tramways Association," the toast being briefly acknowledged

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by the president, Alderman S. Flint, J.P. Proposing a vote of thanks to the Mayor, Councillor Timpson remarked that Alderman North had occupied the chair for four years, and had been instrumental in raising £100,000 for wounded soldiers.

On the resumption of the business meeting in the afternoon, the report of the Executive Council on the formation of a National Joint Council for the tramway industry was considered, and a statement as to the objects of the proposed Council, and as to the negotiations which had taken place with regard to its formation, was made by Mr. McElroy. The feeling of the meeting was generally favourable to the proposal.

On Friday morning, after meetings of the Executive Council and the Managers' Section, the business meeting was resumed at 11 o'clock. The report of the Executive Council and the treasurer's statement were received and adopted, and the officers for the ensuing year were elected. The names of the new officers and members of Committee are as follows :—

President.—Mr. T. B. Goodyer (Croydon).

Vice-President. — Alderman Sir John W. Courtis (Cardiff).

Hon. Secretary.—Mr. W. Clough (Bury).

Ordinary Members of Committee.—Clr. J. Timpson (Portsmouth), Messrs. A. L. C. Fell (L.C.C.), J. B. Hamilton (Leeds), G. W. Holford (Salford), and R. L. Horsfield (Walsall).

Mr. C. J. Spencer (Bradford), hon. secretary 1911-1918, retired on account of his accepting an important post under Government, and an interesting feature of the sitting was the presentation to him of a valuable gold watch, together with a handsomely appointed dressing-case for Mrs. Spencer, which had been subscribed for by the members. Speeches were made by Mr. Hamilton (chairman of Executive Council), the President, the Chairman and Vice-Chairman of the Bradford Tramway Committee, and others, expressing the heartfelt admiration, esteem, and real affection of the Association for Mr. Spencer, and the highest appreciation of his valuable services. In the course of his reply Mr. Spencer said that he had been a member of the Association from its inception ; the post he was vacating involved a great deal of hard work, but it was pleasant work, and well worth while ; he thanked the Corporation of Bradford for the assistance of the clerical staff and office accommodation. The Conference then unanimously elected him an honorary member, the highest honour within its power, which is shared by only one other member.

The proceedings closed with votes of thanks to the officers and to the Corporation of Leicester, and the members were afterwards entertained at lunch by the retiring President, Alderman Flint, Chairman of the Tramways Committee, in the Museum Buildings.

During the Conference visits were paid by parties of the members to various engineering features of interest in Leicester and the neighbourhood. The Conference, as a whole, was considered a highly successful event.

The Post-War Position of Electric Power Supply.

The discussion on Mr. Ernest Hatton's paper (of which an abstract appeared in our last issue) was opened by Mr. J. M. McElroy (Manchester), who remarked that the question of electric power supply was engaging the attention of several other associations, especially the Incorporated Municipal Electrical Association, and proposals relating thereto were under the consideration of the Government. The importance of the subject to tramway authorities was due to the fact that at least 25 per cent. of the total output of electrical energy was used by tramway undertakings, of which there were 176—93 municipal, and 83 company undertakings. These consumed 620 million units per annum, of which 79 per cent. was taken by municipal undertakings. Of the 176 tramways, 38 had their own power stations, and 138 purchased energy; but 50 per cent. of the energy used was generated by the former in their own stations. If, however, the London County Council system were excluded, only 39 per cent. was generated in tramway power stations. The question whether energy should be generated or purchased had been much debated in bygone days, but the position was now quite different. Experience showed that in certain towns the tramway authorities had been overcharged in comparison with industrial concerns, having in view their good load factor. In 1911 the two Associations—the I.M.E.A. and the M.T.A.I.—prepared a joint scheme, settling the principles on which the charges for energy from combined stations should be based. He had recently inquired of all the municipalities concerned, with the result that he found that practically none of them had adopted the scheme; it would be interesting to know why. Mr. Hatton asked why the tramways should not help the power side of an undertaking. There was a suspicion that in order to develop the power side, exceedingly low prices had been charged for motive power, which could not have been done without the tramway load; cheapening power at the expense of the tramway users was unjustifiable. He (Mr. McElroy) advocated the development of electric power supply on lines that would help all industries, including tramways. The main conclusions of the Coal Conservation Sub-Committee's report were worthy of serious consideration; they included the appointment of a board of commissioners to develop electric power supply over the whole country, and to stop the extension of uneconomical stations, the delegation of control to new district authorities, and the standardisation of system. In a prefatory note the Minister of Reconstruction referred to the relations between company and municipal undertakings, and stated that the whole matter would be thoroughly investigated before any action was taken by the Government. The Board of Trade Committee had also issued a valuable report; it recommended the formation of a new body of Electrical Commissioners, to have general control in the United Kingdom, the abolition of the existing system of small areas, the division of the country into suitable areas presided over by District Boards which would be responsible for generation, while the existing undertakings might retain the distribution, and the financing of the scheme with Government assistance. After further quotations from the report, he expressed the view that the setting up of a national authority and of district boards controlling wide areas was based on sound principles, but the details must be carefully examined when it was seen what steps Parliament proposed to take. Something ought to be done quickly to direct future development on right lines; the continuance of present conditions would be fatal to success in competition, and a cheap supply of power was essential to the national welfare.

Mr. H. Webber (Keighley) agreed with Mr. Hatton that the reports were too rosy in anticipating great results in the near future. All undertakings had suffered from heavy standing charges owing to rapid changes in the methods of generating electrical energy, and the new scheme would likewise be burdened with heavy capital outlay for new plant, compensation to municipalities, long mains, &c. Transmission losses would be nearly as costly as the transport of coal by rail. The North-East Coast companies had been developing on lines similar to those proposed, but were not supplying much cheaper than in Keighley, where before the war energy for power was supplied at less than ½d. a unit. No great economy in steam consumption was to be gained by increasing the size of station above 30,000 kw., and a 6,000-kw. set was nearly as economical as one of 15,000 kw., though the latter showed a saving in labour. Breakdowns in large stations would be more serious, and reduplication of feeders essential. He believed the scheme would eventually develop into a working system, but it should not be rushed.

Mr. H. P. Stokes (Bexley Heath) feared that the discussion might drift into narrow lines, and urged that the matter should be considered from the national point of view. Conservation of coal was the main question—engineers were apt to look at it from the standpoint of use. Coal was our most valuable national asset, and should be used in the most economical way possible; generating steam was *not* the best way of utilising it. If it were used to the best advantage, electricity would be a by-product; it possessed enormous resources, more important than the mere generation of power. The Association ought to support the formation of a committee to develop the use of coal on the most advantageous lines. They were too apt nowadays to standardise everything: electrical energy could not be limited to one particular form—each form possessed peculiar advantages for certain processes; standards might be fixed for railways and lighting, and for certain industrial processes, but to establish one standard for all purposes was a mistake.

Mr. W. Murray (Walthamstow) said he understood that from the engineering standpoint the scheme was a good one, but from a financial point of view he thought it was open to criticism. Everything depended on what was done with the existing generating stations; if they were scrapped, the new scheme would be handicapped with an immense burden of debt. There was also a danger of losing in distribution the saving in generation—long mains were very costly. If a loss was made, who would bear it? During the first few years a loss was possible, and even probable. Apparently municipalities must part with their tramway or supply stations, whereas private companies could carry on. The appointment of the Commissioners was in the hands of the Board of Trade, but, in view of past appointments, the Board ought to be subject to some supervision. The District Boards were to be small bodies—larger numbers would give greater safety from their capture by cliques. Compensation for displaced officials ought to be compulsory, not optional.

Mr. R. H. Wilkinson (Huddersfield), congratulating Mr. Hatton on his paper, said that if, when starting the tramway undertaking, Huddersfield had purchased energy, it would have cost 3d. a unit, and the growth of the system would have been restricted; having its own power station, supplying

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energy at ¼d. a unit, the system had developed to a length of 56 miles of track, and a revenue of £170,000.

Mr. E. S. Rayner (Doncaster) thought that Mr. Hatton's opinions had been modified since he drew up his report to the Newcastle Corporation. He contended that no station ought to be taken over without a guarantee that the supply of energy would be cheapened. He doubted whether Government control tended to economy, citing the telephone service as a case in point, and questioned the advisability of handing over the whole power of control to a board. Capital charges had a great effect on the supply price, but not on the generating cost, and if the capital were watered the scheme would be of little use. With regard to the question of charging uniform prices everywhere, he pointed out that the location of important industries, such as the manufacture of iron and steel, cotton, shipbuilding, &c., was not determined by the availability of a supply of power.

Mr. C. L. E. Stewart (Rawtenstall) held that the Coal Conservation Report had been discredited; the Board of Trade Committee's report was more worthy of consideration. Certain stations of moderate dimensions could beat the big ones in point of economy, and the big station had not proved its case. Both reports dealt with units generated, whereas the real issue was units sold; at Rawtenstall the works cost was 0.4d. per unit, but they had to get an average price of 0.9d. per unit sold. The loss in distribution might amount to 20 per cent. He drew attention to the statements of Mr. Fedden and Mr. Pearce at Manchester with regard to the cost of transmission of electrical energy. Referring to Mr. Murray's remarks, it was not intended to scrap old stations or to build superstations at once, but to develop the scheme by degrees in suitable areas, weeding out inefficient stations. The Government scheme would do away with the spirit of emulation at present existing between neighbouring undertakings. Frequency and phase should be standardised, but the voltage should be left open.

Mr. C. Furness (Blackpool) said that the discussion was degenerating, and that the report of the Board of Trade Committee had been depreciated; he felt it his duty to support the report in the national interest. There was no intention of scrapping economical plant. They had been marking time since August, 1914, with regard to extensions; many towns were waiting to spend capital in development when they were permitted to do so—in the neighbourhood of Blackpool he knew of an aggregate contemplated expenditure of £300,000. The real question was whether each should go his own way, or whether they should have a joint board, and lay out capital on the most economical lines. He did not commend the action of the Council in asking Mr. Hatton to read a paper on this subject—there were matters of far greater importance to tramway men which should have been discussed that morning. He thought that Mr. McElroy had over-rated the importance of the traction supply. At Manchester the cost of energy for traction was 13 per cent. of the revenue; at Newcastle it was only 7 per cent., at Blackpool 12½ per cent., at Cardiff 5 per cent., at Burnley 20 per cent. The cost was not a factor of great moment, and he, personally, did not believe in the fetish of low costs—a reasonable profit was justified.

Replying on the discussion, Mr. Hatton remarked that at Keighley Mr. Webber was practically supplying a huge factory, so that the cost of cables was comparatively small. The experience of the Newcastle companies showed that the risk of breakdown was not serious. With regard to Mr. Stokes's remarks, the utilisation of coal was under investigation by the Government. He agreed with Mr. Wilkinson regarding the advantage of having one's own power station. Mr. Rayner suggested that he had changed his mind, but it should be remembered that he reported on the Coal Conservation Report, and that the Board of Trade Report had not then been published. Let them all join together, if it were necessary in the national interest—but under Government control, not that of a company. Referring to Mr. Stewart's remarks, he said that the supply of power to railways was a matter of vital importance; and he reminded Mr. Furness that tramway men were keenly interested in the constitution of the District Boards.

THE BRITISH MAGNETO INDUSTRY.

Three months ago we formed one of a party of journalists representing the technical Press of the country which was invited by the British Ignition Apparatus Association to visit the various works in the Midlands, to see what had been accomplished in the cutting of German associations by British enterprise in the manufacture of magnetos for ignition purposes.*

Last Friday, with a similar aim in view, we were privileged to make a tour of inspection of the works of the British Lighting and Ignition Co., Ltd. (proprietors, Messrs. Vickers, Ltd.) The manufacture of magnetos affords as striking an example as any of the extent to which a key industry—for such it is now recognised to be—was allowed to fall into the hands of the foreigner. The enterprise and perseverance, under many discouragements and initial obstacles, of the British firms who have taken up the manufacture of magnetos, have completely reversed this unsatisfactory condition of affairs. British magnetos are to-day being produced which are demonstrably superior to the foreign article and these machines are standing greater strain and stress than was ever thought of before the war.

There is every possibility that the work will have a measure of protection against outside competition when peace comes, and the pioneer work of the manufacturers should have its reward. It is not a bad start, after all, to have effectually dissipated the fabled superiority of Stüttgart. A visit to some of the factories now engaged in the production of magnetos should convince anybody that this is purely a fallacy.

The B.L.I.C. works are housed in a five-storey building with a basement utilised as a general stores. The lighting of the works is excellent, and in only one or two cases did we note that artificial light had to be used. The factory is fitted out with up-to-date machinery which is well arranged, the whole works being electrically driven, both the individual and collective drive being utilised. We were greatly interested in a number of ingenious machine tools and jigs that we saw at work in the factory, and the moulding of insulating material is carried out very efficiently. We were informed that the Bosch Company spent a large sum annually on cutting tools for turning moulded insulating material and parts, as the high-speed steel tools used were only capable of turning a small number of parts. The B.L.I.C. firm employs diamond cutting tools for turning all moulded insulation parts, including brass contact pieces, &c. These tools are very efficient, and we were informed that they had a very long life.

Another feature that we noted with pleasure was that the firm employs the metric system of weights and measures. We were informed that the firm had to use the system in certain instances, and it has been adopted throughout the magneto factory, with a resulting saving of much time and labour.

Extreme care is taken in machining, and the working limits employed are very fine, every part being manufactured to limit gauges. So intricate are certain parts of the magneto that in many instances special machine tools have been evolved. After each separate operation, the parts are examined carefully in a well-organised view room.

Special care is given to the armature and condenser; the fineness of the wire and the extreme delicacy of the mica demand particularly deft skill in handling.

In the main test rooms all material is examined and carefully tested—magnets for strength and performance, insulating materials for breakdown voltage, and the metals used in the mechanical parts for strength and hardness. The finished magnetos undergo most exhaustive tests; every machine is submitted to a prolonged endurance test at high speeds and at a voltage much greater than that required for actual service. Every machine is tested to see that the sparking at high speed is regular, special devices being employed to detect instantly any variation under high speed conditions.

An important feature, appealing to motorists, is the capacity of the magnetos for sparking at low speed, thus giving easy starting. They are designed specially with this end in view, and new features are rapidly being incorporated to improve them still further in this respect.

Special attention is being devoted to experimental and research work, both in regard to electrical performance and manufacturing processes. Important results have already been obtained, which are being embodied in the newer designs, with the result that smaller, lighter, and more efficient magnetos are now being produced.

* Elec. Rev., June 21st, 1918.

ANOTHER 35,000-KW. TURBINE WRECKED.

On August 1st a 35,000-kw., 20-stage, 1,500-r.p.m., single-cylinder impulse turbine in the Northwest Station of the Commonwealth Edison Co., Chicago, Ill., was completely wrecked. The main generator and possibly some of the wheels were the only parts not seriously damaged. There were no fatalities and no casualties. The turbine had been in service since December, 1917, and was of the latest design of the General Electric Co., U.S.A. Naturally, one of the first thoughts of engineers on learning that the machine was wrecked was: Is this accident a parallel with the accident to the turbine of the same type and capacity wrecked in the O Street station of the Elevated Railways Co., Boston, Mass., on February 14th of this year?* It is not identical, though the trouble was in the low-pressure end, as at Boston.

According to *Power*, September 3rd, the Chicago machine carried no load at the time it went to pieces, but had been in service all day. It was taken off the line shortly after midnight, July 31st, preparatory to cleaning the condenser, and, as is the usual good practice, the crew immediately arranged to give the machine its regular monthly overspeed run to test the automatic stop governor.

* Elec. Rev., April 5th and 12th, 1918.

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The overspeed test is given by the operator, who pulls up on the governor lever. This was being done when the accident occurred. The generator is of 25 cycles. The switchboard operator states that the speed at which the turbine began to be demolished was that which gave but 26½ cycles, or less than the customary 10 per cent. allowed before the automatic overspeed stop governor functions. The speed corresponding to 26½ cycles is about 6 per cent. above the normal speed of 1,500 R.P.M., or 1,590 R.P.M. When the overspeed test was made on June 1st the speed reached 28 cycles, or 12 per cent. above normal. The operator tripped the throttle by hand when he saw that the automatic stop did not function at 27½ cycles. On the July 1st overspeed test the automatic stop governor tripped the throttle at 27½ cycles.

At the time of the wreck the conditions were ideal for observation of the behaviour of the machine, for correct reading of the tachometer by the men at the turbine and of the frequency meter by the switchboard operator. There was no emergency, there were no unusual conditions. The builders understand that the voltmeter pointer was hard over against the extreme stop, and are attempting to determine at what speed the generator would have to run to create such voltage.

At the time of the wreck the steam pressure was 240 lb. There is comparatively little load on the station at this hour of the morning. The throttle was wide open. The watch engineer was standing at the throttle while the overspeed test was being made. Nothing unusual was happening. Suddenly there came a thump, severe vibration, and a crash as the low-pressure casing burst and pieces of metal and blades flew about the room. The man at the throttle tripped it when he saw the low-pressure casing burst.

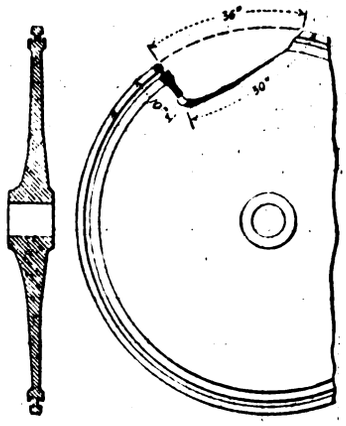

Fig. 1.—Showing Piece cut out of the Nineteenth Wheel.

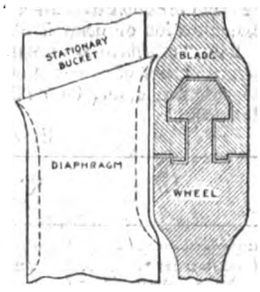

Fig. 2.—Dotted Line shows how Diaphragms were Cut Away.

The significant facts relative to the damage to the turbine are these: The cast-iron low-pressure casing was blown away, from the eighteenth wheel onwards. The high-pressure casing, made of cast steel, was cracked, chiefly below the reinforcing webs. The diaphragms in the last low-pressure stages were broken up; the semisteel cone supporting these diaphragms was demolished. The governor was knocked away completely from the turbine. Housings for the three bearings for the turbine, that is, that at the governor end, and the two between the turbine and generator, were all broken.

The bedplate beneath the outboard-bearing pedestal was cracked. The housing at the bearing on the high-pressure end was torn away where its flanged bottom was bolted to the bedplate. The flanged bottom of the bearing housing was tilted up in the direction of rotation of the shaft.

The next to the last low-pressure wheel of the Chicago machine, or the nineteenth wheel, had a piece 36×30×12 in. broken out of it as shown in fig. 1. The breaking of this wheel is the most significant feature of this accident.

The top or the periphery of the last (twentieth) low-pressure wheel particularly was bent so that it presented a wavy line. About one-quarter of the number of blades on this wheel were torn away and the remainder were badly bent. Some blades remained on all the wheels that were visible. The turbine at the time of writing had not been opened up, therefore the condition of the high-pressure end of the rotor was not known.

The shrouding on the last low-pressure wheel is, of course, gone. Incidentally, it is enlightening to know that some weeks ago the shrouding on the third from the last low-pressure wheel, or the seventeenth, got loose from the blades. The blades were cut down and new shrouding was put on.

Pieces of diaphragms and pieces of the great cone supporting the low-pressure diaphragms fell into the condenser, crushing the tubes for several rows from the top row. The support for the bearing at the exhaust end of the turbine was not fractured, but the bolts holding it were loosened. All the nozzles in the twentieth diaphragm were knocked away, and the ring holding the tops of the nozzles was broken.

The violent vibration and backlash of its gears possibly shook the governor completely from its position. It is reasonable to presume that it was not knocked away by being hit by a piece of metal. It was farthest from the low-pressure end where such pieces started on their flight, and in a direction at right angles to that taken by the flying pieces. However, one will recollect that at Boston four large pieces of metal went through the end wall of the turbine room near the roof. This is in a direction at right angles to lines drawn radially from the turbine rotor, or from the direction that most of the flying pieces of metal took.

The breaking of the bedplate near the pedestal for the outboard bearing excites inquiry. There are two bearings between the low-pressure casing and the main generator, one on each side of the flexible coupling. When the housings for these bearings broke, the shaft was not held rigidly except at its extreme ends. The generator rotor, weighing many tons, revolving at least at 1,500 R.P.M., would naturally tend to spring the shaft and cause it to whip, and this would be likely to put stress on the bedplate sufficient to fracture it. This assumption invites credence because the bedplate where it was cracked was raised from its normal position.

To return to the broken nineteenth wheel, the most significant feature of the wreck, the piece broken out was of the shape and relative size shown in fig. 1, and weighed about 200 lb. A natural inference is that this was the first part of the rotor to let go, and so precipitated the wreck. A portion of the piece was taken to the builders' shops at Schenectady for examination, and they say the metal shows no defects.

The wheels are of forged steel, tensile strength 130,000 lb., elastic limit 73,000 lb. The nineteenth wheel is about 8 ft. in diameter and is shaped as shown in section in fig. 1. Ordinarily the temperature of these wheels when the machine was in service was that corresponding to the vacuum in which they revolved. When running without load, however, the temperature might have varied from about 95 deg. F. to 200 and 300 deg. F. Our contemporary does not question the accuracy of the designer's calculations relative to these wheels, but remembers that when this design of turbine was first brought forth, the Massachusetts Institute of Technology was engaged to check the stresses in the wheel, that in this particular wheel (one from the Boston turbine), the factor of safety was found to be four, and the professors did express it as their opinion that because of the shape of the wheel fracture might develop if it was subjected to sudden extreme temperature changes.

It is possible that the wheels of the Chicago machine were subjected to temperature changes at the time of the wreck, as the machine had been carrying its usual load, and it was only two or three minutes from the time the load was taken off until the damage was done.

Besides the symptoms audible immediately previous to the turbine letting go—there was no undue vibration, one violent thump being the first indication of trouble—there is other evidence that the wheel was the first part to break; and incidentally this evidence seems to show that the blades on the last two wheels did not let go first, and by centrifugal force alone, as was current rumour in the days immediately after the accident. An explanation, given in the following, is necessary here:—

Reference to fig. 2 shows how these last low-pressure blades were mounted on the wheel. The clearance between the diaphragm and the wheel was ordinarily ½ in.; but in the Chicago machine the diaphragms were cut away as shown by the dotted line, to give sufficient clearance to allow for two possibilities, namely, distortion of the diaphragm, and failure of the wheel to preserve rigidity at its rim. The peripheral speed was about 1,000 ft. per sec. for these last wheels. Therefore should rubbing of the diaphragm against the wheel occur, the base of the blades would be burned away at the fastenings. There was no evidence of such rubbing in the Chicago machine. Many of the blades had the appearance of having been struck a heavy blow, and it is likely that this blow, together with the centrifugal force, tore them from their fastenings. The blades appeared to have been wrenched away from the wheel. At the time of writing no examination of the thrust bearing had been made. The adjustment to the thrust bearing, as it was indicated by the indicator for the purpose, revealed no change in the position of the bearing.

After the Boston accident, all turbines of this type had their secondary valves locked by the builders, thus lightening their load. The Chicago machine had its load limited to 28,000 KW. maximum.

WAR ITEMS.

Conditions in Germany.—The "Times" correspondent at the Hague, referring to the condition of affairs in Germany, mentions that some thousands of Dutch workers engaged in various industries remain at Duisberg, and they are being fed by their employers. Accidents are constantly happening owing to the machinery being worn out. "Last week in the Rheinisch-Stahlwerke a mechanical saw was destroyed owing to electrical contact, four Dutch workmen being killed."

Exemption Applications.—Chelmsford Tribunal has dismissed an appeal by E. Hockley (46), electrical engineer, as

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he holds a voucher issued by the War Agricultural Committee, with the right to re-appeal.

At Exeter, the National Service Representative applied for a review of the case of J. Lake (33, Grade 1, late C 2), electrical engineer at the Corporation electricity works. The city electrical engineer wrote that the man had charge of the electrical power motors in the city, and it was important that they should be maintained. He had charge of about a third of the motors in the city which were supplied with energy from the Corporation works. The exemption was confirmed.

At Torquay, three months were conceded to J. F. Veale (48, Grade 2), electrician.

At St. Albans, exemption was refused to F. Sandford (32, Grade 3), electrical engineer, of Childwick Green.

Canterbury Tribunal has granted another four months' exemption to A. Johnson (26, Grade 2), in charge of the electrical installation and motors of Messrs. Court Bros.

On the recommendation of the Advisory Committee, the Rochdale Tribunal has granted exemption until December 31st to B. R. Eves (37, Grade 3), tram conductor and motorman, engaged with the Corporation.

At Taunton, on a review, exemption held by T. H. Horrill (38, C 2), engine driver and stoker; W. H. Trott (38, B 2), engine driver and stoker; S. G. Coles (25, B 2), cable jointer, &c., and G. W. Lee (19, Grade 3), electrical engineer, engaged in the Corporation electricity department, were withdrawn, the men now holding protection certificates.

Before the Sevenoaks Rural Tribunal, an appeal was made by the Electric Light Co. for exemption, without the volunteer condition, for W. Ellis (25, Grade 3), electrical engineer. The managing director (Mr. Reeves) said that Ellis was the only skilled man left, and his working hours would not allow him to carry out the volunteer duties. He produced a letter from the Board of Trade to the effect that Ellis was necessary for the proper carrying out of the undertaking. He regularly worked 12 hours per day, and frequently had to take on another shift. Colonel Sladen said that the company must get another man to help. After Ellis had made himself proficient in drill and shooting he might be released from the volunteers. The assistant manager said that they had tried to get men, but they could not unless they offered to double the wages, and this no company could stand. Col. Sladen: It is not a question of companies making money, it is a question of the defence of the Empire. The volunteer condition was imposed, and Mr. Reeves said he should appeal to the County Appeal Court on the ground that the man's time was fully occupied.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Greatest Industrial Problem.

I always look to your leader on war problems with considerable interest, and the article on "Industrial Problems" of the 20th inst. is certainly no exception. One direction in which I have been seeking for a means by which after-the-war difficulties may be reduced is the immediate development of a scheme of national education of the wage-earners in regard to economics of wages in relation to production on the one hand and supplies on the other. It appears to me that the Industrial Reconstruction Council might do a distinctly useful work by the issue of well considered posters illustrating pictorially how a "£5 per week" standard of wages for one trade, with other producers securing corresponding rates, may prove very unremunerative in practice when it reduces the possibility of the potential employers of such highly-paid men securing enough orders to keep their works going. For example, we need to bring home to the bootmaker that if the community doubles his wages in order that he may buy bread, the baker's wages must be correspondingly increased so that he may buy boots; and that while that process may work fairly well when all the boots that he can make can be sold at a suitable price either at home or abroad, it may leave him without wages at all if bootmakers of other nations can supply as good boots for less money. In such event even "protection" would not enable us to pay with boots for the foreign corn that we need.

While it can be neither expected nor desired that wages will revert to pre-war rates, it does appear to be important that every possible step be taken to secure that the wage-earners may be convinced that a good standard of living can better be ensured upon the basis of a lower rate of wages than rules at present, than can be ensured upon continuance of the existing rates, and this valuable education of the general public would probably be materially furthered by well-conceived pictorial advertising propaganda. The need for a colossal readjustment of the popular view is illustrated by the general recognition that a baker or greengrocer who raises his charges is a "profiteer" who is fair game for the weak jokes and extortionate fines of any Court, while the child of 17, who gets 40s. a week for typewriting to help the War is a "patriot"—like her father, who used to wash cabs, but is now a munition worker drawing £6 a week from a grateful country! And the "people love to have it so."

G.P.O., *September 27th*, 1918. **A. J. Stubbs.**

The Householder and the Coal Rationing Order.

Owing to my absence from town, and to the unavoidable delay caused by the recent deplorable railway strike, the corrected proof of my notes upon "The Householder and Clause 7 of the Coal Rationing Order" did not reach you in time to enable you to insert some necessary corrections. Moreover, owing to an oversight, two tables intended to be separate were printed as one, which will cause some confusion of thought in the mind of the reader. Further, in estimating the *actual* draft upon our fuel resources, I decided that the heat value of the gas obtained in producing coke, and of the net coke residue in the production of gas, should be dealt with in more detail.

The "Summarised Results" published in your issue of to-day, should, therefore, be set forth as under. The expression "effective" heat means the percentage of the total heat of combustion of the quantities mentioned in Clause 7 of the Order, which may be assumed on the average, to appear as sensible heating effect.

The meaning of the expression "effective coal equivalent" is best explained by an example, thus:—The net weight of coke produced per ton of coal distilled in the manufacture of gas is about half a ton (1,500 lb., less 375 lb. used for heating the retorts). It is assumed that 1·125 tons of coke is needed for the production of 4,500,000 "effective" therms. In the production of 1·125 tons of coke available for sale, there will therefore be distilled 2·25 tons of coal, and the production of 1·125 tons of coke will, therefore, result in the concomitant production of about 22,500 cb. ft. of gas, of which about 21,000 cb. ft. will be registered by the consumer's meter. The "effective" heating value of 15,000 cb. ft. consumed by the householder is taken to be 3,400,000 therms. Therefore, the "effective coal equivalent" of 21,000 cb. ft. is $\frac{21,000}{15,000} \times \frac{3,400,000}{4,500,000}$, or nearly 1·06 lb. of coal. Hence the *net* draft on the fuel resources of the country, when the householder obtains 4,500,000 therms "effective" heat from the consumption of coke, is 2·25 less 1·06, or 1·19 tons of coal.

The "effective coal equivalent" of the coke produced in the manufacture of the quantity of gas necessary, on our assumptions, to produce 4,500,000 "effective" therms, is arrived at in similar fashion.

SUMMARISED RESULTS.

—	Anthracite, 1 ton.	Coal, 1 ton.	Coke, 1½ tons.	Gas, 15,000 cb. ft.	Electricity, 800 units.
"Effective" heat ..	5,000,000	4,500,000	6,000,000	3,400,000	2,400,000
Cost (pence)	738	534	792	720	1,200
Relative cost (coal taken as unity) ..	1·38	1·00	1·48	1·35	2·25
Gross demand on coal resources (tons) ..	0·90	1·00	3·00	1·60 coal and 0·26 ton coke.	1·96

—	Estimated consumption to maintain room 20 ft. × 16 ft. × 11 ft. at 65° to 70° on cold day, from 8 a.m. to 10 p.m.	Cost of items in Col. 1.	Burning-hours for expenditure of about 8½d.
Coal	35 lb.	about 8½d.	14
Coke	40 lb.	,, 9½d.	about 12½
Gas	330 cb. ft.	,, 16d.	,, 7
Electricity ...	24 KW.H.	,, 36d.	,, 3¼

—	Mode of heating. Coal.	Coke.	Gas.	Electricity.
Gross demand upon coal resources for production of 4,500,000 Therms. "effective" heat obtained by householder. (Tons)	1·00	2·25	2·45	3·75
Net demand, taking into account "effective" coal equivalent of by-products. ... (Tons)	1·00	1·18	1·17	3·75
Equivalent quantities	1·00	1·125	20,000 cb. ft.	1,470 KW.-hrs.
Cost ... ... (Pence)	534	594	960	2,205
Relative cost	1·00	1·11	1·79	4·13

It will be seen that the *net* draft upon our fuel resources is only about 18 per cent. greater in the case of gas and coke heating, but remains nearly four times as great for electric heating as compared with coal.

The *cost* for equivalent "effective" heating to the householder is nearly twice as much for gas and over four times as much for electricity compared with coal, but gas and electric heating make far less demand upon "service," and afford many advantages, *e.g.*, in point of cleanliness* and in ease of regulation. Such items enter importantly into the question of actual cost, with

* In the final report of the Coal Conservation Committee, it is mentioned (footnote p. 19) that the measurable damage done in Manchester and Salford by smoke is estimated at nearly £1,000,000 per annum.

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which, however, we are not at the moment primarily concerned. The plain fact is that we have to consider not only our own fuel requirements, but also those of our Allies, and it is an imperative obligation upon every individual, in the present circumstances, to adopt every measure calculated to reduce the demand upon our coal resources in order that the fuel requirements of our Navy, of our Army, and of our Allies be not jeopardised.

Although some of the above comparisons are necessarily based upon rough estimates, it is recognised that the greatest avoidable waste of heat energy occurs in the consumption of fuel for "domestic" purposes, and the annual requirements in this direction are estimated at the respectable figure of 35,000,000 tons of coal. Hence householders and others have an opportunity of doing their "bit," and by care and attention, and the employment of common sense, it should be practicable substantially to reduce this figure during the next twelve months.

Ed. C. de Segundo.

London, E.C.
September 27th, 1918.

German Post-War Plans.

On behalf of the members of the Glass Industry Interim Industrial Reconstruction Committee, which has been formed (under the ægis of the Ministry of Reconstruction, the Board of Trade and the Ministry of Labour) of an equal number of representatives of Employers' Associations and Employés' Unions in every section of the glass industry, I hope you will allow me to call attention, through your columns, to the vital significance to this country of certain trade developments contemplated in Germany.

We learn from the German Press that after the war Germany will seek to restore her credit abroad by a concentration of effort upon the export of certain chosen manufactures. Chemicals are named as the first of these manufactures; then comes glass.

Now, Sir, the glass industry of the world is not in the first rank of importance in the eyes of Germany because of its relative size and volume, or because of the wealth it will *directly* bring to the German people. There is another and a greater reason than that. The reason for the choice of glass is this: that it is a key to the gate of many other industries. A nation holding the monopoly of glass could hold up nearly all other trades. We can make hardly anything without using glass at some stage of its manufacture, even if glass is not an actual part of the finished product.

Here usually glass is part of the finished product; perhaps in no great quantity; but, however small its use, wherever it is, it fulfils a *rôle* that is essential. Our welfare and comfort, in health and in sickness, our ships, our trains, our homes, our food—in almost every side and thing of life glass has its place.

And not in peace alone, but also in war.

When the history of the war is laid bare, it will be found that the difficulty of making glass for lenses and prisms, and for test tubes, crucibles, and retorts, hampered the work and equipment of our fighting forces to a dangerous extent, and tremendous efforts were needed to save the situation. When the history of the anti-submarine campaign is written, it will be found that glass played an important *rôle*.

Before the war, the British glass manufacturer and his men had, owing to Germany's hold, little chance of profit or employment. Under war conditions it has been difficult to produce the vital requirements of the country fast enough. There is now opening in this trade for investment of capital and for well-paid, skilled labour. Will it last? It will be in danger after the war if not supported in a prompt and practical way.

At a recent meeting of the Imperial War Conference there came up for discussion the freeing of industry in Great Britain from dependence on German dyestuffs. Now, you cannot make dyes or any other product without glass. Yet we do not read that the Imperial War Conference has discussed British dependence on German glass!

Our industry is ready to do its part; the manufacturer is ready to put into his works the best available plant, and the workmen are prepared to use this plant to the best advantage. This is a big job, but it does not frighten us. We only ask of our rulers and of the public that they will give to glass its proper position in the national life of the country.

We want to manufacture in Great Britain under conditions that will give (1) security and return to capital; (2) security and a return to brains (management and technical advisers); (3) security and substantial wages and good conditions of employment to our workers.

To put our trade in good position to meet the future, progress has already been made. In the Society of Glass Technology, we have a common meeting ground for labour, capital, science, and technics, and every branch of the industry is to be represented on our Committee and the District Councils under it. We are organising ourselves.

But this is not enough. Germany's rise has been attributed directly to the English policy of the "open door." We of the glass industry fear that the policy of the open door may be carried to such an extent that the British glass industry may become extinct.

On this point employers and workers think alike. Reform of this condition and help during our reconstruction period is not a political question but a business proposition. The German Government will spare no pains or expense to secure return to their virtual monopoly in optical and chemical glass, and their commanding position in glass generally, because they perceive very truly how that return would lead to supremacy in other industries and manufactures. The British glass industry does not intend to allow this return if it can help it. But we ask from our rulers some support. We do not ask them to bolster up an inefficient industry so that we may make profits at the expense of the nation, but we do ask that the industry be given the chance of full development, and that a "key" industry be saved from the hands of Germany, determined to capture it at all costs because it is a "key."

John Stokes,
Chairman of the Glass Industry Interim Industrial Reconstruction Committee.

London, N., *September 16th*, 1918.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Brown, Boveri Motor-Car Engine-Starter.

Messrs. Brown, Boveri & Co., of Baden, Switzerland, have for some time been devoting attention to the subject of electric starters for petrol motor-car engines, and have recently taken out British patents in connection with an electric motor, so combined with the usual hand cranking arrangement that no space is, as in the usual location of the starting motor, taken up at the sides of the engine, thus leaving free access to the valves, carburettor, magneto, water circulating pump, &c.

As will be seen from the accompanying sectional drawing (fig. 1) the starting motor is enclosed in a casing at the front end of the engine. The crankshaft of the latter carries on its forward end the fixed half of a toothed or jaw clutch, while the sliding half is mounted on the rear end of the hand cranking-up shaft. The sliding half is toothed on both sides or faces, and is capable of being engaged both with the jaws on the end of the crankshaft and also with the jaws forming part of the gear wheel M. The latter is also capable of being slidden axially together with its jaw clutch by means of the electromagnet E fixed on the engine casing, the body of the gear wheel M serving as the armature of the electromagnet. The wheel M is driven from the starting electric

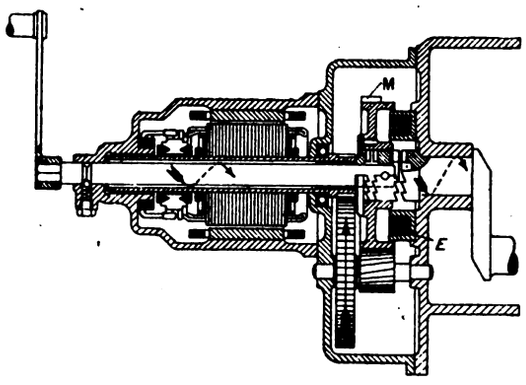

Fig. 1.—Sectional Elevation of Brown, Boveri Electric Petrol Engine-Starter.

motor through a train of three gear wheels. The motor armature is fixed on a hollow shaft surrounding the hand cranking-up shaft, which also carries the primary driving pinion. The arrangement is such that when the electric starter is brought into use the electromagnet is energised, the gear wheel M being drawn to the rear, so locking into one block the three jaw clutches. When the engine is started by hand only the rear pair of clutches are enmeshed, that connected with the electric motor being left out of gear.

As illustrated, the arrangement would appear to have the drawback that when the electric starter is in use the hand starting crank is also being rotated at a high speed, to the possible danger of passers-by; however, doubtless the designers intend that the actual handle shall be of the detachable type, so that it can be stored away in one of the car's lockers, and only brought into use in case the starter, owing to a discharged battery, should fail to operate, or other emergency.

Device to Facilitate Transposition of Line Wires.

While the work of stringing wires on pole lines is under way, and it is desired to transpose the positions of the wires of a pair on insulators, the work is greatly facilitated by the use of a recently patented device known as a transposition yoke.

As shown in fig. 2, p. 324, the yoke is equipped with wire carriers swivelled to it so that the wires of each pair may be readily transposed, or one pair of wires may be transposed with respect to another pair of wires, all without disconnecting the wires from the carriers or relaxing the stringing tension.

The bar, to which each pair of wires is connected by loops, is swivelled on the bolt supporting it, but is ordinarily prevented from rotating on the bolt by its engagement with the flattened

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part of the bolt shank illustrated in the small figure. In transposing, the bar is raised sufficiently to clear the flattened part of the bolt, and is then turned so as to transpose the wires. The same may be done with the bar to which both of the bolts are

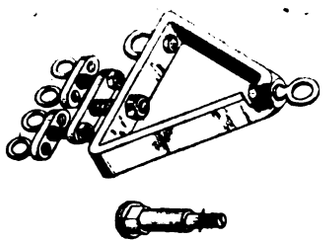

Fig. 2—Transposition Yoke.

connected, permitting the transposition of one pair of wires with respect to a second pair of wires.

The device was invented by Harry C. Williams, of Irvington, N.J.—*T. and T. Age.*

BUSINESS NOTES.

To our Correspondents.—We shall be glad if our correspondents will remember that all communications intended for the use and information of the Editors should be so addressed. Criticisms of the inexperience and strange Press standards of some publicity representatives receive full confirmation when items of personal interest intended for editorial use are addressed to the "Advertisement Manager" or the "Advertisement Department." It is not our practice to include in the Electrical Review personal or trade references as a consideration for advertisement business received, nor to insert matter purely on the ground of personal friendliness with anybody. The adoption of anything below a Grade I standard would open the way to endless abuses, and would justifiably shake the confidence in, and respect for, the Electrical Review that we modestly believe the industry to have.

Training for Foreign Trade Service.—America is taking up the question of her foreign trade with all the imaginative enthusiasm of youth. Here is a development that may well be emulated in our country. As far back as December, 1915, Dr. R. P. Claxton, Commissioner of Education for the United States, called a Conference for the purpose of discussing the question of training Americans for the foreign trade service, which had already become a prospect of vast importance. General Swiggett, Specialist in Commercial Education for the Bureau of Education, became chairman of a main Committee to investigate the methods followed by leading commercial nations to train for foreign service. The latest development is the appointment of a powerful Advisory Council.—*Financier.*

Import Prohibitions.—By Proclamation the importation of time-recording instruments of all kinds, and movements and parts thereof, is prohibited, save under special licence from the Board of Trade.

"Neutral" Activity.—The German machinery for conducting trading operations through neutral countries is apparently getting to work. In addition to the evidence that has been forthcoming from other directions, and to which we recently referred at length, we now gather from a Christchurch dispatch to the *Daily Mail* that many New Zealand firms have received letters from neutral countries making tempting business offers, it is believed on behalf of Germany. "One writer frankly states that he is ready to overcome the difficulty of communication between New Zealand and the countries engaged in war." The letters have been placed before the Government authorities.

Mr. Hughes, the Australian Prime Minister, in a communication to the British Empire League, refers to the need for having a simple and definite origin mark as a means of identifying genuine British goods. In his opinion it is absolutely necessary, in view of the practical certainty that after the war the enemy will pass his goods off as British or Allied if he can get the chance to conceal their true origin. It was a quite usual practice before the war for firms to import German goods, and then mark them with a British firm's name or trade-mark. For such a practice very heavy penalties should be imposed. However patriotic British purchasers may be, they will be only too easily defrauded unless a British origin mark is introduced.

An After-War Exhibition at Birmingham.—Arrangements are on foot for holding simultaneously early in the year after next, assuming that the war does not last too long to make that date impracticable, three British Industries Fairs at London, Birmingham, and Glasgow. We have before us printed particulars respecting the Birmingham scheme, which is under the official organisation of the municipality and of the Chamber of Commerce of Birmingham. The three Fairs, though running simultaneously, will not overlap in regard to class of exhibits, for the classes of manufactures shown at London and Glasgow will not be shown at Birmingham. This will, it is thought, be a convenient arrangement for the oversea buyers who are expected to flock to these shores in search of British manufactures immediately transport facilities are available after the end of the war. They will know that they can find all articles of a similar nature grouped together at one of the three cities. We do not think that electrical manufacturers will need to be greatly persuaded concerning the importance of exhibition displays to bring them into direct touch with foreign and Colonial visitors, assuming that the time is right and that the exhibition is of such a character as to place their manufactures amid suitable surroundings. The latter point is affected to some extent by such matters as classification of exhibits, so we may mention that the principal classes in which electrical firms will be interested are the following:—(2) Lighting, where electric light fittings, table and hall lamps, standard lamps, &c. (*not* electric pocket lamps, which are generally shown at the London Fair), and appliances and glassware can be displayed; (12) Cooking and heating stoves of all kinds, giving a good opportunity for the effective display of electrical appliances in a branch of the industry which has an unlimited future. There are in the Birmingham programme some other sections of less direct electrical bearing, such as machine belting, engineers' tools, small machine tools, &c. The Fair will not be run for private profit. Firms connected with the sections of the industry interested in the Birmingham event can obtain full particulars respecting provisional applications for space, terms, &c., from Mr. F. Greenwood, at the offices of the Chamber of Commerce, 95, New Street, Birmingham, or at 36, Oxford Street, London.

Bankruptcy Proceedings.—S. Smith (Smith & Sons), Widnes, "music and musical instrument dealer, electrical engineer and general dealer."—Application for debtor's discharge to be heard October 25th, at Liverpool.

Book Notices.—"Directory of British Manufacturers for Russian Trade." 1918. London: Russo-British Trade Exchange, Ltd., 16, Regent Street, S.W. 1. This is the second edition of this directory, which is edited by R. A. Lenski, and is published in the Russian language for circulation in Russia. Its object is to place in the hands of Russian merchants an epitome of representative British and Canadian manufacturing and trading houses, and in the course of its 700 pages all branches of business are included.

We have received a copy of the first number of the *Decimal Educator* (September, 1s.), which is to be issued quarterly to further the work of the Decimal Association (212 and 213, Finsbury Pavement House, E.C. 2). The journal is the new official organ of the Association, "established to promote the adoption of a decimal system of coinage and of the metric system of weights and measures in the United Kingdom." The issue contains an historical sketch of the Association, and the other contents include short articles, amongst others, on the Balfour Report, the Metric System in the Textile Industries, on Teaching the Metric System and Instruction for Adults, the Present Position of the Metric System in the British Empire and the United States, and one entitled Arguments for Decimalists. The journal will be found to contain much interesting matter, and all those who are interested in the movement should possess a copy.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVII. No. 9. September, 1918. New York: The Institute. Price $1.

Liquidations.—Moore Radiator Tube Co., Ltd.—Creditors must send particulars of debts, &c., to the liquidator (Mr. G. G. Poppleton, 26, Corporation Street, Birmingham) by October 12th.

Bynoe Low-Pressure Superheater System, Ltd., and Low-Pressure Superheating, Ltd.—Meetings called for October 30th, at 1 and 2, Great Winchester Street, E.C. 2, to hear an account of the winding up from the liquidator, Mr. F. Morse.

List.—Messrs. Belling & Co., Derby Road Works, Montague Road, Edmonton, N.—Illustrated folder giving brief particulars and prices of a variety of types of their electric fires.

Cable Urgently Needed.—The Guildford Electricity Supply Co., Ltd., is in urgent need of a short length of cable for repairs (5 to 10 yards lead-covered TCC cable; outer conductor, ·25; two inners, ·50. Advertisements have brought no response. Can anybody help?

Moon Chart.—Messrs. C. A. Vandervell & Co., Ltd., have sent us the moon chart for October, compiled by their chief engineer, Mr. A. H. Midgley. We hope that not many more moons will wax and wane before this kindly attention becomes unnecessary.

Non-Ferrous Metal Industry Act.—Lists of further firms or individuals to whom licences have been granted appear in the *London Gazette* for October 1st.

Trade Announcement.—The Concordia Electric Wire Co., Ltd., desire all communications to be addressed to their head office and works (Trent Mills, New Sawley, Derbyshire). A branch office and stores have been opened at 155, Victoria Street, Westminster, S.W. 1.

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LIGHTING AND POWER NOTES.

Birmingham.—Shorter Working Hours.—A proposal has been made with a view to economy of fuel and lighting in works in the Birmingham district that the pre-breakfast working time should be dispensed with. According to the *Engineer*, inquiries show that many manufacturers are entirely in favour of paying the same rate for a 50-hour week as is now paid for a 53-hour week, provided that an undertaking is given by the accredited representatives of the workpeople that the output of work shall be maintained.

Colne.—Price Increase.—The Corporation has decided to increase the charges for electricity for lighting from 5½d to 6d. per unit, and for power and traction by ¾d. per unit, from October 1st last.

Continental.—Spain.—The following concessions for hydro-electric schemes have been sanctioned:—The use of 3,500 litres of water per second from the river Cubillas, at Ablote, Granada, for the generation of electricity, by Rafael Rubio Cabreriza; 1,200 litres per second from the Guadaloupe, at Alcariz (Ternil), by Miguel Diaz Gascon; 3,000 litres per second from the Quivios, at Fuente de la Vega, by the Sociedad Fabrica de Mieres, for the generation of electricity for use in the company's works.

Owing to the difficulty of importing coal, the Government has taken special measures for the utilisation of electricity. Committees of producers and consumers are to be formed in the principal districts to ascertain the amount generated, to superintend its equal distribution amongst industrial and other consumers, and to limit the hours of supply.

A new central generating station is being established at Palme de Mallorca for the supply of electricity throughout the island. The plant to be at first installed will comprise four 2,000-H.P. steam turbines and generators.

The Sociedad Productora de Fuerzas Motrices has been formed in Bilbao, with a capital of 6,400,000 pesetas, to build a generating station of 20,000-H.P. capacity, which will yield an estimated yearly output of 60,000,000 KW.-hrs., at Pobla de Segur (Lerida).

The Sociedad Fabrica de Meros has applied to the Government for a concession to utilise the water-power of the river Quiros, near Arroyo, for the generation of electricity.

Sweden.—Among the new electricity supply companies recently formed in Sweden are the Wemmenhog-Skytts Kraft Aktiebolag, organised at Skurup, with a maximum capital of £17,000, and the Karbole Elektriska Abtiebolag, formed at Karbole, with a maximum capital of £3,300.

Edinburgh.—Proposed Extensions.—At a meeting of the T.C., last week, it was stated that a shortage of electricity supply was being felt at Leith, and the Dock Commission was being seriously hampered in work of national importance. The T.C. is trying to obtain the support of the Leith T.C. and the Dock Commission to an application for sanction to proceed with the new power station at Portobello, and also to erect two new boilers at the McDonald Road station.

Grays.—Price Increase.—The U.D.C. has decided to increase the charges for electricity for lighting and power by a further 16⅔ per cent., a total increase on pre-war charges of 50 per cent., as from October 1st. The charge for public lighting is to be advanced by £100, and the minimum charges of 6s. 6d. per lamp per summer quarter and 13s. per winter quarter are to be adhered to.

Grimsby.—Price Increase.—The T.C. has decided to increase the price of electricity by 15 per cent.

Leeds.—Wages.—The General Purposes Committee has recommended the T.C. to increase the war bonus to all municipal workers by 5s. per week to men over 18 years of age, making a total bonus of 25s., and by 2s. to female employés, a total of 16s. per week.

Leek.—New Plant.—The U.D.C. has resolved that the scheme for the installation of new generating plant be carried out, and that application be made to the L.G.B. for sanction to a loan of £4,000.

Leyton.—Price Increase.—The E.L. Committee has recommended that the charges for private lighting and power be increased from 33⅓ per cent. to 50 per cent. over pre-war rates, and that the charge to the tramway department be increased from 10 per cent. to 50 per cent. over the average pre-war rate for the year, such increases to take effect from the commencement of the next Christmas quarter.

London.—Walthamstow.—Price Increase.—The E.L. Committee has recommended the following revised charges for electricity:—Lighting: Up to 750 units per quarter, 6d. per unit; for the second 750, 5½d.; above 1,500, 5d. Power: Up to 500 units per quarter, 2½d. per unit; second 500, 2½d.; above 1,000, 1¾d.; from 30,000 to 150,000 per annum, 1¾d.; above 150,000, 1½d.; bioscope lanterns and public lighting, 3½d. After the September quarter the special charges for arc lamps and metal-filament lamps are to be increased by 60 per cent. over pre-war rates. Supply by slot meter is to be increased on the same scale, plus the usual ½d. per unit meter rent and ½d. per unit for free wiring installations.

Southwark.—Wages.—The B.C. has granted an increase of 3s. 6d. per week to employés in the electricity works, on the award of the Committee on Production.

Price Increases.—The Notting Hill E.L. Co. has advanced the price of electricity for lighting from 7d. to 8d. per unit, with a promise of a reduction if the revenue rises above the previous amount.

The Metropolitan Electric Supply Co., Ltd., has given notice that the charges for private lighting—5½d. per unit, trade lighting 5d. per unit, and power and heating 1½d. per unit—are subject to an increase of 40 per cent., as from the end of the present quarter.

Hackney.—Year's Working.—The annual accounts of the B.C. electricity department for the year ended March 31st last show that the revenue amounted to £102,078 and the expenditure to £57,742. Of the gross profit of £44,336, interest absorbed £14,268; loan repayment, £16,687; allowances to employés with the Forces, £1,825; £7,327 was placed to the relief of rates, and £3,586 to the reserve fund. During the year 19,063,540 units were generated and 668,464 purchased; 16,937,179 units were sold, as follows:—Private lighting, 1,713,520; power and factory lighting, 12,993,402; dust destructor, 123,344; public lighting, 137,546; and bulk supply, 1,969,367. The total cost per unit was ·8d., an increase of ·05d. compared with the preceding year, and the average price received was 1·42d. per unit against 1·33d. The load factor was 24·87 per cent., against 21·97, and the maximum demand was 7,775 KW. (A.C. 5,500, D.C. 2,275), against 7,951 (A.C. 5,900, D.C. 2,051). Compared with the previous year the expenditure increased by £7,264 and revenue by £14,114, net profit by £5,476, and units sold by 1,634,807.

Manchester.—Price Increase.—The E.L. Committee has recommended an increase from 30 to 40 per cent. over pre-war rates for electricity for lighting purposes. Small power consumers are to be charged an additional 15 per cent., and large consumers 7½ per cent. The advances are to come into force in December.

Oldham.—Price Increase.—The Electricity Committee has decided that the charges for electricity for lighting be increased by a further 20 per cent.; for power, heating, and cooking by 30 per cent.; cotton mills under agreement subject to a coal clause by 20 per cent.; and for traction purposes by 7½ per cent.

Lydney.—At a meeting of the District Council it was reported that the Government intended building 1,000 houses at Beachley, and that electric light would be laid on.

Peterborough.—Price Increase.—The Electricity Committee has decided on a further addition of 20 per cent. to the charges for electricity, making a total increase of 40 per cent.

Rotherham.—Price Increase.—The Corporation has given notice that the charges for electricity for power and heating purposes will be increased to 45 per cent. over pre-war charges from the September meter readings.

Salford.—Sale of Plant.—Subject to the sanction of the Ministry of Munitions, the Corporation has accepted the tender of the Blackburn Corporation for the purchase of a turbo-generator, at £2,500.

Shipley.—Price Increase.—The E.L. Committee has decided to advance the charges for electricity to power users not under agreement from 50 per cent. to 75 per cent. over pre-war rates.

Shrewsbury.—Price Increase.—The T.C. has been recommended by the E.L. Committee to increase the charges for electricity from 40 per cent. to 50 per cent. above pre-war charges.

Southport.—Electric Heating.—The Fuel Rationing Order has led to a large increase in the demand for electric radiators, of which there are now some 800 in use.

Spenborough.—E.L. Restrictions.—The Electricity Department has received instructions from the Ministry of Munitions to refuse applications for electricity for lighting and heating except in special circumstances, and under the Ministry's sanction, and to prohibit extensions to existing installations of motors without the permission of the Electricity Department.

Owing to urgently needed repairs, the supply was suspended between 8 a.m. and 2 p.m. on Sunday last.

Stafford.—Price Increase.—The Corporation has decided to increase the charges for electricity for lighting to 6½d. per unit, subject to the present rates of discount, and for power by 15 per cent.

West Bromwich.—Price Increase.—The E.C. recommends that for power purposes the price of electricity be advanced by ½d. per unit, with an additional sliding scale of 2 per cent. in respect of each 6d. per ton advance in the price of coal; and for lighting purposes a sliding scale of 2 per cent. in respect of advances in the price of coal.

Windsor.—Proposed Price Increase.—The Electrical Installation Co. has applied to the B. of T. for consent to increase the maximum charge for electricity from 8d. to 1s. per unit.

Worcester.—Water Power.—The E.L. Committee has recommended the T.C. to acquire the site of Bransford Mill, and the water rights of the Teine, in connection with the Powick generating station.

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TRAMWAY AND RAILWAY NOTES.

Continental.—France.—Electrically-driven brushes are being used on the Orleans Railways, in France, for cleaning railway cabs and vehicles. Various forms of revolving brushes, driven at speeds of from 500 to 800 r.p.m. through flexible shafts by electric motors of ¼ to ½ h.p., are employed, the apparatus, as a whole, being slung, according to requirements, from various kinds of portable standards, with springs and counterweights.

Spain.—Fernando P. Casariego, of Orviedo, has applied for a concession to construct an electric tramway from Laviana to La Felguera.

Formby.—Proposed Light Railway.—The B. of T. has confirmed the scheme of the L. & Y. Railway, passed by the Light Railway Commissioners, after an inquiry in 1915, authorising the construction of a light railway at Formby.

Glasgow.—Year's Working.—The annual accounts of the Corporation Tramways Department for the year ended May 31st, 1918, show that the revenue amounted to £1,412,635, compared with £1,260,115 in the previous year, and the expenditure to £1,044,183, against £838,065. Of the net revenue of £368,452, £11,119 was paid to the Paisley District Tramways Co., income-tax absorbed £64,405, £45,383 was placed to the depreciation fund, and £78,511 to the permanent way renewals fund, leaving a net balance of £177,552, against £160,984, which has been paid over to the common good of the city. The working expenditure account includes traffic expenses, £527,152 (or 4·818d. per car-mile); general expenses, £156,949 (1·435d. per car-mile); general repairs and maintenance, £179,811 (1·643d. per car-mile); power, £86,019 (·786d. per car mile, or ·503d. per unit); and allowances to dependents of employés with the Forces, £93,120. The total expenditure per car-mile was 9·543d., against 7·799d., and the income 12·9d., against 11·728d.; 99 miles of track were open for traffic; 26,261,231 car-miles were run, against 25,786,047; and 41,054,757 units were used for traction and car lighting, or 1·56 units per car-mile. The average number of cars in use was 685, the average number of miles travelled per day per car being 105; 40·5 per cent. of the receipts were from ½d. tickets, and 63·3 per cent. of the passengers carried were ½d. fares. During the year £16,479 was spent on capital account, and £7,681 on track renewals. Since June 1st, 1915, the department has been carrying its own employer's liability and workmen's compensation risks, and £4,335 has been transferred to this fund; £2,129 was paid out during the year in compensation, leaving a balance of £2,205. Ordinary repairs to the track amounted to £85,979, and repairs to the power plant to £8,815. The department now employs 2,273 women workers, including 290 drivers, 1,518 conductors, and 465 car washers. Of the 47,077,967 units generated, 46,433,970 were at 6,600 volts a.c., 487,187 at 550 volts d.c., 156,910 at 100 volts d.c., and, in addition, 1,712,980 units were supplied by the Electric Lighting Department. The maximum load on the power station was 17,100 kw., the load factor 32·6 per cent., and the coal consumption per unit 2·75 lb.

Halifax.—Tramcar Kitchens.—A Press correspondent has been informed that the National Kitchen tramcar in service at Halifax serves an average of 700 portions per day. The car is run on routes where a half-hourly passenger service is in vogue, and stops for 28 minutes at selected spots for the distribution of food; it then precedes the passenger-car until a loop is arrived at. To obviate this, it is hoped soon to have railless vehicles for the purpose. In spite of the extra cost, owing to the presence of the driver and conductor, and the cost of electricity for running the car, the venture pays its way.

Leeds.—Proposed Extensions.—The Tramways Committee has requested the Parliamentary Committee to obtain powers for the construction of a tramway through the Hawksworth Wood Estate, and from Dewsbury Road to the new Middleton town-planning site, and also for powers to run an omnibus service from Dewsbury Road and Hunslet to the same site.

Leeds—Bradford.—Parcel Carrying Service.—An arrangement has been completed for an inter-city service of parcel carrying by the Leeds and Bradford tramway undertakings, to commence at the beginning of November. The charges will vary from 4d. for 3 lb. and under, to 9d. for 56 lb. The Bradford parcel service, which has been in existence for many years, permits collection and delivery at any address within ½ mile of any line or terminus. The Leeds service was only recently established, and collection and delivery is limited to appointed agents on all the car routes.

London.—Accident.—By a collision on Saturday afternoon at Hammersmith between a motor lorry and a L.U.T. tramcar, the conductress and the drivers of the tramcar and lorry were injured, and had to be removed to hospital.

Musselburgh.—Novel Claim.—Mr. Andrew Clark, miners' agent for the Mid and East Lothian district of the Scottish Mine Workers' Association, is formulating a claim against the tramway company for loss of wages sustained by miners, who were prevented from getting to their work by a breakdown of the cars.

Stockton.—Proposed Purchase.—A special meeting of the T.C. is being held to consider the purchase of the tramway undertaking within the borough.

West Riding.—Service Reductions.—The Yorkshire (W.R.) Electric Tramways Co. has announced, as from Sept. 29th, a reduction of Sunday services between Wakefield and Leeds, Sandal, Ossett, Horbury, and Agbrigg, and between Leeds and Rothwell; a number of stopping places have also been discontinued.

United States.—The Skip-stop System.—The skip-stop, which means cutting out many needless stops of tramway cars, is rapidly being adopted in the U.S. The system has been advocated by the Fuel Administration as a means of saving fuel. It is estimated that 400,000 tons of fuel can thus be saved annually, also it means less wear and tear on brakes and equipment generally. Fewer starts and accelerations mean not only lower energy consumption per mile, but a reduction in time required to travel a given distance. The *Electrical Review*, Chicago, says:—"As a nation we have opposed the skip-stop, perhaps unthinkingly. But when we become accustomed to it, we like it. It is one of those measures instituted during the war because of the war—a fuel-saving measure—that will, we hope, stay when the war is won, because it relieves our utilities, makes them more efficient, improves city transportation, and conserves coal."

TELEGRAPH AND TELEPHONE NOTES.

American War Cables.—The Home Secretary has specially appointed Mr. F. H. Mitchell, C.B.E., to be responsible for the expeditious transmission through London of Press cables sent by the American correspondents with the American troops to their papers.—*The Times.*

Cable Mileage.—The total number of submarine cables owned and operated by private companies throughout the world is 412, with a mileage of 223,769 miles, and the cables owned by nations throughout the world are 2,140, with 48,990 miles, making a total of 2,552 cables with a mileage of 272,759 miles. At the present time, on account of the war, some of these cables are not operated.—*T. and T. Age.*

China.—According to the *Westminster Gazette*, what is believed to be the first direct wireless message from Europe ever received in China arrived on September 25th. The honour belongs to the new French Lyons wireless station, and the message was received at the French station at Shanghai in perfect order.

Direct Wireless to Australia.—Direct wireless communication between Great Britain and Australia was established on September 22nd, when two messages from the Premier (Mr. Hughes) and from Sir Joseph Cook were received by the Amalgamated Wireless Co. of Australasia from the new station at Carnarvon.

The messages were received at Sydney perfectly clear and distinct, despite direct transmission over 12,000 miles. They were confirmed verbatim by cable on the following day. Both of them appealed for reinforcements for the Australian battalions.

The previous record was made when Mr. Marconi at Buenos Ayres in 1910 received a message from Clifden, County Galway, 6,735 miles away. According to the *Daily Mail*, the managing director of the Amalgamated Wireless Co. in Sydney, who had been using a highly developed receiver, reported that he had picked up a message from Carnarvon, and asked that special messages should be sent to him as a test. The wireless communications from Mr. Hughes and Sir Joseph Cook were the result, and they went half round the world in a fourteenth of a second. At present the Australian instruments can receive, but cannot send, over so great a distance, but the experiment will undoubtedly lead to a direct service with Australia.

Spitzbergen.—The British expedition to Spitzbergen, in the Arctic Ocean, returned to England on Tuesday last.

Germany had a wireless installation on the island, set up by Prince Pless and Count Zeppelin in 1912, with direct communication to Berlin. The station has been destroyed, and the German wireless records have been brought back to England for examination.

CONTRACTS OPEN AND CLOSED.

OPEN.

Birkenhead.—October 10th. Electrical sundries, lamps and fittings, for the Mersey Railway Co. Mr. J. Shaw, General Manager & Secretary, Central Station.

Bedford.—November 13th. Two water-tube boilers, mechanical stokers, and induced-draught plant for the Corporation. See our advertisement pages to-day.

Manchester.—October 4th. Electricity Department. High and low-pressure steam and feed pipework, &c., at Stuart Street.

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Portsmouth. — October 15th. Tramways Committee. Six months' supply of stores, including various electrical items. See "Official Notices" September 27th.

South Africa. — JOHANNESBURG. — November 27th. Municipal Council. 2,000 copper ribbon bonds, and 2,000 copper solid bonds (Contract No. 424). A copy of the specification can be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence), London.

Warrington.—October 22nd. Water-tube boiler, for the Electricity Department. See our advertisement pages to-day.

CLOSED.

Australia.—P.M.G.'s Department, N.S.W. :—

900 listening and ringing keys, £401.—Automatic Telephones (Aust.), Ltd.

P.M.G.'s Department, Queensland :—

Telephone material, schedule 436, £114.—Western Electric Co. (Aust.), Ltd.
Telephone material, schedule 436, £631.—James Paton & Co.

Victorian Railways :—

Voltmeters and charts, £149.—Australian General Electric Co.
—*Australian Industrial and Mining Standard.*

Leeds.—The E.C. has accepted the tender of Messrs. William Airey & Son, for excavating and concrete work, forming part of the building extensions at the electricity works, at £19,999.

Electricity Committee :—

Two-phase switchgear, £1,274, plus cost of erection.—Ferguson, Pailin & Co.
Three-phase switchgear, £6,300, switch cubicle, £540.—British Westinghouse E. & M. Co.
Centrifugal pump, £2,980.—Rees Roturbo Manufacturing Co.
Two boilers, with unit stoker, £33,988.—Babcock & Wilcox, Ltd.
6,000-KW. turbo-alternator and condensing plant, £39,126.—Richardsons, Westgarth & Co.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, October 4th. At 6 p.m. At Great George Street, Westminster. Lecture on "The Experimental Study of the Mechanical Properties of Materials," by Dr. W. Cawthorne Unwin.

Friday, October 18th. At 6 p.m. At Great George Street, Westminster. General meeting.

Salford Technical and Engineering Association.—Saturday, October 5th. At 7 p.m. At the Royal Technical Institute. Paper on "Railway Electrification," by Mr. S. J. McCann.

Chief Technical Assistants' Association.—Saturday, October 5th. At 3 p.m. At Anderton's Hotel, Fleet Street, E.C. Paper on "Automatic Voltage Regulation," by Mr. Murdoch.

Institute of Marine Engineers (Inc.).—Tuesday, October 8th. At 6 p.m. At the Minories, Tower Hill, E.C. Paper on "Feeding and Circulating the Water in Steam Boilers," by Mr. J. Watson.

Industrial Reconstruction Council.—Tuesday, October 8th. At the Institute of Journalists, Tudor Street, E.C. At 6 p.m. Conference on "Interim Industrial Reconstruction Committees," introduced by Mr. W. Henderson-Pringle.

Electro-Harmonic Society.—Friday, October 11th. At 8 p.m. Smoking Concert. At the Holborn Restaurant, Venetian Chamber.

Birmingham and District Electric Club.—Saturday, October 12th. At the Swan Hotel, Birmingham. At 7 p.m. Paper on "Some Modern Applications of the Gyroscope," by Mr. H. F. Stevenson.

NOTES.

Engineering Wages.—The Committee on Production has increased the rates of pattern makers aged 21 and over, in the Birmingham and District engineering trade, by 2s. a week.

Electro-Harmonic Society.—The first smoking concert of the 1918-19 season is to be held on Friday next, October 11th, at the Holborn Restaurant (Venetian Chamber). It will commence at 8 p.m. The dates of other events for the season will be found in the ELECTRICAL REVIEW for August 2nd.

The artistes for next Friday are :—Mr. Richard Ripley, tenor ; Mr. Thomas Howell, baritone ; Mr. Olley Oakley, banjo ; Mr. Walter Weir, recitations ; Mr. George Ellis, humorist ; Mr. Finlay Dunn, entertainer at the piano ; Mr. Bernard Flanders, A.R.A.M., pianoforte solo and accompanist.

Fire Prevention.—The British Fire Prevention Committee has issued a "Warning" (free to the public) for householders, pointing out the precautions that should be observed in order to prevent outbreaks of fire, and the most effectual methods of dealing with them. Written inquiries regarding precautionary measures will be answered by the Committee, and copies of the leaflet can be obtained from its offices (8, Waterloo Place, S.W. 1), on application in writing, enclosing a stamped addressed envelope. Destruction of property by fire is, perhaps, the most wasteful and extravagant of the ills to which man is heir, and now that the heads of families are in so many cases absent from home on war service, it is highly desirable that those who remain in the household should omit no safeguard which may lessen the risk. The action of the Committee in distributing free expert advice on the subject is, therefore, most timely and commendable.

Volunteer Notes.—LONDON ARMY TROOPS COMPANIES, ROYAL ENGINEERS (V.).—Headquarters : Balderton Street, Oxford Street, W. 1.

Corps Orders No. 40, by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Captain of the Week.—Capt. W. Hynam.
Next for Duty.—Capt. W. Darley Bentley.
Sunday, October 6th. — Annual Musketry course at Pirbright. Parade, Waterloo Station, 8.45 a.m. Drill order, rifles and side arms. Mid-day and tea rations to be carried.
Monday, October 7th to Saturday, October 12th.—Drills as usual.
Sunday, October 13th.—Commandant's Parade, at Waterloo Station, 8.45 a.m., for work at Esher. Drill order. Mid-day and tea rations to be carried

C. HIGGINS, *Capt.* R.E., *Adjutant.*

Patent Notice.—The proprietor of British Patent No. 21,881/14 ("machine for winding electromagnetic coils") is desirous of entering into an arrangement for the exploitation of the same. See our advertisement pages to-day.

Educational.—UNIVERSITY ENGINEERING COLLEGE.—We have received a leaflet drawing attention to the correspondence courses in engineering conducted by this Institution, which gives special attention to the Associate Membership Examinations of the engineering societies.

UNIVERSITY OF LONDON, UNIVERSITY COLLEGE.—A course of six lectures on "The Scientific Problems of Radiotelegraphy" will be delivered by Prof. J. A. Fleming, F.R.S., on Wednesdays, at 5 p.m., beginning October 30th, 1918. The course is open both to members and non-members of the University. Fee, £1 11s. 6d. Application for tickets of admission should be made to Dr. Walter W. Seton, M.A., University College, London (Gower Street, W.C. 1).

Mr. George Verity on the Outlook.—Mr. G. Verity presided over the annual prize distribution in connection with Charing Cross Medical School, and in an address to the students, said that the period following the conclusion of peace, if not carefully watched, might result in events such as were being seen in connection with the filthy horrors of Slavonic Bolshevism, but if guided aright, would result in material improvement in the condition of the people. It became the duty of professional men, and notably of the medical profession, to guide aright the forces with which they would be brought into contact.—*The Times.*

Industrial Profit-Sharing: Italian Government Decree.—Referring to the subject touched upon in our leading article last week, the *Times* correspondent in Rome says, under date of September 30th, that at the instance of the Ministry of Industry, Commerce, and Labour, a decree has been issued giving sanction to the principle of profit-sharing between masters and men. "Many industrial undertakings have formed a special reserve fund, after paying the limited dividends now allowed. The decree establishes that one-third of such reserve must be invested in State securities. The rest may form a special joint capital and labour distribution fund. No particular system is laid down, but the principle is established that the relations between Capital and Labour should be regulated on the base of fair sharing of profits, and power is given to individual undertakings to take measures for putting their profit-sharing systems into practice, each proposal being submitted to the Ministry for approval."

Sentence for Assault.—At the Rotherham Court on Monday last, Edward Brewster (23), miner, of Swinton, for assaulting a conductress and motorman on the Mexborough and Swinton Tramways system, was sent to gaol for three months on each assault, to run concurrently.

For Sale.—The Blackburn Corporation has for sale one 300-B.H.P. Bruce-Peebles motor, one 7½-B.H.P. Brush motor, and one 1·9-B.H.P. Westinghouse motor. See our advertisement pages to-day.

The British Engineers' Association.—ENGINEERING INVESTIGATION IN BRAZIL.—The Government, through the Department of Overseas Trade, is embarking upon another investigation abroad ; this time it has agreed to share the cost with the British Engineers' Association of an investigation into the prospects for the engineering industry in Brazil.

The investigator, whose name will be announced very shortly, will spend probably 12 months in Brazil, and his reports will cover the whole field open to engineering enterprise. In carrying out this investigation, we understand that the Council of the Association is not animated by any hostility towards the merchants and other existing channels through which engineering business has been carried on. It is desirous solely of obtaining for its members information of the requirements as to the Brazilian market, the openings for engineering plant and machinery, and particulars of the methods of doing business most likely to suit possible purchasers and users. It will be open to members who receive these reports to do business in any way they like. Some members of the Association are already established in Brazil with branch houses, others already do business through the merchanting and importing houses. Therefore, one result of this investigation should be to make manufacturers more willing to adapt their products and methods to local interests, and in this way this investigation should make it easier for merchants to supply their Brazilian demands from British sources.

The Price of Aluminium in 1919.—The Minister of Munitions announces that the control price of aluminium ingots of 98-99 per cent. purity will be reduced, as from January 1st, 1919 from £225 to £200 per ton, carriage paid to consumers' works The price of remelted aluminium scrap and swarf ingots will remain as at present.

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Electric Lamp Standardising and Fuel Economy.—A plan to save electricity and thereby fuel by the elimination of inefficient incandescent lamps has been adopted by the United States Fuel Administration, and became effective on September 15th, 1918. According to the *Electrical Review*, Chicago, the following programme is recommended:

1. The elimination of unnecessary types of standard carbon lamps and of carbon lamp types for special application as follows: The standard 60-watt multiple carbon lamp 100-130 volt range; the standard 20-watt S-14 bulb multiple carbon lamp 100-130 volt range; the 120-watt standard multiple carbon lamp 100-130 volt range; the complete elimination of standard 30-watt and 60-watt round-bulb multiple-carbon lamps, and all other types of 100-130 volt range multiple-carbon lamps with standard base used for decorative purposes.

2. The complete abandonment of the installation and renewal of carbon incandescent lamps of all sizes and discouragement of their use for any use or application for which tungsten lamps can be substituted; this policy to go into full effect not later than September 15th, 1918.

3. The gradual abandonment of the installation and renewal of metallised filament (Gem) lamps of all sizes and discouragement of their use for any use or application for which tungsten lamps can be substituted.

Under special and unusual conditions where it is absolutely necessary to use lamps with exceptionally robust filaments owing to rough handling or excessive vibration, the use of carbon lamps is recommended so that the metallised filament (Gem) type may be completely eliminated. This policy to go into full effect not later than November 15th, 1918.

4. That the use of considerable numbers of the smaller sizes of lamps for commercial and industrial applications be eliminated where it is practicable to substitute for them large single gas-filled lamps of highest efficiency in a smaller number of lighting units.

5. That the use of vacuum tungsten lamps in sizes of 100 watts and over be eliminated and whenever practicable gas-filled tungsten lamps of highest efficiency be substituted therefor.

6. That electric light and power companies employ no differentials in their price schedules for the sale or renewal of lamps which may tend to encourage the use of larger sizes of lamps rather than smaller sizes, except as such differentials are justified by differences in the cost of the service.

7. That all manufacturers of carbon and metallised filament (Gem) lamps insert with each standard package of such lamps shipped by them a printed notice directing the attention of the user of the lamps to the fact that the particular lamps in the package should be used only in locations where it would be impracticable, because of excessive vibration and rough handling or for therapeutic and heating purposes, to use satisfactorily a more efficient type of lamp.

Searchlight Problems.—According to the *Electrical World*, solutions of the following searchlight problems will be of great military value at the present time, and should be sent under confidential cover to the Officer in Charge, Searchlight Investigations, General Engineer Depôt, Corps of Engineers, United States Army, Washington, D.C.

(*a*) Means for determining the finding power of a searchlight which will take into account the colour of the light, the nature and colour of the target, the condition of the atmosphere, and the distance between the searchlight, the target, and the observer.

(*b*) Means for rapidly determining the intrinsic brilliancy of a searchlight light source.

(*c*) A simple system of remotely controlling the operation of a searchlight in azimuth and elevation. The present or proposed systems require from five to fifteen or more wires, and are too complicated.

(*d*) A mirror design which shall be more efficient for anti-aircraft service than the standard parabolic mirror.

(*e*) A light source which shall be more efficient than a high-intensity carbon arc. A thallium arc has been suggested because it has only one line (green) in the spectrum.

(*f*) A mirror material which shall have the reflecting and longevity properties of silver-backed glass, without the fragility of glass mirrors.

Fuel and Light.—Ration Date Postponed.—Although the Household Fuel and Lighting Order came into force on July 1st, the Coal Controller has decided that the gas and electric light rations shall not commence until the taking of meter readings at the end of the present month. An extension of time for the application of coal rations has also been granted, and is now fixed for October 31st at the latest, though it will start from the date of the requisition form, which should be sent in as early as possible. Any penalty which may be attached to non-observance of the order will not become effective until after the readings of the meters at the end of September. After the last three months' trial no excuse will be acceptable from those who fail to observe the restrictions which are necessary to meet the national emergency.

The Controller of Coal Mines has forwarded a letter to the collieries and district coal committees throughout the country in which he states that the present arrangements in regard to retail coal prices render it necessary that in those cases in which it has been customary for collieries to charge differential winter and summer prices, there should be substituted in future an average price, *i.e.*, where the difference between the winter and summer prices has been 1s. per ton the "through" price will be 6d. per ton above the summer price. This direction comes into operation as from October 1st.

Sir Albert Stanley, telegraphing to the Municipal Tramway Association at Leicester last week, said that coal economy was at present one of the most vital considerations. Munition works were short as was also the domestic supply. If and when industrial rationing was put into force many industries would be compelled to make much greater reduction than 15 per cent. Tramway undertakings were not being singled out for special treatment.

The Order governing the rations for Scotland came into effect on October 1st. The allowance for fuel in Scotland is 4 tons where the number of rooms occupied is not more than three; and an additional ton of coal for each additional occupied room up to 20 tons. Compared with the English rations, this gives an increased allowance on an average of one ton of coal, on account of the colder weather in the North. The Scottish lighting allowance exceeds that of the English by about 20 per cent.

The Price of Coke.—The Board of Trade have made an Order, entitled the Gas Coke Prices Order, 1918, fixing the price of gas coke and breeze used for industrial purposes. The Order comes into force on Monday next, October 7th. It contains provisions authorising the Controller of Coal Mines to suspend any of its provisions in any districts, or to vary the maximum prices in any cases of hardship.

Government Control of American Power Plants.—A Bill to give the President authority to take over all the power plants of the United States, whether steam, electrical, or hydraulic, and to control them for the duration of the war, was introduced in the House on August 19th. According to *Power*, the Bill has the endorsement of the President and the Secretary for War, as well as of the heads of the various boards having direction of war activities and conservation. It carries an initial appropriation of $200,000,000, a large part of which would be spent in the purchase and building of power plants at the mouths of coal mines. The Bill provides "that the President may construct or acquire power plants and transmission lines, and incidental property necessary for the production of material and commodities essential to the national defence." He may either take over privately owned power plants or advance funds from the appropriation to assist in their private operation. The power to construct or acquire any power plant, transmission lines or incidental property will terminate at the end of the war, and the power to operate and maintain the plants shall continue only for such time as the President shall deem necessary for the public interest. Compensation when the plants are taken over is to be fixed by the President. In case of a dispute, 75 per cent. of the amount fixed by the President shall be paid, and the owner has the right to sue for the remainder.

Key Industries Exhibition.—The Key Industries Exhibition which has been organised by the Industrial Section of the Tariff Reform League, with the sanction of the Ministry of Munitions, will be opened on Monday, October 7th, by the Right Hon. J. Austen Chamberlain, M.P., at the Central Hall, Westminster, London, S.W. 1. No charge will be made to the public for admission to the exhibition, which will remain open until October 22nd, after which it will be shown in Manchester and other leading provincial centres.

The Metric System.—The Congress of Uruguay has passed a law requiring the use of the metric system in all trading transactions. The Montreal Chamber of Commerce has suggested the adoption of the system in Canada.

Institution and Lecture Notes.—University College, London.—A course of three public lectures, illustrated by lantern slides and experiments, on "The Principles of Fuel Economy in the Home," will be delivered by Mr. A. H. Barker, Lecturer in Heating and Ventilating Engineering, on Wednesdays, October 9th, 16th and 23rd, at 7 p.m. The lectures will be of a popular character; they are designed to meet the needs of householders who are faced with the problem of fuel economy. A leaflet, giving a syllabus of the lectures, may be obtained by sending a stamped addressed envelope to the Publications Secretary, University College, London (Gower Street, W.C. 1).

Fatality.—A Glasgow paper states that Robert Howat, 21 years of age, an apprentice electrician, while at work in the Ioco Proofing Co.'s premises, Netherton Works, Anniesland, on September 26th, making new connections, was accidentally killed by shock.

The Recalescence of Steel.—Referring to the note in our last issue with regard to the Wild-Barfield furnace, it has been pointed out to us that owing to a certain lag in the phenomena, decalescence occurs at a temperature somewhat higher than that at which recalescence takes place; hence, when steel has been heated up to the temperature of decalescence, as indicated by the loss of magnetisation, it can be withdrawn from the furnace and quenched before it cools down to the temperature of recalescence.

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Electrical Incendiarism.—According to a Reuter message, the town of Ham, the largest in the devastated country which the Germans spared in their retreat last year, was destroyed by infernal machines arranged in the houses; by the pressing of buttons miles away, long after the last Boche soldiers had crossed the Somme bridge, fires were started which gutted every house in the town, and the bridges were blown into the air. Ham had not suffered by shell fire.

The Germans have numerous engineer detachments at work preparing mines to be discharged by distant electrical controls.

Pre-war Trade Union Conditions.—Mr. G. H. Roberts, M.P., Minister of Labour, stated, on Sunday, that the Government fully intended that after the war there should be a restoration of Trade Union rules and customs, and that it would shortly be his duty to introduce a Bill in the House of Commons carrying out the Government pledges in that respect. A somewhat different statement was made by Mr. Barnes on Wednesday in London. Mr. Barnes sees the impossibility of return to the old conditions, and asks for a *quid pro quo* if the Unions waive their rights.

Appointments Vacant.—Shift engineer for Redditch U.D.C. electricity works (£3 17s. 6d. inc.); switchboard attendant (65s. per week) for the Blackburn Corporation electricity department. See "Official Notices" to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Mr. McCullough, on resigning the managership of the tramways at Carlisle, has been presented by the staff with a piece of silver plate.

Blackburn Town Council, in Committee, has unanimously approved the Electricity Committee's recommendation to grant a sum of £500 to Mr. P. P. Wheelwright, borough electrical engineer, in respect of the extra duties performed in connection with special work on which a large profit was made.

Mr. J. W. Warr, deputy electrical engineer to the St. Helens Corporation, has been appointed chief mechanical engineer to the United Glass Bottle Manufacturers, Ltd.

The employés of the Belfast electricity department have presented Mr. Parker, chief clerk, with a cutlery canteen and a cheque, on the occasion of his marriage. Councillor Duff, vice-chairman of the Electricity Committee, presided, and Mr. Bloxam, chief electrical engineer, made the presentation.

Heston-Isleworth District Council has appointed Mr. E. Broad, senior engineer at the electricity works, to be assistant station superintendent, at £270 per annum.

Mr. J. E. Edgecombe, borough electrical engineer of Kingston-upon-Thames, has been appointed director of the Tungsten Lamp Association. The Corporation of Kingston-upon-Thames has voted him the sum of £500 for his special work in connection with the extension of the power station. Mr. Edgecombe's chief assistant, Mr. T. A. Kingham, has been appointed acting borough electrical engineer, at a salary of £400 per annum.

Mr. H. L. Cottam, borough electrical engineer, has been appointed by the Controller of Coal Mines to act as District Engineer in the Horsham area in connection with the Coal Economy Campaign.

Mr. J. K. Brydges, borough electrical engineer, Eastbourne, has been appointed by the Controller of Coal Mines to act as District Engineer in connection with the Coal Economy Campaign.

A proposal to advance the salary of Mr. P. W. L. Phillips, borough electrical engineer at Bedford, from £400 to £500, is to be further considered. The proposal followed upon an application from Mr. Phillips, who is serving in the R.A.F., that the amount of his salary be raised to the figure which it might have been expected to have reached had he been carrying on his duties when the recent increases to borough officials took place.

General.—Mr. E. Pelham Bennett, London and South of England manager for Simplex Conduits, Ltd., and formerly the company's manager in Liverpool, has been appointed to the Royal Air Force, Air Construction Service.

Councillor D. Hayward, chairman of the Electricity Committee, has accepted the mayoralty of Walsall.

Lieut. W. P. Durtnall, R.N.V.R., has been granted a temporary commission as Staff-Captain in the R.A.F., and is engaged in the Technical Department of the Chief Electrical Engineer of the Air Ministry.

The Minister of Munitions has appointed Mr. A. E. Berriman, chief engineer to the Daimler Co., to be Deputy-Controller of the Technical Department of the Department of Aircraft Production of the Ministry, in succession to the late Prof. Bertram Hopkinson, F.R.S.

Roll of Honour.—Dispatch Rider Samuel Heighes, who was employed by Messrs. Cunningham, Ltd., London, was killed in France during an air raid.

Private G. A. Henderson, Manchester Regiment, who has died of wounds, was employed by Messrs. Baxendale & Co., Ltd.

Private F. Shutler, Loyal North Lancashire Regiment, who has been killed, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Corporal David Hunter, H.L.I., one of the heroes of Mœuvres, whose praise has rung throughout the country since Sir Douglas Haig referred to the gallant stand made by the corporal and six men when surrounded by the enemy, is a native of the mining village of Kingseat, Dunfermline, and a son of an employé at the Fife Electric Co.'s generating station at Townhill.

Corporal C. Brailsford, R.F.A., who was on the electricity staff at Grassmoor Colliery, Chesterfield, has been wounded for the third time.

Driver J. N. Lloyd, R.F.A., late of the electrical engineering department of the Scarborough Electric Supply Co., Ltd., has gained the Military Medal.

Private J. W. Wild, Manchester Regiment, killed in action, was employed by Messrs. Baxendale & Co., Ltd.

Sapper R. Barry, R.E., killed in a train accident in France, was employed by the British Westinghouse Co., Ltd., Trafford Park.

The Military Medal, for bravery and devotion to duty, has been awarded to Sergeant E. L. Lane, R.G.A., who has been four times mentioned in dispatches. The award was made in recognition of his services in leading 100 men through a difficult situation. He was formerly employed at the Dukinfield electric generating station.

Private O. Hansom, Welsh Regiment, who has been killed in action, aged 19, was the eldest son of Mr. Oswin Hansom, engineer and manager of the Liverpool District Lighting Co.

Second-Lieut. A. V. Shillcock, Royal Berkshire Regiment, of Handsworth, Birmingham (formerly a member of the staff of the General Electric Co.) has been awarded a bar to his Military Cross.

Gunner J. F. Chater, Warwickshire R.G.A., who has been killed in action, was employed at the electric supply station, Summer Lane, Birmingham.

Private G. Crosland, Manchester Regiment, killed in action, was an employé of the B.I. & Helsby Cables, Ltd., of which firm his father, the late Mr. Joseph Crosland, was works manager.

Private W. Cleworth, K.O. Royal Lancaster Regiment, killed in action, was employed by Messrs. Connolly Bros., Ltd., Blackley, Manchester.

The death in action is announced of Private H. Lees (38), Royal Warwickshire Regiment, formerly an employé of the General Electric Co., Ltd., Witton.

Second-Lieut. W. Hayes, one of Messrs. Falk, Stadelmann's Manchester representatives, has been killed in action in France.

Rifleman E. T. S. Morris (London Irish) has been killed in action, and Private R. W. Dennis (W. Yorks. Regiment) wounded. Both were formerly in the General Office of the India Rubber Co., Silvertown, E.

Obituary.—The *Australian Industrial and Mining Standard* states that Mr. William Warren, for many years superintendent and general manager in Australia of the Eastern Extension Telegraph Co., died in Sydney, early in July, at the age of 82 years, closing a career which had been practically throughout associated with telegraphic communication. "Mr. Warren was one of the party which laid the first cable between Suez and Bombay. When his company secured the concession to lay the first cable across Bass Strait from Low Head, Tasmania, to Flinders, Mr. Warren was sent out to do the work and to become manager. When the Eastern Extension Telegraph Co. bought out the Telegraph Construction Co. and established the connection between Banjoewangie (Java) and Port Darwin, Mr. Warren became their chief representative in Australia, and retained that position until a few years ago, when he retired upon pension."

The *Times* "Killed in Action" column states that the death occurred on September 20th, at Penmaenmawr, of Thomas Davies, A.M.I.C.E., A.M.I.E.E., late Lieutenant R.E., Codsall, Staffs., aged 36 years.

AN AUTOMATIC SPACING AND PUNCHING MACHINE.

An article by S. A. Hand in the *American Machinist*, September 17th, describes a very novel and ingenious machine for automatically spacing and punching structural steel. All motions are electrically controlled from a central keyboard in much the same manner as musical instruments are played. This machine, which was designed and built under the supervision of Edward V. Wurts, chief engineer, Steel Utilities, Inc., Newark, N.J., automatically spaces and punches variable structural members in both web and flange in one passage through the machine, and in any lengths and widths up to the maximum delivered by the rolling mills. Any number of beams varying in size, length, number, and arrangement of holes may be punched expeditiously as a like number of beams which are exactly similar in every respect. This will allow material to be punched and shipped as the progress of the work demands instead of having to punch all of one size and pattern while the machine is set, which often means sorting out, shipping part, and storing part to be rehandled for later shipment.

One man operates the machine by placing the work on the

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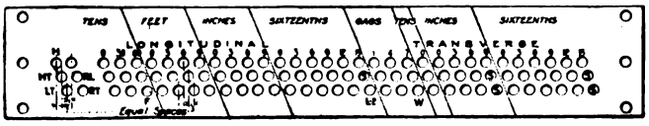
entering table from a storage bed and discharging it from the delivery table to a loading or runout table. The labour and cost of making templets and of laying out work is eliminated; detail drawings, tracings, and blueprints are not required. The record sheets used in the machine are made up in much less time than is required for making the usual detail sheets. The method of making the record sheet practically excludes error, and with the safety devices prevents punching the work, except as indicated, and ensures against all annoyances of lost time and back charges so frequently encountered through incorrectly punched work.

The equipment consists of two punches—a flange punch for punching one or two holes in either or both flanges of a beam or channel, and a web punch for punching from one to four holes in the web. Motor-driven roller tables on entering and delivery sides move the work to and from the punches, which are set in tandem. The longitudinal travel of the beam is regulated by a distance control, which automatically advances and stops the beam in correct position relative to either punch. The transverse spacing is accomplished by a transverse control connected to the web punch, which automatically traverses the punch head across the beam, stopping in position for punching.

In operating the machine the record sheet is placed in the keyboard; the beam or other work to be punched is placed on the entering table and the operator closes the starting switch. The beam progresses through the machine, stops in position for punching, is punched, again advanced, stopped



W = Web punch; F = Flange punch; L2 = Readings in same inch longitudinal-set in previous reading; LT = Readings in same inch transverse; H = Hold same foot-longitudinal; RL = Repeats longitudinal setting; RT = Repeats transverse setting; GAGS = No. 1 to 4 web punch and No. 5 to 8 flange punch; HT = Holds transverse; S = Separator adjustment.

FIG. 1.—GUIDE PLATE FOR PUNCHING RECORD SHEETS.

and punched, and so on until all the holes in web and flange have been punched and the beam delivered on the loading table. The operator then resets the machine, removes the record sheet and inserts a new one, or the same one again, and when the next beam is placed on the entering table the machine is ready to be again started.

The controls are operated from the keyboard, in which electrical contacts are made through the perforations in the record sheet. The stop motions of the punches are controlled from the record sheet and electrically interlocked with the table motor circuit and both control motor circuits, so that the punch cannot operate until the work is at rest. The spacing distances must have been fully run out before the punches can start, and any failure of the apparatus holds up punching, making it impossible to punch a hole otherwise than is indicated in the record sheet. All punches are provided with gags set from the record sheet.

When the beam approaches punching position a slowdown device makes electrical contact, slowing down the tables. At slow speed the beam meets a set stop, arresting its travel, the motor circuits are opened, and the punch circuits are closed, starting the punches indicated by the record sheet. The return stroke of the punch operates a switch to reset the apparatus, advances the record sheet for a new setting and starts the table motors, when the cycle is repeated. The punch operates only when all three motors have stopped, and the table motors start automatically on the return of the punch.

The record sheet is a perforated card prepared in advance for each beam or length of work. The perforations denote tens of feet, units of feet, inches and sixteenths of an inch for longitudinal movement, and tens of inches, inches and sixteenths of an inch for transverse movement, web punching, flange punching, punch gags, punch spacing, and repeat and hold for both longitudinal and transverse movements. Electrical contacts are made through the perforations in the sheet. The location of the hole determines the particular contact to be made and therefore the operation to be performed.

The keyboard has two opposed sets of small plungers or contact points which, through the perforations in the record sheet, energise the corresponding relays and contactors on the automatic switchboard to set and control the movements of the machine for punching one hole or group of holes. The upper contacts are connected to a common feed wire carrying 30 volts D.C. The lower contacts connect individually to their respective relays on the switchboard. When the record sheet is inserted the upper keyboard is brought to a horizontal position and latched to the stem of a solenoid. The upper keyboard lifts slightly after each punching operation, and the record sheet feeds forward to bring a new set of perforations between the contact points for the next operation. The feed mechanism also opens the circuit while the record sheet is advancing and closes it when the sheet is in position. The keyboard feed is driven from a small motor through a friction drive, but may be driven from the main shaft of the punch.

The automatic switchboard mounts the relays and contactors for the control of the machine. For longitudinal distance control, groups of relays for tens of feet and feet energise the selected foot segment, limiting the feet of longitudinal travel.

Groups of relays for inches and sixteenths of an inch connect to the respective stop-pin solenoids and set the stop pins selected by the record sheet. Similar groups for the transverse control are for tens of inches, inches, and sixteenths of an inch. The first two groups in combination energise the slowdown and stop contacts for the designated inch, and the last group sets the stop pins. The gags, punch-adjustment, and punch-starting relays are all set from the record sheet, but the final closing of the punch-starting circuits is through a relay set from the stop circuit. Contactors for motor control automatically give fast or slow speed for forward or reverse movement of table, longitudinal distance control, transverse distance control, and adjustment motors. A system of electrical interlocks on contactors holds up punching until both longitudinal and transverse distances have been completed, and arrests punching and stops the machine in the event of failure of any part.

The motor circuits and stop-pin solenoid circuits are all 230 volts D.C. The control circuits for keyboard-operated relays and slow and stop contacts are 30 volts D.C. from a ½-KW., 230- to 30-volt motor-generator set. The various switches are used for hand control and are grouped on a board conveniently placed for the operator. The automatic switchboard may be located in any desired position where it can be properly housed and protected, it was designed for standard equipment which was furnished by the General Electric Co., which also supplied the motors.

The feed tables on the entering and delivery sides of the punches are motor-driven roller tables of the familiar rolling-mill type. The work may be run on the entering table from the end or may be pushed or pulled on at the side in the usual way. A kick-off in the line of the delivery table places the punched work on skids for loading, or transfers it to a runout table to be conveyed to the loading point.

The longitudinal distance control, or spacing, mechanism comprises the foot-measuring devices and the mechanism for measuring inches and sixteenths. The foot-measuring devices consist of a carriage sliding on fixed guide rails at one side of the delivery table; a heavy screw under the carriage and between the guide rails; a motor drive for the screw and a series of foot segments or electrical contacts placed one foot apart on an insulating bar parallel to and above the guide rails. These foot segments are energised from the record sheet. The work, driven ahead by the rotation of the table rollers, pushes the carriage in advance along the guide bars. The carriage is provided with a latch which is electrically dropped into engagement with the thread of the screw at any even foot. The dropping of this latch controlled by the record sheet arrests the travel of the carriage at the particular foot desired. The carriage thus forms a stop for the work, permitting it to travel up to the desired foot, as determined by the record sheet.

Two copper shoes are supported on the carriage to slide under the foot segments, one in advance of the other. The carriage also has three trolleys, with wires stretched along the table. The leading shoe and one of the trolleys have the function of slowing down the table motor when the live foot segment is reached. The other shoe and two remaining trolleys make connections which set the latch and close the circuit for the contactors starting the longitudinal control motor.

Inches and sixteenths of an inch are measured by a rotation of the screw, which permits a farther advance of the carriage and work after the latch has been set in engagement with the screw.

The screw is driven by the control motor through a friction clutch. The inch-measuring disk is geared to the screw so that while the screw makes three revolutions per foot of carriage travel the inch disk makes one revolution. The inch disk has a slot on one side extending through eleven-twelfths of its circumference, equivalent to 11 in. of carriage travel. Opposite this slot, but supported in the sixteenths disk (which is sleeved on the same shaft with the inch disk), are 12 equally-spaced stop pins, any one of which may be projected into the slot to limit the inches of carriage travel. The stop pins are set by solenoids, through relays, from the record sheet, and are spring retracted when the solenoids are de-energised. The set inch stop pin allows a rotation of the screw until the pin engages the end of the slot. The carriage and work have then travelled the designated number of inches, the work being still driven at slow speed against the carriage. The sixteenths stop pins, identical in construction and operation with the inch pins, are carried in a fixed housing. In the sixteenths disk, opposite the pins, is a series of sixteen slots of different length, one for each pin, to permit rotation of the sixteenths disk corresponding to the recorded sixteenths of carriage travel. When the set inch pin has engaged the end of the inch slot the sixteenths disk, carrying the inch pins and the sixteenths slots, begins to revolve with the inch disk and the screw, and so continues until finally arrested by the set sixteenths stop pin. This stops the movement of the carriage and the work at the desired foot, inch and sixteenth of an inch of carriage travel, as indicated on the record sheet.

The friction drive allows the motor to drift to rest without jar. When the stop pins are released the sixteenths disk is returned to the initial position by its counterweight. A jaw

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clutch connects the screw shaft and the pinion driving the inch gear and disk. When the clutch is open the screw may be rotated independently of the inch disk, and by reversal of the motor the carriage may be returned to its initial position. The clutch is controlled by a solenoid operated from the switchboard. Slowdown contacts for the motors are spaced around the circumference of a fixed disk next to the inch disk, and are operated by a cam on the web of the gear.

The sixteenths and inch mechanisms return to zero position after every setting except when held in position by a keyboard contact, when the next setting advances in the same inch or foot of travel respectively.

If an inch or sixteenths stop pin should fail to engage its slot or the latch fail to engage the screw, or if the latch or stop pin should fail to release, electrical interlocks will prevent the punches from operating, the machine will stop and wait to be reset, and indicating lamps will light up to show the defective circuit.

The transverse distance control governs the travel of the web punch across the work.

The web punch is a heavy, double-frame punch of special design, motor driven, with a stop-motion clutch electrically controlled from the record sheet. When the spacing movement is completed the punch starts, and, after punching, again starts the spacing apparatus for the next hole or group of holes. It will punch up to four 1-in. holes in 1-in. material.

The distance between the pairs of punches and dies is adjustable and controlled from the record sheet. This adjustment is similar to that of the distance controls. The two pairs of punches are also moved as a unit. The punches are made selective by gags set from the record sheet.

The flange punch is a heavy horizontal power punch specially designed to co-operate with the feed tables and spacing mechanisms. It is motor driven and provided with an electrically controlled stop motion similar to that on the web punch. The machine will punch up to 2½-in. holes in either or both flanges of a beam, or one 1-in. hole in either or both flanges of a channel. Gags for the punches are set from the record sheet. The machine is set by hand or power for the size of the beam.

The flange punch co-operates with the spacing mechanism in the same manner as described for the web punch. Web punching or flange punching, or both, takes place, as determined by the record sheet.

The spacing apparatus, with the keyboard and automatic switchboard, has been operated during the past two years by

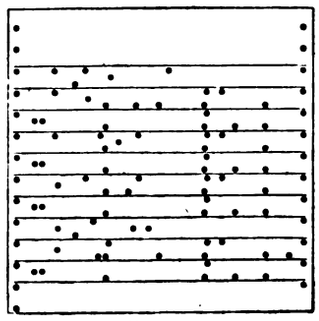

Fig. 2.

Fig. 3.

Fig. 2.—Record Sheet.

Fig. 3.—Beam 12 in. × 17 ft. Automatically Punched.

Steel Utilites, Inc., of Newark, N.J., demonstrating the speed and accuracy of the spacing and the reliability of the machine.

The following results are from a recent run of the machine: Duration of run, 8 hours; number of beams handled, 151; lineal feet of beam handled, 2,471; number of spacings made, 3,070; number of holes dummy punched, 5,073. Thirteen record sheets were used in rotation for beams from 12 to 17 ft. long, with an average length of 16 ft. 4 in. Longitudinal spacing varied from 15 ft. to 1/16 in., with an average of 9½ in. The transverse spacings were from 15 in. to 1/16 in. with an average of 3 in. One man operated the machine. Fig. 1 shows the plate for guiding the punch in punching the record sheet; fig. 2 represents the record sheet, and fig. 3 is an outline drawing of a beam automatically punched with the punches and spacing mechanism controlled by the record sheet, fig. 2.

NEW COMPANIES REGISTERED.

Chain Elevators, Ltd. (151,486).—Private company. Registered September 21st. Capital, £30,000 in £1 shares. To carry on the business of manufacturers of and dealers in devices for raising and promoting the circulation or carriage of liquids and fluids, pump manufacturers, electrical and general engineers, steel makers, shipwrights. Agreement with J. C. Grant and A. Jarvis. The subscribers (each with one share) are:—D. B. Callow, 28a, Davenport Road, Catford, S.E. 6, secretary; E. K. Mizen, 22, Lancaster Road, Stroud Green, N. 4, cashier. The directors are to be appointed by the subscribers. Solicitor: F. S. Clark, 53, Cannon Street, E.C.

Photector Co., Ltd. (151,497).—Private company. Registered September 23rd. Capital, £2,000 in 1,900 ord. shares of £1 each and 2,000 founders' shares of 1s. each. Mechanical, technical, commercial, electrical, or general engineers, technical advisers, consulting engineers, tool, mould, and castings manufacturers, metal workers, chemists, metallurgists, owners of patents, &c. Agreement with Justus Eck. The subscribers (each with one founder's share) are:—Justus Eck, 10, Priory Road, Chiswick, W. 4, engineer; F. Sawyer, Charlbury, London Road, Norbury, S.W. 16, solicitor's clerk. Justus Eck is one of the first directors, and may retain office while holding 1,000 shares of any class. Sergius Brook, of 13, Grange Road, Gunnersbury, may, while holding 600 shares of any class, appoint any person approved by the board as a director.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

La Plata Electric Tramways Co., Ltd.—Supplemental trust deed dated September 17th, 1918, to secure interest at 5 per cent. per annum on the arrears of interest accruing prior to January 1st, 1920, and on the instalment of interest due July 1st, 1918, on the first mortgage debenture stock outstanding. (The amount of said debenture stock outstanding is £100,450, and same carries interest at 5 per cent.) If during period of postponement any moneys are available for payment of interest on said debenture stock, such moneys are to be applied for that purpose.

Dowsing Radiant Heat Co., Ltd.—Mortgage of contract moneys, dated September 6th, 1918, to secure all moneys to become due from the company to the London, Provincial & South-Western Bank.

Chile Telephone Co., Ltd. (29,252).—Capital, £360,000 in £5 shares. Return dated August 1st, 1918. 66,000 shares issued. £220,000 paid; £110,000 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

Southern Brazil Electric Co., Ltd.—Mr. E. H. Tootal presiding at the annual meeting, said that the business had been restricted by war conditions. The gas works at Campinas were shut down in consequence of inability to obtain coal, but as it was being carried on at a small loss they had no reason to regret the cessation of that service. The old consumers would now be supplied with electricity instead. The receipts from the Campinas tramway service had suffered from several causes. The electrification of the steam railway, of which only a small part still remained to be done, should now be soon completed. The new municipal concession at Itapira was giving very satisfactory results, and the same could be said of the other small stations. They had a sufficient volume of water during the year, and on completion of the new Jaguary station their capacity for supplying power would be materially increased.

Victoria Falls and Transvaal Power Co., Ltd.—Net earnings for the year ended December, 1917, £836,301. After providing £236,273 for interest and premium on debentures, £236,273 for depreciation and income-tax, &c., £262,766 remains as net profit, plus £72,425 brought forward, making £335,191, out of which £50,000 has been put to reserve. Two dividends, each of 3 per cent., less income-tax, were paid on the preference shares, and 5 per cent. on the ordinary shares, with a further and final dividend of 4 per cent., less tax, on the preference shares, which are entitled to share *pro rata* with the ordinary shares in the surplus profits distributed until the preference have received a total of 10 per cent. for the year. A balance of £97,690 is carried forward.

To be Struck off the Register.—Unless cause is shown to the contrary the following companies will be struck off within three months:—

Affleeks Engineering Works, Ltd.
Alexandra Electrical & Engineering Works, Ltd.
Carleon Electrical Co., Ltd.
Electric Lamp Repairs Co., Ltd.
Lounge Electrics, Ltd.
Manchester Cable Co., Ltd.
Overseas Development Trust, Ltd.
Patent Lighting Co. (1915), Ltd.
Printex Accumulator Co., Ltd.
Universal Electric Canoe Co., Ltd.

Direct West India Cable Co., Ltd.—Net result of working, year ended June, 1918, balance £15,225, against £27,374 for the previous year. Interim dividend 3 per cent., free of tax, already paid; similar further payment now, leaving £12,525 to be carried forward. The cable was interrupted for a few days near Turks Island by a landslide. The insulation of the Bermuda-Turks Island section remains low. An increase in the amount to the credit of spare cable is accounted for by the purchase of new cable sent to Halifax during the year.

Halifax and Bermudas Cable Co., Ltd.—Net result of working for year ended June, 1918, balance £9,697, against £19,650 for the previous year. Interim dividend of 3 per cent., free of tax, already paid; similar further payment now, leaving £6,697 to carry forward. The cable has been interrupted on two occasions by anchor near Halifax, and quickly repaired, and on February 17th in deep water. The latter repair has not been effected owing to adverse weather and war conditions. The cable recovered is in a good state of preservation, and the trouble is evidently local and due to chafing.

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Stock Exchange Notice.—The following securities are to be quoted in the Official List:—

County of London Electric Supply Co., Ltd.—10,578 additional ordinary shares of £10 each, fully paid (Nos. 105,001 to 115,578.)

Dundee, Broughty Ferry, and District Tramways Co., Ltd.—The profit for the past year (including £587 brought forward) is £5,117, out of which 3 per cent., less tax, is being paid on the ordinary shares, £1,000 is put to reserve, and £83 carried forward.

Cuba Submarine Telegraph Co., Ltd.—Interim dividend on the ordinary shares for the June half-year at the rate of 5 per cent. per annum, free of tax.

STOCKS AND SHARES.

Tuesday Evening.

The course of Stock Exchange business runs strongly in favour of industrials of all kinds, where speculation is rearing its head, and any share which offers a reasonable scope for a "run for the money" is assured of popularity. One kind of patriot argues that he prefers shares which do not pay a dividend, because if they go up and he sells them at a good profit, there is no income-tax to pay on the transaction. It is said in the Stock Exchange that quite a large amount of the buying now afoot can be traced to provincial towns where munitioners are making large money, and turn their attention to Stock Exchange flutters by way of a diversion from their everyday work. Probably there is more than a modicum of truth in this, because, to judge from the way in which some industrials are being run up, the buying is indiscriminate, and at the same time widespread.

With the unconditional surrender of Bulgaria, and the fine news from other Fronts, markets as a whole are in a very cheerful frame of mind. Home Railway stocks have benefited with the rest, and amongst Undergrounds, Metropolitans recovered ¾, and the deferred dividend stock rose to 25, Underground Income Bonds gained a point, and the £10 shares at 2¾ are ¼ up. Nearly all the steam stocks have thrown off the depression caused by the recent strike, and, although business is not stimulated to any noticeable extent, the tone is once more comparatively firm.

The market for home electricity supply shares is steady, and even those who have been most cautious in their views respecting the industry are beginning to express hopes that a turning in the long lane of depression may be at last within sight, and that the public before long will take an interest in these shares for post-war prospects. The observer of the market is not inclined to quarrel with such sentiment, but at the same time it is impossible to avoid the reflection that the reduction in dividends, which seems likely at the end of the present 12 months, will hold down prices for some time to come yet. City of London Ordinary are ⅛ up at 11⅜, and Westminsters maintain their rise at 6⅛. Meanwhile, the manufacturing shares are quiet without developing any pronounced tendency. Ediswans are the feature, rising to 16s. 9d. after being 15s. 3d. The "A" shares 12s. paid are officially quoted at 5s., the first preference changed hands at the end of last month at 21s. 9d., and the 5 per cent. second debenture stock, which is not quoted in our lists, has risen recently to 73½, which, it may be noted, is 10 points above the quotation that ruled upon the outbreak of war. The first debenture at 75½ is 16½ points up from that time. British Aluminiums, now quoted ex the dividend of 9½d. per share, have risen to 37s. 6d., the company's 6 per cent. non-cumulative preference are also ex dividend, and stand at the relatively high price of 19s., while the 5 per cent. prior lien debentures at 88, and the debenture stock (5 per cent. minimum) at the same level are both firm. The last-named is in receipt of 5½ per cent. interest at the present time. British Westinghouse preference have gone back 1/16. British Insulated at 2¼ are practically unchanged, allowing for deduction of the dividend of 9d. last Friday, and the company's 6 per cent. preference shares stand at £1, which seems high enough in view of the yield offered by the National War Bonds.

Having regard to the good prices commanded by many of the best-class industrial shares, of which the electrical list affords a fair number of examples, it would seem to be worth while to sell these in order to put the money into the War Bonds at the present juncture. The latter return 5½ per cent., allowing for premium redemption, and where preference shares can be sold on a 6 per cent. basis, there appears to be little object in holding the latter. It is arguable, of course, that the buyer of the preference shares might just as well be exhorted to put his money into War Bonds as the seller is, but, from the business point of view, the post-war outlook is sufficiently uncertain to render the 6 per cent. return on any preference shares, however good, an insufficient yield considering the liability of the price to fall away later on, while, on the other hand, there can be no decline in the War Bonds, seeing that they are repayable at a premium within short dates.

Marconis continue to be one of the most active shares in the Stock Exchange. The market is buoyant, and, although there was a little profit-taking which reduced prices from the top, an under-current of strength is so noticeable that each bout of profit-taking is easily met. Possibly, Marconis are high enough at the present time, and 4 13/16 looks a giddy price to pay for these £1 shares, notwithstanding the huge scope that there is for the company's future. The subsidiaries are as strong as the parent shares, Americans spurting to 34s. 6d., while Marines have jumped to 72s. 6d. Canadians improved a little to 15s. 6d., and Spanish at 16s. are also harder.

Telegraphs are steady as a whole, Anglo-American preferred rising to within half a point of par. Westerns continue their weekly rise, with another ⅛ to their credit at 16¼. The telegraph manufacturing shares show no particular change, and the rubber share market remains quiescent. There has been a fresh demand for chemical issues of all kinds, in which Castner-Kellner participated with 1/16 rise. Babcock & Wilcox recovered to 3⅞ after their somewhat sharp reaction. Victoria Falls ordinary rose to 20s. on the publication of an excellent report, and the preference keep hard at 24s. The Stock Exchange is greatly interested in the suggestion that the whole of the American railroads should be electrified, and that the work should be put in hand irrespective of the end of the war. Now that the Government has control of the railroads, it is urged that the present offers a favourable opportunity for making the change, which would involve the saving of vast quantities of coal.

Brazilian Tractions have advanced sharply, and Mexicans are also better here and there. Kaministiqua Water fell 3 to 114½, while Shawinigan Water at 122 is a couple of points to the good.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Oct. 1, 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6⅜	—	£7 17 0
Charing Cross Ordinary	5	4	3⅛	—	6 8 0
do. do. 4½ Pref.	4½	4½	3¼	—	6 18 6
Chelsea	8	5	3⅛	—	7 16 10
City of London	8	8	11⅜	+ ⅛	7 0 8
do. do. 6 per cent. Pref.	6	6	9¾	—	6 3 1
County of London	7	7	9⅞	—	7 1 9
do. do. 6 per cent. Pref.	6	6	9¾	—	6 8 1
Kensington Ordinary	6	7	5⅜	—	6 17 7
London Electric	Nil	Nil	1¾	—	Nil
do. do. 6 per cent. Pref.	4	5	3½	—	7 13 10
Metropolitan	3	4	3⅛	—	6 10 7
do. 4½ per cent. Pref.	4½	4½	3½	—	6 18 6
St. James' and Pall Mall	8	9	6½	—	6 18 6
South London	5	5	3	—	6 18 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	6⅜	—	7 7 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	99½	+1	6 0 6
do. Def.	1½	1½	23⅝	—	6 7 8
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10⅝	—	*6 13 4
Eastern Extension	8	8	15⅝	—	*5 2 5
Eastern Tel. Ord.	8	8	158½	—	*5 1 0
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 5
do. do. Pref.	6	6	10½	—	5 17 1
Great Northern Tel.	24	22	38	—	5 15 9
Indo-European	13	—	57½	—	5 12 6
Marconi	15	20	4⅞	+ ⅛	4 2 0
Oriental Telephone Ord.	10	10	3⅜	—	3 4 0
United R. Plate Tel.	8	8	7⅞	—	*5 3 3
West India and Panama	6d.	1/3	1⅞	—	*3 6 8
Western Telegraph	8	8	16⅜	+ ⅛	*4 15 7
Home Rails.					
Central London Ord. Assented	4	4	62½	—	6 8 0
Metropolitan		1	26¼	+ ¾	3 16 5
do. District	Nil	Nil	25	—	Nil
Underground Electric Ordinary	Nil	Nil	2¾	+ ⅛	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	6	4	84½	+1	*4 14 8
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅜	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3⅝	—	—
do. do. 2nd Pref.	5½	—	2½	—	—
do. do. 5 Deb.	5	5	68	—	7 7 3
Brazil Tractions	—	—	51	+2	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Ptce.	5	5	58½	—	8 11 0
do. do. Preferred	Nil	Nil	41½	—	Nil
do. do. Deferred	Nil	Nil	36½	+1	Nil
do. do. Deb.	4½	4½	57½	—	7 7 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	50	+1	Nil
do. 6 per cent. Bonds	Nil	Nil	42	—	Nil
Mexican Light Common	Nil	Nil	28	—	Nil
do. Pref.	Nil	Nil	40	—2	Nil
do. 1st Bonds	Nil	Nil	61½	+ ½	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅞	+ ⅛	8 17 4
British Aluminium Ord.	10	10	1½xd	+ ⅛	5 6 8
British Insulated Ord.	20	20	2¼xd	—	4 9 0
British Westinghouse Pref.	7½	7½	2⅛	—	5 9 1
Callenders	20	25	10¾	—	5 19 1
do. 5 Pref.	5	5	4½	—	5 11 1
Castner-Kellner	22	20	3⅝	+ ⅛	5 8 4
Edison-Swan, "A"	—	—	—	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	10	1⅜	—	7 5 6
Gen. Elec. Pref.	6	6	10½	—	6 3 10
do. Ord.	10	10	18½	—	*5 8 1
Henley	25	25	2½	—	5 11 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	—	*5 16 9
Telegraph Con.	20	20	47½	—	*5 1 0

*Dividends free of Income Tax.

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THE DUTIES OF THE PROGRESS DEPARTMENT.

By W. J. HISCOX.

(*Continued from page* 293.)

THE FOUNDRY—THE SMITHY AND PRESS SHOP—THE TINSMITHS AND COPPERSMITHS.

(*g*) *The Foundry.*—The "creative departments," of which the foundry is the most important, in most factories, may be looked upon as the foundation of production, for the output of these departments determines not only the percentage of orders completed in accordance with programme, but also the aggregate output of the factory. Castings or forgings represent the measure of the job in the case of 90 per cent. of the total orders, for in the machining of these parts more and longer operations are involved than in the case of bar material. Apart from this, the casting, particularly, is the fabric of the unit, the other details being merely accessories, and work cannot be commenced in connection with the assembly of the unit until the most essential article is to hand.

In modern organised factories, extensions to buildings and plant are constantly being effected, to cope with the increasing volume of business; but these extensions in many factories are confined to the machine and fitting departments, the requirements of the foundry in this respect being quite overlooked. Yet it is obvious that, if it has been deemed necessary to extend the machine and fitting departments, it is just as necessary to extend the foundry in a like proportion, for increased orders mean an increased demand for castings, and the foundry which could only just meet the requirements of the shops in days gone by cannot be expected to meet the increased demand for castings which will automatically follow the extension of the machine shop unless the same facilities are given.

This distinction also occurs with regard to plant. The modern machine shop is equipped with the latest appliances, obsolete machinery being removed to make room for more efficient machines. The foundry, on the other hand, usually has to be content with what it already has in the way of moulding machines, despite the fact that machine moulding is practically the most essential factor governing rapid production.

The foregoing is written with a view to dispelling any illusions with regard to obtaining a progressive output from an obsolete foundry; it is obviously impossible for the Progress Department, no matter how well organised it may be, to do itself justice if one of the departments of the factory, upon which so much depends, is unable to meet the demands made upon it, through being insufficiently equipped.

As in the case of other departments, the Progress Department should give the foundry a date for the completion of all castings in connection with a specific order, time being allowed for the making of a new pattern where necessary, and all outstanding patterns should be watched by the progress man, to ensure these being in the foundry early enough for the date to be met.

The progress section leader must interest himself personally in all matters affecting foundry production. It is not enough for the machine shop chasers to attempt to hustle specific castings from the foundry, as and when they are required; indeed, this practice need not be indulged in at all if the section man is doing his duty. He must remember that the machine shop should always have sufficient castings available to carry on for at least three or four weeks, and he will, therefore, fix his delivery dates accordingly. A list of all castings on each order is kept in the Progress Department, as instanced in the article dealing with the Pattern Shop; and as this list also shows all the outstanding patterns, it is a fairly simple matter for the progress man to keep in touch with the foundry requirements and output. If this list is kept up to date, the progress man, when urging the completion of a specific casting, will know exactly upon what date the pattern was available, and will, therefore, be able to ensure that his demand is not impracticable.

A copy of every delivery note, showing thereon the department for which the casting is intended, should be sent by the foundry foreman to the Progress Department, or, as an alternative, an official sheet, enumerating the whole of the castings dispatched on any one day, should be sent, the works order number and the departmental destination being entered against each item. If this is sent in early on the day following the actual dispatch, each progress man can correct his list of outstanding castings, and thus know to within a few hours the exact position with regard to castings on any order.

The date given to the foundry by the Progress Department must cover, in addition to the making of the pattern and the actual casting of the article, the time required for trimming, sand-blasting, or pickling, and these points, therefore, must not be lost sight of by the progress man when estimating for delivery.

Any casting delivered from the foundry and scrapped subsequently, should be covered by a reject note issued by the Inspection Department, and a replace casting ordered. This will be treated as a new order by the Progress Department; but if the casting in question is the only one of its kind on the order, the new date should be arranged so that the new casting can be finished early enough to prevent any unnecessary delay in the delivery of the completed unit. On the other hand, if the rejected casting is one of many, the replacement should be rushed through, so that it may, if possible, pick up with the other castings on the same order at an early stage of machining.

(*h*) *The Smithy and Press Shop.*—These two departments may be treated as one for the purpose of this article, and the procedure adopted by the Progress Department is substantially that adopted in connection with the foundry. In this instance, however, a large proportion of the dies, &c., are already in existence, and these are not usually kept in a separate department, as in the case of patterns, but in the tool store of the department responsible for the production of the required part. The special tools are usually made in the tool room, which department has to cater for the needs of the entire factory, consequently it has been deemed necessary for the Progress Department to fix a date for their completion. A copy of each tool-room date affecting the smithy and press shop orders should be sent to those departments, so that the foreman will know when the special tools may be expected.

A forging and pressing list should be kept in the Progress Department, giving particulars of the parts required, the special tool numbers (if any), and the estimated and actual dates of delivery. For advising the Progress Department with regard to finished work, the procedure recommended for the foundry in this connection should be adopted, viz., a copy of each delivery-note, or a daily list of completed parts, should be sent to the Progress Department.

In some concerns, the press shop depends to a large extent upon the tinsmiths' department for the supply of sheet material, which is cut to convenient dimensions to suit the pressing machines. When this is the case, a copy of the tinsmith's date for the delivery of the material should be sent to the press shop by the Progress Department, the three dates in question, viz., for tools, material, and the completed article, appearing on the same form.

Tool castings and forgings should receive prompt attention, the Progress Department fixing dates for these, to allow the tool room ample time to complete the tool in accordance with programme.

(*i*) *The Tinsmiths' and Coppersmiths' Department.*—This department differs from the foregoing, owing to the fact that rough material, requiring subsequent operations in other departments, and also finished articles, are produced. This means that in many instances the Progress Department has to fix two distinct dates in connection with one order, and the progress man must, therefore, make himself acquainted with the particulars of the parts required. With regard to the sheet metal work required by the press shop, this has already been briefly dealt with under the heading of that department, and the same procedure should be adopted by the Progress Department with regard to parts requiring subsequent operations in the machine shop or elsewhere.

With regard to finished articles required in connection with the final erection of the unit, the same date as tha

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given for the completion of the sub-assemblies in the fitting shop should be given, as this would ensure finished tinsmiths' and coppersmiths' work being ready when required. When the tinsmith or coppersmith has to fit his own parts to the unit in the course of erection, the time for this to be done must be arranged by the two departments concerned. If considered desirable, the Progress Department could either enter on the tinsmiths' programme the date given for the erection of the unit, or merely endorse the programme "As Required," leaving the Erecting Department to make the necessary arrangements. In all other matters the procedure recommended in connection with the other departments should be adopted.

(To be continued.)

TECHNICAL EDUCATION AND DISCIPLINE.

By "IMPERIAL."

Although everyone has grown accustomed to the fact that the war has changed everything, there are still many who consider that development and progress are impossible. It is an attitude similar to that of Julia, who, "Vowing she would ne'er consent—consented." It is fortunate that, since it appears to be necessary to say "We can't," the contradictory nature of the English mind makes us embark upon, and achieve, the impossible. A consideration of the enormous progress made in, say, electric furnaces, where the business is forty times what it was before the war, or of the fact that the Westinghouse and the B.T.H. have both developed a complete line of automatic contactor gear, to mention but two minor instances, shows that we cannot stand still. The world still rolls on, and where there is life there cannot be stagnation. It is idle, then, to contend that every reform must wait until peace is declared—we shall be far too busy then re-adjusting our perspective to try any gigantic changes.

In the question of education, one advance has been made—there is a President of the Board of Education who is professionally interested in the subject, and who devotes his energies to the work of his department, instead of to militant politics. This is an improvement on the days when Mr. Arthur Henderson held the post so that he could be in the Cabinet without being distracted by the cares of an executive department—an elevation of education to the level of the Duchy of Lancaster!

Many alterations have been made since this desired change occurred—the status of the teaching profession has been greatly advanced, and the remuneration made more adequate to the talent demanded. More will be done when the new Bill becomes law, but in the higher branches of technical education there are many things that it would be difficult for Mr. Fisher to enforce, but which could easily be started from within. During war-time, when the youth of the country becomes liable for military service in its nineteenth year, the time left for University work is short. In London, since the earliest age for matriculation is 16, the time left is two years. It would be deplorable if, because of this, all the boys ready to leave school stayed on in a supernumary capacity, as a senior form. They would waste time, and inevitably acquire "swellld heads." It would be worse if they all ceased training altogether; and yet in most colleges the course covers three, and often four, years. Some effort should be made to provide a condensed intensive course, always avoiding "cramming." The fundamentals of the profession could be thoroughly instilled without the mind being overloaded by details, which, in the subsequent military training, would be at first useless, and at last forgotten. To provide a thorough grounding even in the fundamental essentials would, however, in the brief time, demand much more work than most technical—particularly engineering—students at present accomplish. They must work harder and longer—longer hours per day, with shorter vacations—or else college vacations largely occupied on some definite work. The longer hours are not difficult to obtain—every elementary school in the country starts at 9 or 9.30. Every secondary school starts at much the same time. Why should nearly every college start at 10 o'clock? Not one in fifty of the students does a stroke of work before coming to college, and it breeds and encourages late hours and lazy habits. When at college I found, and said, that I did my best work between 10 p.m. and 1 a.m. It was partly true, partly a convenient fiction to cover the fact that I wanted the hours until ten for lighter occupations than the theory of machines or the intricacies of rotary converters. But even if wholly true, it might have led to deplorable physical results, and it certainly fostered a taste for bed in the morning hours. If colleges commenced at 9 o'clock students could not stay in bed until 8.30 every morning, and a consistent effort to stay up until after midnight would soon prove a failure. It would reduce also the opportunities for philandering, which, though a privation for the individual, would not eventually be a loss to the nation.

Although it can scarcely be denied that longer hours would be an ultimate advantage to the student, it would impose an additional burden on the already depleted and overworked staffs. New recruits to the teaching profession are few, and must at present be physically unfit—a fact which excites little sympathy, and commands no obedience, from the average undergraduate of even the newer Universities. This does not constitute an *impasse*, however. Women are doing many things that were outside their sphere before the war, and there is no reason why they should not teach arts subjects, mathematics, and pure science in University colleges. This suggestion may occasion a howl of derision and dismay from staff and students alike; but let me assure them, from my experience, that the women who have adopted the profession of late years can, in many cases, do their hair and dress well, and have quite human ideas of amusement. They have also a well developed sense of their position and authority, and could maintain better order than some, at least, of the men whose lectures I attended.

But strict discipline is necessary, whether women are teaching or men. When a boy is in school he is subject to strict rules—even if they be enforced by prefects. When he arrives in college he is treated as a man and freed from restraint to an absurd degree. The effect of this is worse than that of the late hours. It is supposed to generate a spirit of self-discipline and independence. Which of these it was that caused an incident wherein the principal of a certain college returned one afternoon to find suspended on his door a length of chain and a porcelain handle, with a legend exhorting him to "Pull and let go," it is not for me to say. The only disciplinary measure in this case was that two men were carpeted, and one suspended for the remainder of the week—which, as his parents were in India, and he was living alone, troubled him but little.

When the student leaves college he runs up against a sterner discipline—especially now that he goes into the Army. But even in the old days, when he went into the shops, he found he was not the lord of creation he had believed. A lot of nonsense is knocked out of him then—but why should it ever be bred? He could gain a sense of responsibility, and, at the same time, of the necessity of instant and implicit obedience to the command of a superior, as easily as he now obtains his ideas of omniscience and omnipotence. He could gain the desirable characteristics by good discipline. Unfortunately, the word is generally misunderstood, and, if used in connection with men in a works, provokes talk of "Prussianism" and "dragooning." Neither of these is an essential part of discipline—they are merely inferior substitutes. But even they are better than nothing. Discipline and earlier hours are, however, essentials not only in war, but in peace time also.

The earlier hours need not stop after college. A few firms realise that early and short hours give advantages to both staff and employers, but many do not. The same works manager who in Manchester referred to the Ford organisation as "Prussianism and dragooning," once said that the work done per day by a technical engineer was directly proportional to the number of hours he worked. This is hardly a tenable theory—it at least does not hold true at the limiting value.

It is little hardship on any man to arrive at his office by 9 o'clock—if he works his hardest he is of little use after 5.

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Consistent concentration on one subject over longer hours than these must produce staleness and mental fatigue; but the man who is free outside those hours can live farther from his work and get more variety of scenery, live a healthier life, and have a change of occupation in his home life. At the present moment it also aids in daylight saving and economy of fuel. But the point of permanent value is the better life of the individual and its consequent beneficial reaction on the life of the nation. Such a life would leave the experienced business men with time and energy to devote their attention to local and Imperial Government, instead of leaving it to professional politicians and journalists.

But, even apart from these points, the earlier hours are an essential to our national progress and to our healthy national, mental, and physical life. Now, when men are working with women and untrained assistants, their labour is far more intensive and fatiguing. Many a man is keeping his own card indexes, and doing clerical work he would never have touched three years ago—there are still employable but unemployed women who could do it for him. He may do it better than they, but his hours are excessive if he does it all, or else he neglects his proper business.

Probably the best hours for a man to work are from 9 until 4.30, with only half an hour for lunch. He would then not have time to eat or drink too much at mid-day, and would be far less sleepy in the afternoon. That, however, is a matter of opinion and of detail. The national interest demands that we should attend to the broad principles of the matter, and carry out at once the reforms that are urgently needed. We are a nation at war, and each must do his best. To do that he must work under the best conditions possible. Moreover, it is a sacred trust to those who are fighting for us that the world to which they return must be better than the old. Reconstruction cannot be relegated to a post-war problem. It must be done by us now, quickly, so that there is an adequate recompense to those who return, for all they have suffered.

A D.C. GENERATOR FOR CONSTANT PRESSURE AT VARIABLE SPEED.

In a paper by S. R. Bergman (*Journal* of the A.I.E.E., Vol. 37, No. 8), what is stated to be a new solution of this problem is presented. The advantages of the machine described are: the machine is self-excited and regulates independently of speed and load; it may be compounded; no external regulating device is used; the regulation is instantaneous and is approximately independent of the heating.

Fig. 1 illustrates, diagrammatically, the principle of the machine. The armature is series wound, and the field contains twice as many poles as the number of poles for which

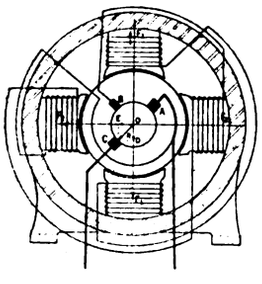

Fig. 1.—Constant Pressure Generator.

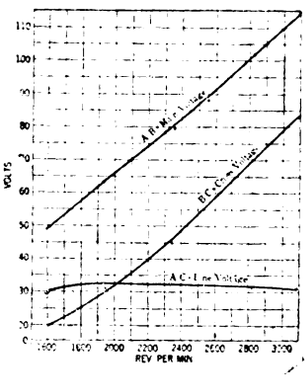

Fig. 2.—Variation of Voltages with Speed; 1.5 kw., 32-volt, 1,600/3,200 r.p.m. Generator.

the armature is wound. In the case illustrated, the armature is wound for two poles and the field contains four poles, symmetrically located. The load is taken from the brushes A and C and a third brush B is placed 90 electrical degrees from the load brushes.

The field may be considered to consist of two independent magnetic circuits, one of which circuits F_1 is saturated, and the corresponding flux ϕ_1 is called the main flux of the machine. The second magnetic circuit F_2 is not saturated, and the corresponding flux ϕ_2 is called the cross flux. The flux ϕ_1 generates, between the brushes A and B, an E.M.F. which is called the main voltage of the machine. The flux ϕ_1 does not generate any E.M.F. between the brushes B and C. Similarly the flux ϕ_2 generates, between the brushes B and C, an E.M.F. which is called the cross voltage. This flux does not generate any E.M.F. between the brushes A and B. The excitation of the machine is taken from the brushes A and B, for which reason the brush B is called the exciting brush. The excitation consists of two multiple branches, one branch exciting the main poles and the second branch exciting the cross poles. The two fluxes ϕ_1 and ϕ_2 are entirely independent of each other, which may be verified by separately exciting the machine, and tests show that if the main excitation is varied only the main voltage is affected, the cross voltage remaining constant; and if the cross excitation is varied only the cross voltage is affected, the main voltage remaining constant.

The directions of the main and the cross fluxes are such that the difference between these fluxes is interlinked, with the line brushes A and C, as shown in the figure, and thus the line voltage AC is the difference between the main voltage AB and the cross voltage BC. Hence, the voltage AC = AB − BC. Since the main circuit is saturated the flux

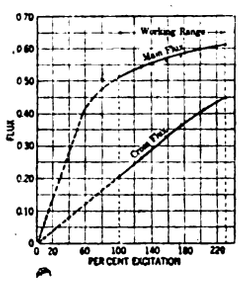

Fig. 3.—Fluxes Against Excitation.

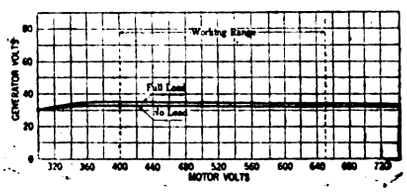

Fig. 4.—Generator and Motor Voltage Variation on Test.

ϕ_1 remains constant and the main voltage AB is proportional to the speed. Therefore, the excitation of both the main and the cross fields is proportional to the speed. The cross circuit not being saturated the cross flux ϕ_2 will increase in proportion to the speed, and, hence, the cross voltage BC must increase with the square of the speed. The cross circuit should not be entirely unsaturated, since then the cross voltage would increase too fast and the machine voltage would decrease with increasing speed. The cross flux should approach saturation, and it is possible to choose the saturation of the cross magnetic circuit, so that the line voltage AC remains constant. In fig. 2 is shown the variation of the different voltages with the speed. Since the excitation is taken from the brushes A and B the variation of the exciting ampere-turns follows the main voltage AB and may, therefore, in proper scale, be read from the curve AB. From

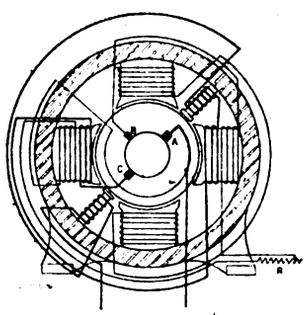

Fig. 5.—Complete Diagram of Connections.

these curves may be determined the amount of flux in each magnetic circuit for any given excitation, and in fig. 3 are plotted the two fluxes against the excitation. These saturation curves show that over the working range the main magnetic circuit is nearly saturated and the cross magnetic circuit at first is unsaturated, but from a certain point, where the curve bends, this circuit starts to approach saturation.

Since the line current is taken from the brushes A and C (fig. 1), there exists an armature reaction OR in the direction of AC. This armature reaction may be resolved in two components, one OD in the direction of the main flux, and the other OE in the direction of the cross flux. The main magnetic circuit being saturated, the additional excitation, due to the armature reaction, cannot add anything to the main flux. The component OE in the direction of the cross flux will, however, interfere with this flux, and would disturb the regulation of the machine. In order to overcome this influence a series winding is added to the cross poles; this winding should have an equal and opposite strength to the armature reaction working in this direction, and is called the compensating winding. The location of this winding is shown in fig. 5. By changing the strength of the compensating winding it is possible to obtain either rising or falling

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machine voltage with increasing load. By over-compensation the voltage will rise with the load, and with under-compensation it will fall. The strength of the compensating winding can be made to compensate for the IR drop resulting in a flat compounded generator.

If a generator of the type under consideration is coupled to a motor, such a motor-generator is capable of transforming from a variable voltage to a constant voltage. Fig. 4 shows the performance on test of a motor-generator, the motor voltage varying from 400 to 650 and the generator voltage being maintained constant at 32 volts. As will be seen from fig. 4 the generator voltage rises slightly with the load, showing that the machine is over-compounded.

If the motor of a motor-generator of this type be thrown directly on the line a voltmeter connected to the generator shows that the voltage, due to sudden acceleration, exceeds the rated voltage. The amount of this over-shooting of the voltage depends upon the relative values of the time constants of the two multiple exciting circuits. For example; assuming that the rate of increase of the exciting current is nearly the same in both circuits then the flux in the unsaturated circuit will appear at a later time than in the saturated circuit. Consequently the negative voltage will not develop fast enough, resulting in the phenomenon which may be called over-shooting of the voltage. It is possible, however, to speed up the rate at which the cross magnetising current increases by the insertion of resistance in this circuit. The complete diagram of connections is shown in fig. 5, in which the permanent resistance is designated as R. Tests have demonstrated that if this resistance is properly chosen it is possible to entirely eliminate over-shooting of the voltage. In this figure there have also been added commutating poles to ensure perfect commutation.

The resistance R also serves another purpose, namely, to keep the regulation of the machine approximately the same when the generator is cold as when hot. Assuming that the generator was built in accordance with fig. 5, without any resistance in the cross circuit, it is obvious that when the generator is cold the current in both exciting circuits will be larger than when hot. The main flux will not be influenced by this increased excitation, since saturation exists. On the other hand, the increased exciting current of the cross circuit will cause an increase in the cross flux resulting in an increase of the cross voltage. Since this voltage is negative it follows that when the machine is cold the line voltage will be too low. By inserting a resistance of zero temperature coefficient the variation of the cross excitation is limited, and tests show that if the resistance R is approximately ¼ or more of the resistance of the cross exciting circuit, the change of excitation, due to heating, will be limited to such an extent that the variation of voltage is less than 5 per cent., corresponding to a temperature range of 100 deg. C.

This generator is in reality a combination of two independent generators, one boosting the other; the machine must, therefore, be somewhat larger in size and weight than a standard machine of the same speed and output. On the other hand, there are several other conditions which tend to make this machine more economical than the standard. When the speed increases all flux densities and hence the stability increases. In a machine of standard make in which the shunt excitation is regulated in order to maintain constant voltage, the flux densities and hence the stability decreases with increasing speed. Therefore, a standard machine requires much larger gaps than this new machine and, furthermore, the armature reaction in the standard machine must be chosen with due consideration to the speed range. In order to give an approximate idea of the size and weight of this type of generator, as compared with the standard type, it may be stated that by a sacrifice in the efficiency of approximately 10 per cent., the new machine will have the same weight as a standard type of the same rating. This type of constant potential generator shows some distinct advantages over a standard generator with automatic voltage control. Where reliability of service is concerned this new type is claimed to be superior, since there are no automatic devices for maintaining the regulation. The new machine has also the advantage of being instantaneous in action, even at violent and large speed variations. Therefore, it is thought that this new machine will satisfy a long-felt need in certain applications of the electrical industry.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

15,009. "Electric igniting devices." E. G. Pulford. September 16th.

15,042. "Temperature indicators for transformers, &c." British Thomson-Houston Co. (General Electric Co., U.S.A.) September 16th.

15,045. "Electric switch." R. K. Damey. September 16th.

15,052. "Ignition magnetos for internal-combustion engines." M-L. Magneto Syndicate & E. A. Watson. September 16th.

15,073. "Alternating-current switches." W. J. Higgs & D. D. Rayner. September 17th.

15,093. "Means for generating electricity." G. W. Muir. September 17th.

15,094. "Electric signalling telegraph." W. F. Grafton. September 17th.

15,102. "Converting sea and river tides into continuous power for generating electric current, &c." R. Poyner. September 17th.

15,104. "System of production of undamped electrical oscillations for wireless telegraphy." F. Sepulchre. September 17th.

15,123. "Automatic or semi-automatic exchange systems." D. A. Christian. September 17th.

15,124. "Energy meters for alternating electric current." Fabrique des Longines Francillon & Co. September 17th. (Switzerland, September 17th, 1917.)

15,153. "Dynamo-electric machines and motors." W. Aldred. September 18th.

15,187. "Electromagnetic switches." British Thomson-Houston Co. & H. C. Hastings. September 18th.

15,188. "Electric heating devices." British Thomson-Houston Co. (General Electric Co., U.S.A.) September 18th.

15,193. "Sparking plugs for internal-combustion engines." Soc. Clerget, Blin et Cie. September 18th. (France, September 19th, 1917.)

15,197. "Electromagnetic recording apparatus for telegraphic circuits." J. S. Withers (K. C. Cox). September 18th.

15,214. "Electric power supply systems." C. R. Woodland & R. Woodland. September 19th.

15,228. "Switch for closing electric circuit for certain period." Aktieselskabet Mekano & H. A. Schepeler. September 19th.

15,230. "Means for making sealed joint between wall of vitreous material and electric conductor which passes there through." G. C. Chelioti and Osram-Robertson Lamp Works. September 19th.

15,235. "Electrical apparatus for transmitting motion step-by-step to receiver." A. Barr, Barr & Stroud and W. Stroud. September 19th.

15,243. "Electrical boring machine." P. Elnegaard & E. Sorensen. September 19th.

15,277. "Electric accumulators or secondary batteries." E. J. Clark and Hart Accumulator Co. September 20th.

15,280. "Control gear for electric motors." J. Lewis. September 20th.

15,299. "Magnetic devices for detection of submerged objects or firing of mines." H. Gerrard & G. F. Partridge. September 20th.

15,301. "Detection of conducting bodies submerged in electrolyte." A. G. Ionides. September 20th.

15,302. "Electric furnaces." P. W. Fawcett & J. R. Hoyle. September 20th.

15,306. "Devices for detachably connecting electric conductors to terminals of magnetos, &c." A. G. Harding & G. F. Joseph. September 20th.

15,320. "Electric furnaces." British Thomson-Houston Co. (General Electric Co., U.S.A.) & H. Gerrard. September 20th.

15,345. "Electric blast furnaces." J. Bibby & J. O. Boving. September 20th.

15,346. "Telephone transmitters." Western Electric Co. (Western Electric Co., U.S.A.) September 20th.

15,353. "Holders for incandescent electric lamps." J. B. Belcher. September 21st.

15,367. "Electrically-heated warming or cooking plates of the enclosed type." F. P. Fletcher. September 21st.

15,375. "Telephone switching apparatus." Automatic Telephone Manufacturing Co., J. Savin & R. R. Wade. September 21st.

15,402. "Electrical apparatus." A. M. Low. September 21st.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

4,118. Electric welding machines. G. Gandolfo. March 21st, 1917. (118,422.)

5,617. Ignition magnetos for internal-combustion engines. J. E. Malivert. April 28th, 1916. (106,482.)

8,740. Electrically-heated cooking stoves. C. W. Winterbotham. June 18th, 1917. (118,423.)

9,489. Treatment of magnetic material suitable for use in static transformers and other electrical apparatus. A. F. Berry. June 30th, 1917. (118,425.)

11,860. Ignition magnetos. A. R. J. Foster. August 17th, 1917. (118,432.)

12,191. System for the protection of three-phase alternating current systems. R. J. Jensen. August 24th, 1917. (118,437.)

12,303. Electric motors coupled with compressors or pumps. W. J. Sturgess. August 27th, 1917. (118,445.)

12,427. Ignition devices. E. C. R. Marks (Splitdorf Electrical Co., U.S.A.). August 29th, 1917. (118,458.)

12,456. Electrical switches. H. W. Cox. August 30th, 1917. (118,459.)

12,566. Electrical accumulators. C. H. Worsnop. September 1st, 1917. (118,464.)

13,193. Automatic telephone central-station apparatus. A. E. Stevens. September 14th, 1917. (118,478.)

14,458. Electromedical coils. M. H. Goldstone. October 6th, 1917. (118,494.)

16,263. Railway signalling. McKenzie, Holland & Westinghouse Power Signal Co. (Union Switch & Signal Co., U.S.A.) November 7th, 1917. (118,513.)

16,908. Starters for internal-combustion engines. A. H. Midgley and C. A. Vandervell & Co. November 16th, 1917. (118,519.)

16,931. Carbon brushes and brush-holders of electric motors and generators. Veritys, Ltd., & C. R. Ailen. November 17th, 1917. (118,520.)

17,091. Induction coils. M. A. Codd. November 20th, 1917. (118,524.)

18,283. Electric current controllers. G. Ellison & J. Anderson. December 10th, 1917. (118,536.)

1918.

861. Electric fans. British Thomson-Houston Co. (General Electric Co., U.S.A.) January 15th, 1918. (118,546.)

4,044. Circuit breakers for ignition magnetos. Labrosse & Esteve. September 6th, 1917. (118,393.)

4,353. High-tension electric fuse. A. Nielson. April 12th, 1917. (114,681.)

4,374. Dies for shaping insulators and the like. H. O. Busch-Jensen. March 12th, 1918. (118,563.)

7,722. Protective devices for electric circuits. British Thomson-Houston Co. (General Electric Co., U.S.A.) May 8th, 1918. (118,578.)

8,978. Electrical fuse carriers. A. C. Robinson & A. C. Checketts. May 31st, 1918. (118,584.)

9,751. Control of electric motors. British Westinghouse Electric and Manufacturing Co. June 13th, 1917. (116,393.)

9,976. Electrical condensers. Philips-Brinton Co. July 20th, 1917. (118,090.)

11,474. Timing mechanism for ignition systems. Bosch Magneto Co. September 26th, 1917. (118,587.)

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SALES PROMOTION.

IN the past, the chief source of weakness in the British commercial machine has been in the sales section, rather than in the manufacturing. Taken all round, British manufacturing has no superior in the world. whatever may have been lacking in adaptability to the requirements of particular markets, but our selling capacity has not always attained the same high standard of excellence.

What apparently has been wanted in the past in some large commercial houses is a Sales Promotion Department. It is true, of course, that the majority of enterprising firms have spent considerable sums of money on advertising, representatives and agents, foreign trade propaganda, and other sections, which, taken collectively, form the chief constituents of a Sales Promotion Department; but too often these several interests, which have a vital connection with each other, have been exploited on their individual merits, rather than collectively, with the result that they have not given each other reasonable and practicable support. In many cases their merits, either collectively or individually, have never been realised at all.

A highly efficient Sales Promotion Department should, we suppose, have the control and direction of the following sections:—Press advertising, and all advertising matter; representatives and agents, both home and foreign; shipping section promotion; security of credit; trade marks: printing and stationery, &c.

Each of these several interests possesses a vital connection with the others, and, if full benefit is to be derived from them, they should be controlled by one responsible head. and one policy should direct the whole. In the advertising section full benefit is not attained by a large proportion of advertisers. A glance through our own advertising pages will show that many of our firms are to-day publishing matter which is distinctly business-like and useful to purchasers. There is a decided improvement as compared to several years ago; but even here, and certainly in many other trade journals with which we are familiar, advertisers are too often content to make their advertisements merely announcements that they are manufacturers of this or that class of goods for which, if the buyer cares to make inquiries, he can have a quotation. The chief space is devoted to a display of the firm's name, rather than of the goods themselves and the reason why they are likely to be what the buyer wants. The fault appears to be due to the fact to which we have already referred on several occasions—that the advertising section is regarded as of secondary importance, and is allowed to drift into the hands of a member of the staff who does not possess sufficient knowledge of this highly important branch of commercial enterprise.

When, however, full benefit is derived from the Press advertising section, another equally important section, in consequence, receives a great impetus from the support afforded—the representative and agents' section. Every successful commercial traveller admits that an efficient Press advertising organisation is the best support he could ask for. It is his best medium of introduction, his most influential advocate, and at all times his sturdy pioneer over rough and personally uncultivated ground. The advertising section and the representative section are, therefore, mutual in effect, and continually contribute to each other's influence.

A great future for foreign trade will doubtless open out for British manufacturers after the war. This section, however, is one which we believe can only yield satisfactory results if conducted on sound business lines. It certainly ranks as one of the most important sections of the

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Sales Promotion Department. Very little service is to be looked for from the contribution of subscriptions of £100 time after time to "influential" gentlemen making promiscuous trips to Russia and elsewhere to interview Consuls and other officials over the space of a few months, if the matter is left at that nebulous stage. It is likely to prove a more fruitful plan for two or three firms to appoint between them a representative for, say, Russia, to devote his entire services to their interests. If he is kept in touch with by regular weekly or fortnightly correspondence, supported with attractive catalogues and advertising literature printed in the language and currency of the country, and if his suggestions and needs are sympathetically anticipated by the Sales Promotion Department, there should be few, if any, failures provided the commodity he is offering is as good as it is pronounced to be.

In the shipping section, also, another promising future will present itself to British manufacturers after the war. It is well known among travellers and others that the average shipping house has so great a variety of goods to buy and sell that it is often a difficult matter to interest the buyers in any one particular commodity. This, apparently, can only be effected by anticipating, as far as possible, the difficulties of the buyers themselves, by studying individual requirements, printing special catalogues and literature in the required language and currency, and by ascertaining precisely in what form samples are required. Many successful manufacturers who have specialised in the shipping section are not content merely to interest the shipping house buyers in their propositions, but, if possible, to stimulate their enthusiasm as well. This result, of course, can only be attained by judicious and sustained attention, but the rewards, which quickly become permanent in effect, are worth the expense.

On the question of extended foreign credit, and upon credit risks in general, the Sales Promotion Department, by virtue of being constantly in touch with the source itself, should be best qualified to pronounce judgment.

Most large firms already possess the nucleus of a Sales Promotion Department, and such firms are devoting every attention to enlarging the scope of this important section. Other firms will doubtless follow their example immediately peace dawns. Nothing, however, can be lost by preparing the foundations now. Probably most large firms would find it possible and desirable to single out enterprising members of their staffs capable of organising and conducting this department, for a thorough inside knowledge of the trade is essential to success.

Our Trade with South Africa.

A study of the recent report by H.M. Trade Commissioner in South Africa (Mr. W. G. Wickham), a summary of which appears on another page, will afford British manufacturers some instructive information regarding future possibilities in that market. The important factors operating in this direction are (1) the progress of manufacturing within the Union; (2) its effect in creating a demand in the immediate future for industrial plant and accessory material; (3) its ultimate effect in restricting the importation of goods which can be produced locally. As regards (1) and (2), bearing in mind various details which have already appeared in these columns, exporters here, after studying Mr. Wickham's report, will be able to make useful deductions as to the types of machines and appliances which will first be needed. As regards the potential future demand for British manufactured goods generally, there appears to be no cause for alarm. If the Union is entering an era of manufacturing as well as agricultural development, increased purchasing power will obviously go with it, and there will be plenty of scope for the sale of imported goods. For a prospering community to demand goods from abroad of a better quality or of a different and more expensive type than are being produced at their own doors, is in these days a sure accompaniment to advancing civilisation. But although the business is there to be got, unless our exporters put forth real and persistent efforts they must not expect to get it. American and Japanese competitors are in the field accumulating knowledge of the market and laying their plans for future trade. We, too, must lay our plans for rapid and decisive action after the war. Mr. Wickham says:—"We shall have leeway to make up, and, in many cases, shall find that we have got to give very complete proof of superior value before we can get back our full share of the business. . . . Firms must improve and strengthen their selling organisation."

The concluding paragraph of our summary should receive attention. If our manufacturers would make greater use of Trade Commissioners, they would, we are sure, find it to their advantage. The more our Commissioners find that we rely upon them, the more zealous they will be in rendering us just that service that they know we are asking at their hands.

Commercial Bribery.

Our attention has been called to particulars issued by the Bribery and Secret Commissions Prevention League with regard to legislation now being put forward in the United States. It seems that the Federal State Commission has recently submitted a special report to Congress on the subject, in which it is stated that bribery of employés is a prevalent and common practice in many industries. These bribes take the form, for alleged services, of gratuities and entertainments of various sorts, and of loans, all intended to influence such employés in the choice of materials.

The growth of the evil is remarked upon; and to show that in some cases employés appear to be quite unaware that the practice is criminal, the Commission quotes the case of a buyer who said to a prospective seller that he was "entitled to 10 per cent., and anyone who demanded more was a grafter." Another man in a similar position was so fully convinced of the justice of his claim that he wanted the representative of the Commission to assist him in influencing the collection of a secret commission. It appears that 14 States have statutes striking at this practice, and yet it tends to grow.

The Commission recommends legislation prohibiting not only the giving and offering, but the acceptance and solicitation, of any gift or other consideration by an employé as an inducement or reward for doing any act in relation to his employer's affairs or business, or for showing, or forbearing to show, favour or disfavour to any person in relation to his principal's or employer's affairs or business. The Commission proceeds:—

> In order to prevent a resort to a common method of corruption, it is recommended that the law should also prohibit the giving of any such gifts or other considerations to members of the agent's or employé's family, or to any other person, for his use or benefit, direct or indirect.

The practice appears to have been most general on the part of concerns introducing the goods and wares of German firms. We have commented before on the comparative absence of bribery and corruption amongst municipal and Government officials in Germany before the war. It is a curious fact, illustrating once more the deep-rooted belief of Germans in their own superiority, that many of the firms who were most strict in regard to their practice at home, never hesitated to employ corruption to any extent outside the Fatherland.

The Bill recommended to Congress by the Federal Trade Commission follows very closely the British model, the punishments provided for the giver and receiver of the bribe being, respectively, to the one who gives or offers, a fine of not less than $1,000 or imprisonment for not more than two years, or both together; and to the receiver a fine of not less than $1,000, nor more than $5,000, or imprisonment for not less than two years (apparently it can be any amount more), or both such fine and imprisonment.

We welcome the distinction which is drawn between the giver of the bribe, who is, as a rule, merely endeavouring to carry out his duty of obtaining trade for his employer (albeit by nefarious methods), and the receiver, who is betraying his trust. It will be remembered that when our own Act was passed we laid stress on this distinction, without, however, being able to obtain any modification of the Law. The most important advance, however, in our opinion, is Sec. 4, which provides that any person guilty of an offence within the provisions of the Act, who reports the facts under oath to the proper official within six months

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after committing such offence, may be granted full immunity from prosecution provided that such information shall not then be in the knowledge of such official. In other words, the party who first confesses can get his confederate locked up while escaping "Scot free" himself. We welcome this excellent provision, which should help to bring to light transactions which are generally only too well and too long concealed, and we have little doubt that it will have a good effect, in view of the fact that men mixed up in such transactions almost invariably quarrel sooner or later.

"Somehow or Other."

Events are moving with such startling rapidity in Europe that it is dangerous to speculate concerning the time when we may be called upon to transform to actual practice some of our pious resolutions of the last few years. It may happen that the emergency will be upon us speedily—we trust that such will be the case. Much has been proposed in preparation for that day. The circumstances are such, however, that we have not to fear immediately the difficulties attendant upon the demobilisation of the fighting forces. That cannot be expected to commence on a large scale for some time to come. It has been in progress for a long while gradually; the pace will increase as the situation develops satisfactorily, but it will still be gradual, and will be systematically effected. The ability of trades to absorb men is to be considered by local Advisory Committees, with the intention to avoid the flooding of the country with unemployed labour. Plans made in advance will be adhered to as far as practicable—experience is certain to compel some variations. The Government has made certain arrangements for the occupation of the waiting Forces with education and training for trade, profession and citizenship. The eagerness to return home that will possess millions of fighting men is understood at Westminster, and probably by "leave," and in various other ways, the irksomeness of the lot of the men will be lessened. The undertaking will be a vast one, and anything that can be done to secure smooth working the nation will be eager to vouchsafe. We have not passed along this way before in all our history, and notwithstanding all the demobilisation experience of the last few years, new difficulties are bound to arise which will call for the exercise of great patience and sympathetic handling.

The problem of the munition workers is of another character altogether. When the situation is so safe as to permit of it, their war-time occupation will end. It has been stated that a period of holiday, rest, recreation, or rejoicing will be given to all. During that period it should be possible for a good deal to be done by way of carrying into effect the plans already made for turning works over from one class of manufacturing to another where necessary. It will be probably at this stage, when the first steps are taken to return to actual Peace-time production, that certain of our industrial problems will experience their first acute period. Without anticipating those problems in the mass, it is essential that we bear constantly in mind one of the leading matters that will require full and considerate attention. It has been brought under public notice in one or two recent speeches; that is why we refer to it now.

At successive crises of the war the Government has negotiated with Labour in order to secure variations in working arrangements facilitating increased productivity, and involving all sorts of changes affecting different classes of workers in many trades. Understandings have been arrived at under which Trade Union conditions, limiting restrictions, and so forth, have been departed from, and undertakings have been solemnly given to restore pre-war conditions at the end of the war. The promise holds good; the intention to keep faith is unaltered. But is fulfilment possible? If it were possible would it be wise? Does Labour desire it? Would not its fulfilment most adversely affect the interests of Labour as a class, as well as the prosperity of the Empire as a whole?

Let us briefly allude to the utterances of two of the highest official representatives of Labour—Messrs. G. H. Roberts and G. N. Barnes. The former, as we reported last week, states that a Bill is shortly to come before Parliament which will ensure the carrying-out of the Government's undertaking. We have no material available to show whether he added qualifications or gave particulars of the details contained in the Bill. But Mr. Barnes we have heard for ourselves, and while we find him agreeing that the conditions should be restored "as far as it is possible to do it," he adds, "if the Government is kept to its bonds," and proceeds to show that in certain respects it will be impossible to return to the old conditions. It is well that this statement should come from such a source; were it otherwise, some Trade Unionists might fear that they were to be robbed of their rights by Capital. The changes effected in industry during the past four years cannot be ignored by any of us. Labour is not likely to make the mistake of ignoring the advances of science and scientific application, the employment of new mechanical and other contrivances, the effect of such devices in rendering unskilled men able to do skilled men's work, the usefulness of woman labour in industry, the general improvement effected in conditions of working in efficient factories, and so forth and so on. The attitude of Mr. Barnes toward all such developments is one of recognition of the fact that since the compact between the Government and Trade Unions was made the situation has so changed that it would be folly to insist on a return to former restrictive ways. But the altered conditions alone cannot dispose of the bargain; therefore, Mr. Barnes, speaking for Labour—we would that he represented a larger section of it—says that those who "give up" must have a *quid pro quo*. What form is that *quid pro quo* to take? As we have said several times lately, utterances on this point are far too vague; but last week Mr. Barnes got a little nearer to definite proposals. How those proposals are to be carried into effect is not quite so definite, for repeatedly in the course of his speech he used the expression, "somehow or other." Three requisites form that *quid pro quo*. First, the eight-hour day, for which Mr. Barnes, Mr. Burns (now shadow of his former self), and the A.S.E., fought unsuccessfully in the different conditions of 1897. One of the ways of introducing this change would be to get rid of the always wasteful pre-breakfast attendance; this idea has been favoured by many engineers for years past, and in our opinion is one of the sanest of the practical propositions that have been put forward for introducing the better conditions of life that Labour demands. Secondly, Mr. Barnes suggests the fixing of standard rates of wages. "Somehow or other," not without much difficulty, this may be secured. Lastly, and here a very justifiable "somehow or other" may be repeated, there must be security for continuity of employment. We have to safeguard our industries, and run them in the interests of the nation and of the Empire: but Mr. Barnes eschews tariffs—at any rate, he will not favour them as a means of wealth production. The wealth which attracts him is the production of "healthy and happy men and women and children." He sees a vast debt of ten thousand millions towering above us. It must be reduced! How? By producing healthy and happy men and women and children? We are sure that Mr. Barnes sees as plainly as any of us that you cannot in the years that are coming have that very desirable state of society unless you have first that material production of wealth which is conducive to health and happiness. You cannot reduce that huge debt at any reasonable rate unless you produce wealth as rapidly as possible. Repudiation of that debt, reduction of the rate of interest, he will have none of. Very definite marks of sanity and of wise leadership these. But if you hold in low esteem the production of material wealth, how will you bring in this contented world? Can we not get any farther than "somehow or other"? The time is far spent, surely.

Probably the speaker's intention was that we should find the way of bringing in the new state of things in the paper that followed from the President of the Board of Trade, in which the investigations of after-war Committees and the developments of war-time were summarised. Of course, there has been a lot of practical reconstruction work in progress as we have prepared efficiently to wage war, but there is much in the recommendations of Committees that is as yet only on paper, and, unfortunately, we still have to rest in respect of such in the vague "somehow or other" of politicians.

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THE PERCENTAGE ERROR.*

By ALEXANDER RUSSELL, D.Sc., M.I.E.E.

In the Electrical Review for September 6th Mr. A. T. Bullen raises the question of the meaning of "percentage error." Everyone who has experience of writing reports on the accuracy of instruments is aware that the percentage error method of stating the accuracy of an instrument has serious limitations. He is also probably aware that different engineers have different methods of defining the "percentage error." Some define it as meaning the error expressed as a percentage of the true instrument reading, whilst others, like Mr. Bullen, define it as a percentage of the actual instrument reading. Some even use both methods. Each has its special advantages and disadvantages. It seems, therefore, very desirable that the question, although an extremely elementary one, should be formally discussed to see whether it is advisable to standardise a definition.

The orthodox academic definition may be given in algebraical symbols as follows:—Let R be the true reading, R′ the observed reading, and e the percentage error. Then, when R′ is less than R, e is defined by the equation—

$$e = 100\,(R - R')/R, \text{ low}, \quad \ldots \quad (1)$$

and when R′ is greater than R, we have—

$$e = 100\,(R' - R)/R, \text{ high}. \quad \ldots \quad (2)$$

R − R′ or R′ − R is called the "error," and (R − R′)/R or (R′ − R)/R is called the "fractional error," In theoretical calculations it is customary to consider the fractional error and not the percentage error. Engineers, however, have a strong predilection in favour of percentages. For instance, in the definition of the slip of an induction motor given in many books it is defined as a percentage!

It is obvious that whether R′ is less or greater than R, e is simply directly proportional to the error and inversely proportional to the reading. Hence, if we double the true reading, the permissible error for a given e is also doubled. If the instrument is reading low, we see by (1) that R′ can have any value between 0 and R and e has any value between 100 and 0. On the other hand, if the instrument is reading high, R′ can have any value greater than R, and thus e has any value between 0 and infinity. An instrument, for instance, can have an error which is 500 per cent. high, but it cannot have an error greater than 100 per cent. low. Possible errors in excess range from zero to infinity, but in defect they must be between 0 and 100. We see, therefore, that different scales are used for measuring errors in excess and defect. It is not surprising that the percentage error method of stating accuracy is found difficult of comprehension by the uninitiated. An ordinary user of electric light studying an official report in which it is stated that his meter is 80 per cent. slow is not easily convinced that his meter bill has to be multiplied by 5. It is easier to convince him that if his meter be reading 270 per cent. fast the meter reading should be divided by 3·7. We have heard of one case where the consumer thought that the meter reading should be divided by 270 and not by 3·7.

A drawback to the percentage method of expressing errors is that we are given in practice the observed reading, and we want to find the true reading. In this case we have to solve equations (1) and (2). If the reading is low, we get—

$$R = R'/(1 - e/100), \quad \ldots \quad \ldots \quad (3)$$

and if high $\quad R = R'/(1 + e/100). \quad \ldots \quad \ldots \quad (4)$

We see at once that when e is 80, the reading being low, R = 5 R′, and when e is 80, the reading being high, we have R/(1·8).

To illustrate that the method is misleading, let us consider the case of an assistant A, who tells you that the length is one foot when it really is one inch. The percentage error is 1,100, and the inaccuracy seems hopeless. But if an assistant B tells you that the length is one inch, while it really is one foot, the percentage error is about 92 per cent., which, although grossly inaccurate, does not strike one as being so terrible as A's mistake, because the percentage error is only one-twelfth that of A. Yet commonsense tells us that the error of B is really as bad as that of A. As another example, let us consider the case of a watch, the rate of which is treble the true rate, and of another watch, the rate of which is only one-thousandth of the true rate. The percentage error in the first case is 200 fast, and in the second case it is less than 100 slow. Even if the latter watch stopped, its error would only be 100 per cent. slow.

To make the definitions of percentage error given above rational, we have to introduce the limitation that e is a small number. For instance, if we never give percentage errors greater than 5, then not much harm is done, and the number can be taken as a rough index of the accuracy of the instrument. It has to be remembered that when the percentage error is a large number, it has a different meaning when in excess than when in defect, and, therefore, ought not to be used.

Let us now consider the other definition of percentage error, the definition which Mr. Bullen wants to be the standard when testing electric meters. Using the same notation as before, and calling e' the "percentage error," we have

$$e' = 100\,(R - R')/R', \text{ low} \ldots \quad \ldots \quad (5)$$

and $\quad e' = 100\,(R' - R)/R', \text{ high} \ldots \quad \ldots \quad (6)$

The great merit of this definition is that we can find the error at once when we know the reading by simply multiplying the percentage error by the reading, and dividing by 100, and then, by adding or subtracting the error from the reading, we get the true reading. In symbols we have, when the reading is low,

$$R = R'\,(1 + e'/100), \quad \ldots \quad \ldots \quad (7)$$

and when high $\quad R = R'\,(1 - e'/100) \quad \ldots \quad \ldots \quad (8)$

It is easy to see that when the reading is low the percentage error lies in value between zero and infinity, and when it is high it lies in value between 0 and 100. The scales of error for high and low readings are thus reversed from what they were in the preceding case. In this case the meters which read low have the huge percentage errors, and however fast they run, the error can never be greater than 100 per cent.

When e' is small we see by the Binomial theorem that it is practically equal to e. Even if we took e' as great as 5 the maximum error introduced by using (5) and (6), instead of (1) and (2), would be less than three in a thousand. Thus, there can be little objection to using (5) and (6) when e' is small. But if e' is large we get quite irrational results. The following table illustrates the relative values of e and e':—

True reading = 100.

Low observed reading.	e	e'	High observed reading.	e	e'
100	0	0	100	0	0
80	20	25	120	20	16·7
60	40	66·7	140	40	28·6
40	60	150	160	60	37·5
20	80	400	180	80	44·4
0	100	Infinity.	200	100	50·0

If the observed reading were 1,000, e would be 900 and e' would be 90, and if it were 10,000, e would be 9,900 and e' would be 99.

From the common-sense point of view for low readings, e as defined by (1) seems to be the best, and for high readings e' as defined by (6). If we were to adopt these formulæ as the standard definitions of percentages, and, of course, we are quite at liberty to do so, as there is nothing sacrosanct about engineering usage, then a meter which had stopped would be said to have a percentage error of 100 slow, and one which went at three times its proper rate a percentage error of 66·7 fast. The comparison in this case seems to be as rational as it is possible to make the percentage method on the assumption that errors in defect are as objectionable as errors in excess.

We are of opinion that in most cases it is best not to give percentage errors at all. In the case of meters, for instance,

* *Faraday House Journal*, Michaelmas Term, 1918.

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surely it is sufficient to measure the ratio n of the true rate to the actual rate. If we do this—

The true rate = n times the actual rate.
The true reading = n times the observed reading, and
The true bill = n times the apparent bill.

Anyhow, this method has the merit of being plainly intelligible to the ordinary consumer, and will obviate the necessity of the worry and consequent friction which is sure to arise when he is told that his meter is 87·5 per cent. slow. Within very small limits the percentage method is good; outside these limits it is misleading.

THE BENJAMIN ELECTRIC'S WORKS.

In its factory in Rosebery Avenue the Benjamin Electric, Ltd., was seriously handicapped by the increasing pressure on its space, although every foot was utilised, including part of the roof. Consequently, when the opportunity presented itself to purchase a ready-built works in the north of London precisely adapted to its requirements, the company gladly seized it, and has now settled down in its new quarters. The buildings, which are practically new, cover an area of over 20,000 sq. ft., and space is available for extensions of 30,000 sq. ft. The shops and offices are of modern design and are all on one floor, with north lighting, thus presenting a marked contrast with the old factory; the lay-out facilitates efficient supervision, and allows of the organisation of the work to the best advantage, the shops being arranged on such a plan

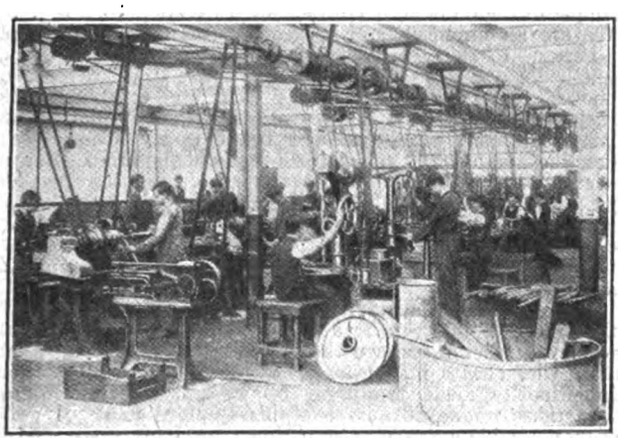

Fig. 1.—Benjamin Electric: Machine Shop.

that the manufacturing processes follow one another in regular order from the raw material stores, through the various departments to the finished goods stores. Thus it is possible to trace the progress of any job from start to finish, with the greatest economy of time both in production and in supervision. Under present conditions, time saving is of the utmost importance to efficient production, and has received the closest attention on the part of the management; even in the short time that the new factory has been in operation the gratifying results which have been obtained, as shown by the increased rate of production, have borne witness to the wisdom of this policy.

We recently had the privilege of making a tour of the shops and observing the vast improvement in the manufacturing facilities which they afford. As the factory was formerly devoted entirely to manual work, there was no shafting in position, and therefore the company was able, in erecting the necessary equipment, to select the most suitable arrangement for the lines of lathes, presses, &c., which are all driven by electric power. The products of the works include the well-known Benjamin reflectors, Goliath lampholders, &c., and a variety of special work of national importance. We have on previous occasions referred to the remarkable spinnings of which the company has made a speciality, but all former efforts have been far surpassed by its latest achievements in this line; the accompanying views show some of the extraordinary products of the spinning department. Press work is also an important feature of the company's operations, and for this purpose there is a range of seven power presses, varying in size from the large deep-drawing machine for the heavier class of work to the small presses on which such parts as holder cases, reflector extensions, small electrical parts, &c., are stamped. In the tin shop a large variety of high-class hand work is turned out; the machine shop is almost entirely engaged in making the tools necessary for successful production; and in the assembly shop the various parts are brought together, after which, if necessary, they pass to the enamelling department.

A comfortable canteen, with accommodation for 150 persons, has been provided for the workers' mid-day meal and the break which is made for refreshment during the morning and afternoon spells; and the interests of the employés have been further studied by the division of the spare ground into allotments, on which already there is an abundance of produce.

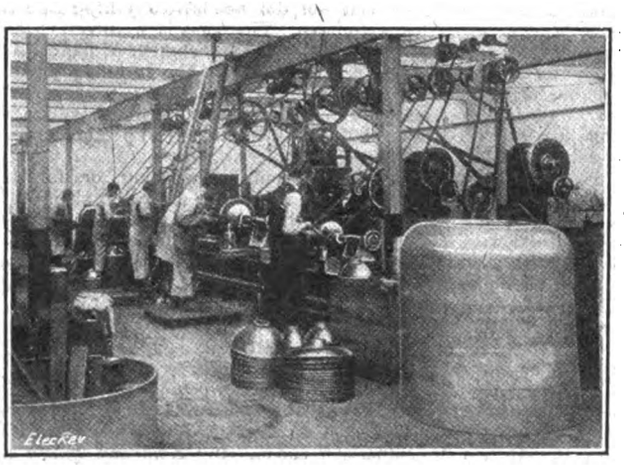

Fig. 2.—Spinning Shop.

The factory was formerly lighted with high-pressure gas, but naturally the Benjamin Electric, Ltd., as experts in illuminating engineering and industrial lighting, could not rest content with this, and the company is carrying out a model installation that will be in keeping with its reputation. We trust that its future progress, under the able direction of Mr. Guy Campbell, will be such that it will not be long before every foot of the spare ground is required for necessary extensions.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Patent Law Reform.

"We ought to have the same patent laws as America. We ought also to have an Empire patent. With all the overseas representatives here, this could easily be arranged."—*Vide* Sir Robert Hadfield, Bart., in morning Press, September 26th, 1918.

Returning once more to this subject, might I ask your support in impressing upon the deputation which is to wait on the President of the Board of Trade almost directly, to make the above suggestions its principal text, when there is a possibility of some practical good being accomplished? In addition, a comprehensive and sound report by the Institution of Electrical Engineers has been accepted by the conferences which have been held as forming the basis for the criticism of the proposed two new Bills coming before Parliament.

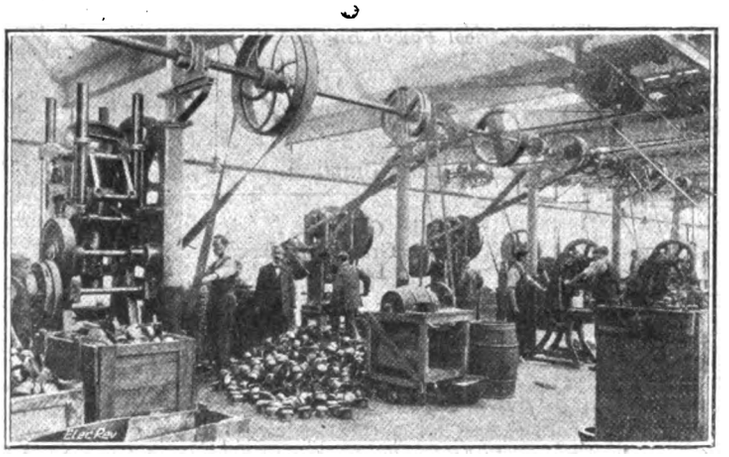

Fig. 3.—Press Shop.

The report justly points out by inference that patents are granted to reward inventors, and that they should not be subject to conditions which simply amount to the legislation of robbery.

The requirement of compulsory working is, of course, not a modern requirement at all. I believe it is found in Letters Patent granted in the reign of Charles I, if not earlier. The philosophy of the subject is at least as old as the French Revolution, but surely

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by this time we ought to have got a long way from that? The whole doctrine is, however, in my opinion, based on a fallacy. It is enough to point out that when the Act of 1907 was passed, Mr. Lloyd George and others exulted over the circumstance that Germans were going to be compelled to put up factories in Great Britain. In actual fact, the Act did not have anything like the effect that it was alleged to have. The point is, however, that in so far as the Act may have led to the establishment of factories by Germans in this country, it simply led to the introduction of a number of very highly undesirable people. It will probably take us a long time to eliminate the undesirable element for which we have to thank the Act of 1907. Do we want to compel the Germans to come over here?

If we do, then let us have compulsory working, or, for that matter, compulsory immigration. If we do not want them, then for Heaven's sake don't let us invite them, as most certainly those compulsory working clauses in the proposed new Bills do. As regards the present obnoxious renewal fees, these ought, in any case, to be materially reduced; but, beyond all that, there is no provision in the proposed new Patent Bill for the establishment of an official search through prior literature *other than British patent specifications*, which, of course, after all, makes any so-called official search a mere farce.

What is the matter with the American patent system? Under it these objections are eliminated, there are no renewal fees, no compulsory working, but no patent is granted unless it can stand a world's search; in comparison, the existing American system *has stood the test of nearly a century, has encouraged invention*, and *has been eminently successful*, and possibly its only objection is that *it is anything but German!*

In the same period of time we in Britain have had numerous Patent Acts, mostly on German lines, and not one of these has been worth a cent so far as the encouragement of invention and progress is concerned, as the report of the Electrical Institution for the guidance of the deputation and the Board of Trade clearly shows.

I, therefore, continue to be in full agreement with Sir Robert Hadfield in advocating the adoption of similar patent laws to those of the United States under a democratic British Empire patent system, and in abjuring anything approaching German lines of procedure.

James Keith.

Leigh-on-Sea, *October 3rd*, 1918.

"Fraternity"—or Tyranny?

I shall be obliged if you will allow me the hospitality of your columns to draw the attention of all technical staff engineers engaged in the electricity supply industry, or in the generation, transmission, distribution, or utilisation of electrical energy in private plants, to the enclosed letter.

To safeguard their own interests, I suggest that these engineers should support the E.P.E.A., and should write out, sign, and send to me, the following memorial, whether they are members of the E.P.E.A. or not:—

"I, the undersigned, holding the position of in the desire to register a protest against the outrageous attitude of the Electrical Trades Union as evidenced by a letter of the London District Secretary of the E.T.U., dated October 2nd, 1918, and their claim to represent the interests of the executive and supervisory officers of the electricity supply industry.

"It is my emphatic desire that any matters affecting the interests of technical staff engineers in the industry should be negotiated with the Government and all other authorities by the Electrical Power Engineers' Association."

W. Arthur Jones,
Hon. General Secretary,
Electrical Power Engineers' Association.

Leytonstone, *October 7th*, 1918.

[COPY.]

ELECTRICAL TRADES UNION.

London District Committee.

District Office,
76, Gray's Inn Road,
London, E.C. 1.
October 2nd, 1918.

To MR. ——.

Dear Sir and Bro.,—It has been brought to my notice that you intend running out of the Electrical Trades Union and joining this bogus organisation, the E.P.E.A.

Before you do this I should like to draw your attention to the position. We have been for a considerable period—and at considerable expense—drawing up working conditions for men employed in electricity undertakings in the London area. You, in addition to every other man in the industry, will materially benefit through our efforts.

Altogether, apart from this, you have up till now benefited to the extent of 23s. 6d., plus 12½ per cent. on all wages earned, got simply through the efforts of the Electrical Trades Union, and if you run out of the Electrical Trades Union, then you will go out of the electrical industry as far as London is concerned.

We are going to make it absolutely impossible for any man who is a member of this bogus trade union (the E.P.E.A.) to get a living in our industry in the London district.

Sincerely trust, therefore, that you will reconsider your position.

Yours fraternally,
(Signed) W. J. WEBB,
London District Secretary.
pp. I.F.W.

The Greatest Industrial Problem.

The leading article in the issue of the ELECTRICAL REVIEW of September 27th bore the title of "The Greatest Industrial Problem," and rightly so, for it dealt with a question lying at the root of the very existence of our national industry, namely, the question of the stabilisation of the relations between employer and employed.

The writer of the article lamented that "the mountain of deliberative effort" had so far "brought forth only a mouse," and concluded his wail with the words: ". . . we have never hesitated to give the strongest possible approval to the Whitley principles, but these alone will not suffice to quench the fires that we fear may burst out *if something does not happen to change the spirit* of many workers, and curb the spirit of recalcitrant minorities who delight in strife." (The italics are mine.)

It seems to me that in the words I have italicised, the writer has laid his finger upon the "fountain and origin" of the evil, but he does not suggest what this "something" may, or should, be.

Some seventy-seven years ago—to be accurate on January 25th, 1841—Ralph Waldo Emerson said in a lecture to the Mechanics' Apprentices' Library Association in Boston, "The ways of trade are grown selfish to the borders of theft, and supple to the borders, if not beyond the borders of fraud. . . . We are all implicated, of course, in this charge; it is only necessary to ask a few questions as to the progress of the articles of commerce from the fields where they grow, to our houses, to become aware that we eat and drink and wear perjury and fraud in a hundred commodities." God save us! What language could Emerson select to-day adequately to describe the cynical selfishness, the ignoble greed that has characterised so much of the trading during the past few years; what words could he find adequately to denounce the methods of the profiteering plutocrats who have sprung into existence as a result of the shameless advantage they have taken—no doubt quite *legally*—of the necessities of the nation?

The context of his lecture shows that Emerson had in mind the relations between tradesmen and their customers, but what valid distinction can there be made between the tradesman who cheats his customer by delivering inferior goods intentionally made to appear up to sample, the employer who takes undue advantage of his employé to deprive him of an equitable reward for his labour or other services, and the employé who puts in a different kind of work when his employer's eye is on him to that when his employer's back is turned? Is it not theft pure and simple in either case? And is not theft—academically—an offence against the law of the land, not to speak of that Higher Authority whose teaching we in this country profess to follow?

Injustice and dishonesty between tradesman and customer have come to be glossed over under the euphemism "tricks of the trade," and it is not to be wondered at, in fact it is only natural, that the same principle—or want of principle—should have permeated the relations between employer and employed. I don't suppose the heart of man is more desperately wicked to-day than it was in Emerson's time or that of the prophet Jeremiah, but its opportunities are greater and more frequent, and the consequences of dishonesty more apparent because of the linking up of humanity in all parts of the world by the electric telegraph and other wonders of scientific invention and discovery.

There is probably no fundamental principle in pure ethics to-day that was not known to pagan philosophers. The constructive power of the practice of the golden rule has been recognised from time immemorial, but the hopelessness of making a man honest by Act of Parliament has passed into a proverb. Many people seem to have the same muddle-headed notion respecting the laws of the land that they have about the laws of nature, namely, that somehow or other a law possesses the power of putting itself into action. The law of the land is only effective because of the existence of power behind it to punish infractions thereof, just as the laws of nature owe their existence and continuance to the Directive Power Which ordained them.

But *quis custodiet ipsos custodes*? If those in whom ultimate authority rests are not themselves honest in virtue of moral principle, legislative enactments, however well drafted, become the breeding ground of bribery and corruption. "The possession of special power constitutes the greatest temptation with which virtue can be assailed; in difficult circumstances few men can wield extraordinary power long without positively committing crime." Legislation, committees, boards of control, and the like, are all very well as means to an end, "your dialectic may force a man to *acknowledge* the right action, but where is the dialectic that will force him to *do* it?" It is comparatively easy to convince the average man that he *ought* to act in such and such a way, or to think in such and such a manner, but unless the impelling force

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so to do comes from within himself, what will your arguments avail if self-interest conflict with right? "Nothing is so easy as to be religious on paper," says Newman.

The truth is—and there is no use in blinking it—that most men of balanced mind and experience of the world know perfectly well the root cause of "the greatest industrial problem" and equally well realise the only possible solution. The cause is primarily the absence of good faith between employers and the employed, and the remedy is the inculcation of sound, healthy moral principle in the minds of the rising generation. Any measures which may be devised to arrest, or even to delay, the headlong speed at which we are rushing towards social and economic ruin, are to be welcomed so long as it is clearly recognised that such measures are, and can only be, of the nature of palliatives. It is futile to expect habits of mind engendered by generations of growing mutual distrust to be changed in a twinkling even by a super-Whitley. No system of water purification will ever make a stream run clear if it springs from a polluted source. "The higher we build upon an unsound foundation, the greater the danger we run. The more we aggregate the victims of an infectious disease, the more we intensify its evil, and the undisciplined will is an unsound foundation, an infectious disease. Any attempt therefore to improve society which does not begin with the will, and consequently with the individual, is either ignorantly superficial or consciously hypocritical."

Radix.

GOODS TRAFFIC ON TRAMWAYS.

Considerably increased attention has recently been directed in railway circles to the carriage of goods by tramway systems, and the present time is not inopportune to briefly review the subject in some of its principal aspects. The following particulars are abstracted from the September 7th, 14th, and 21st issues of the *Railway News*.

Early in June there was a strenuous railway opposition to the proposed goods carrying powers of the Sheffield Corporation; since then Mr. Bonar Law has announced in the House of Commons, on July 16th, that a Select Committee would be appointed "to review the various agencies by which transport and the delivery of goods are effected in this country," and, finally, there has been the decision of the London County Council, at its meeting on July 30th, to adopt the Highways Committee's recommendation to expend £100 on the conversion of two tramcars for an experiment in the carriage of goods on the Council's tramways. The terms of reference of the Government Committee to which we have referred, and which has now been appointed, are very comprehensive, and fully justify the anticipation that the Committee will see fit to consider the particular subject with which this review deals, in addition to the many other issues which must pass under its notice.

In view of the possibilities of road transport on a much larger scale than heretofore, it is scarcely a matter of surprise that the railway authorities should view with apprehension the extension of the statutory powers now held by many tramway authorities.

In many respects the general law relating to tramways was laid down in the Tramways Act of 1870, but that neither expressly authorises nor prohibits the carriage of parcels or goods upon tramway systems, although certain of its clauses appear to assume that such traffic would in some instances be worked upon tramways. Further, it must be remembered that many lines commonly known as tramways are not tramways in the legal sense of the word, but are light railways authorised under the provisions of the Light Railways Act of 1896; there, again, we find that whatever powers may be considered to have been given or may be inferred from the Act of 1896, the right to carry goods where desired by the promoters of a light railway will be clearly defined in the order sanctioning that particular line. We arrive, then, at the fact that the statutory powers with relation to goods carriage on tramways vary with the particular instances; certain tramway authorities are possessed of powers to carry animals, goods, minerals, and parcels; other tramway authorities have only very limited powers. Equally true is it that in some cases the powers even when granted have been exercised, whilst in other cases they have remained unexercised. We should note in passing that with regard to the carriage of mails by tramway there is a general enactment placing upon tramway authorities the obligation to carry when required by the Postmaster-General so to do; in the case of railways the obligation was, of course, placed upon the railway companies in the very early days of their development, viz., by an Act of 1838, whilst the obligation in respect of tramways, to which we have referred, was placed by the Conveyance of Mails Act, 1893.

Extent of Goods Traffic.—It needs only a very slight perusal of the official returns to show that goods and parcel carriage has up till now only developed on a very restricted scale. For information on this point, we may refer to the Board of Trade returns on Tramways and Light Railways and Trackless Trolley Undertakings, published in 1914, and dealing with the year ended March 31st, 1914. The whole of the undertakings of the kingdom yielded a gross receipt of about £16,000,000, and of this sum less than £70,000 was produced from the carriage of mails and parcels, whilst from the carriage of animals, goods, and minerals there was produced a little over £13,000, both these figures being equal to only a small fraction of 1 per cent. of the gross income. Or, to take another analysis of the return, we find that of the total number of undertakings in the United Kingdom barely half earn any receipts from the carriage of mails and parcels, and only about half 1 per cent. earn receipts from the carriage of animals, goods, and minerals. It is interesting to note that in the largest tramway systems of the country goods carriage has been almost entirely undeveloped; if we take the nine tramway systems having a length of 50 miles or over, we find that in the 1914 report not one of these undertakings is cited as deriving any income from the carriage of animals, goods, or minerals, whilst in five cases there is an income derived from mails and parcels, but only in one instance, viz., Bradford, does that income exceed a figure equivalent to 3 per cent. of the gross income of the system to which it refers. These figures relate to the last pre-war year, and they take no cognisance of any particular developments which may have taken place during the war period, such as the traffic at Leeds. The nine tramway undertakings to which we have just referred are those of the London County Council, Corporations of Glasgow, Manchester, Birmingham, Liverpool, Leeds, Bradford, and the Metropolitan Electric and London United Tramways Companies. It would, however, be quite a mistake to suppose that there are not individual cases where parcels and goods carriage have been developed with advantage both to the tramway authority and to the public. Nor would it be right to assume that the absence of receipts from these classes of traffic is in itself any demonstration that the traffic cannot be profitably or conveniently worked, for there are many cases in which the tramway authority has no statutory powers to conduct a goods traffic. To take one instance alone, the London County Council, the largest tramway authority in the kingdom in respect both of mileage and of gross receipts, has only very limited powers in the matter, these being confined to the conveyance of luggage accompanied by passengers, and conferred by the Council's Tramways and Improvement Act of 1911.

At the recent hearing on the Sheffield Bill the Corporation was, naturally, at pains to show the success which had attended the development of goods and parcels traffic at certain places where it had been adopted, and to some of these we may now briefly refer. Huddersfield Corporation, for instance, began to operate its goods carrying powers in 1904, and in the last completed year of working over 13,000 tons of coal were conveyed by the tramway system, in 10-ton wagons from London and North-Western Railway sidings to certain factories in Huddersfield and district; over £1,300 being expended in laying a siding connection whereby the tramway wagons could gain access to the railway company's coal shoots. Again, at Leeds, the Leeds Fireclay Co. made an arrangement with the Corporation in 1915 whereby the company's materials are carried over the tramway lines, and thus conveyed from the company's pits to its works, a distance of five miles. Here, again, it was stated the loads were taken through the city during the hours of early morning and late afternoon without apparently any detriment to the working of the ordinary passenger traffic. Another instance furnished to the committee was that of the Black Country tramways, operating nearly 100 miles of line in the Midlands; in this case old tramcars have been used for the carriage of various goods, the load being something like 5 tons, and, additionally, this company has built a special type of car for goods traffic, taking a load of 10 tons with a 2-ton trailer attached.

Parcel Traffic.—This has been developed on the tramway systems much more generally than has goods traffic, the gross income derived from parcel carriage on the undertakings of the kingdom being over five times that derived from goods traffic. The instances in which parcel traffic has been developed are much more numerous than those relating to goods; many of the large Corporation systems conduct a parcel traffic, including Blackburn, Bradford, Burnley, Halifax, Huddersfield, Leeds, Manchester, and Newcastle-on-Tyne, whilst of the company-owned undertakings the Birmingham and Midlands, the Potteries, and the Spen Valley systems also conduct this class of traffic. The income derived is, in most cases, only a very small fraction of the gross income of the undertakings; judged from this standpoint, Bradford appears to be one of the most successful, but it must, of course, be conceded that in estimating the utility of such a service the convenience afforded to the public by its adoption should be considered no less than the actual income accruing to the tramway authority.

In Manchester an extensive parcel traffic has been developed on the Corporation tramway system since 1907. In that year the total yield therefrom was £1,685, a figure which shortly before the war had risen to one of £13,990 per annum, an increase which certainly affords striking evidence that, at all events in regard to parcel traffic, the tramway can prove a very useful medium of transport. So much impressed was the Manchester Corporation with the possibilities of municipal parcel carriage that some twelve years ago it announced its intention of starting a parcel delivery service not confined to parcels or goods actually carried on the tramways; here the Corporation came into conflict with the principal carriers serving the city, for Messrs. Sutton brought an action against

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the Corporation, and secured an injunction from Mr. Justice Farwell restraining it from conducting a parcel carriage business except as part of the tramway undertaking. Again, when in 1914 the Corporation sought further Parliamentary powers in regard to the running of omnibuses, it also secured the power to convey parcels by such omnibuses, subject to a weight limitation not exceeding 56 lb. Bradford and Huddersfield have also developed parcel services. On the Bradford Corporation tramways during 1916 over 800,000 parcels were dealt with, yielding a gross income of over £11,000, which during the following year had increased to £13,000.

Carriage of Mails.—The carriage of mails, as we have already stated, was made obligatory on tramway authorities, in cases where the postal authorities so desired, and in this connection we should mention an interesting development at Huddersfield, where some years ago the Corporation affixed letter boxes to its tramcars, thus providing a frequent collection of letters from the outlying districts into the chief post office.

Obstacles to Extension of Goods Traffic.—There are, of course, obvious difficulties in the way of any extensive development of tramways for goods carriage. Any system to be practicable would, it appears, entail considerable capital expenditure, in the construction of depôts and of tramway sidings into works or factories, or perhaps into railway goods yards for conveniently loading or unloading the traffic, and in many cases physical difficulties may be presented thereby. Neighbouring towns wishing to have a through system of traffic must, of course, be possessed of the necessary statutory powers to work such traffic, and in many cases fresh Parliamentary powers would be necessary to confer on neighbouring authorities the right, and to authorise the linking up of one system with another. Then additionally to these matters, there is the question of gauge; uniformity of gauge is obviously desirable between systems which are to effect an interchange of traffic, but at present there is nothing like uniformity in this matter. Through running was put into operation, for instance, between Leeds and Bradford, although the Leeds gauge was 4 ft. 8½ in., and the Bradford gauge 4 ft., and in this case variable gauge tracks were used, and the same cars run over the tracks of both systems, practically no difficulty being experienced. For through running, however, uniformity of gauge is an advantage which obviously presents itself. Of the nine large systems we enumerated in a previous paragraph, five have a gauge of 4 ft. 8½ in., two have a gauge of 4 ft. 7¾ in., one has a gauge of 4 ft., and one has a gauge of 3 ft. 6 in. In the United Kingdom there are, in fact, six gauges in operation, varying from 3 ft. to 5 ft. 3 in. Only a little over half of the tramway undertakings have adopted the 4 ft. 8½ in. gauge.

Tramways as Auxiliaries to Railways.—The question of gauge opens up another very important issue of this subject, and that is the extent to which arrangements might be made for utilising tramway systems as auxiliaries to the railways by running railway wagons from the railway goods sidings on to the tramway and thence into tramway distributing depôts or by means of sidings off the tramway into the works or establishments for which the goods are destined. Obviously a large capital expenditure would be entailed by the making of junctions between the railway and the tramway tracks, and by the remodelling and alteration of railway goods depôts which would be necessitated by the institution of such a scheme, and, needless to say, the making of these junctions could only be effected under Parliamentary powers or upon agreement between the railway and the tramway authorities. Moreover, one of the principal difficulties to be overcome would be that concerned with the question of gauge; for whilst a large number of tramways have been laid to the standard railway gauge, that does not of necessity mean that they are suitable for use by railway rolling stock.

The view has been expressed by some that there is something fantastic and altogether unworkable in the suggestion of a through traffic of railway stock over tramway systems. The history of the subject would scarcely confirm this opinion, for the possibility of such a development was anticipated even as far back as 1870 when the Tramways Act was passed. We find therein the stipulation that in every special Act authorising a tramway the gauge of such tramway should be prescribed, and in the event of no gauge being specified it shall be such "as will admit of the use upon such tramways of carriages constructed for use upon railways of a gauge of 4 ft. 8½ in."; moreover, tramway authorities have recognised the possibilities of the development of railway wagon traffic on their systems, not apparently always with favour, for we find the London County Council, for instance, in its Tramways Act of 1911, obtaining a direct prohibition on the point, Section 9 of that Act stating "the tramways shall be of the gauge of 4 ft. 8½ in., but carriages and trucks adapted for use upon railways shall not be run upon the tramways."

Rates for Goods.—If it could be demonstrated that the trader would secure a reduction in goods carriage rates as a result of the institution of road carriage instead of rail carriage, obviously he would avail himself of such advantage. The advantage has still to be demonstrated, at all events, in regard to long-distance conveyance. But it is conceivable that the question of actual carriage cost in some cases might be outweighed by the convenience to the trader of loading or unloading in his own premises, and, incidentally, saving the cost of delivery to or from the railway goods depôt. In the recent Sheffield case evidence was given to the effect that the Corporation's proposed goods rates could not compete with the rates charged by the local carriers; several instances were detailed, in which according to the evidence offered, the tramway carriage rate would work out a good deal higher than the carrier's rate. The rates for carriage, as set out in the Sheffield Bill, are: For coal, 2d. per ton per mile; for iron, ironstone, &c., 2½d.; for grain, timber, light iron castings, &c., 3d.; for cotton, wools, manufactured goods, &c., 4d.; for iron boilers or machinery (from 4 to 8 tons weight), 2s.; and for parcels (from 7 to 56 lb. weight), an increasing scale of 3d. to 9d. for any distance. And, in addition to these rates, the Corporation would be entitled to demand reasonable charges for loading and unloading goods.

Interurban Traffic.—With regard to parcel carriage and small goods carriage within the immediate boundaries of a town, railway interests may have little reasonable objection to make, as the traffic is in many cases of a nature not ordinarily dealt with by the railway companies themselves. But with regard to the development of such traffic on longer routes from one town to another, there is, we think, quite reasonable ground for speculation as to whether or not railway interests may be adversely affected by future developments, for it must here be borne in mind that whereas in the early days of tramway development, tramways merely served individual towns and their immediate surroundings or suburbs, they now, additionally to serving such places, have been the means of linking up one town with another, and often providing a service which by its frequency has become a serious competitor to the railway. In the North, Liverpool and Manchester are physically connected by tramway, whilst there is only a short break in the route from Manchester to Leeds now uncovered by tramway line. In the South, a similar development has taken place from London into Kent, there being a connected line of tramway from the Thames bridges as far as Dartford, a distance of little short of 20 miles.

Whilst these developments were taking place a considerable loss of traffic undoubtedly resulted on many suburban services, but such traffic has, to a certain extent, been recovered, in instances familiar to the public, such as the suburban service of South London. However, the spirit of antagonism between the railway and the tramway still exists, and in no small measure, if we are to accept the opinion of the railway company's goods manager, as expressed in his evidence in the recent Sheffield case. In this connection it may be of interest to quote some words used by the late Sir William Preece, when speaking some years ago at a discussion on tramway matters. He referred to the invariable opposition of railway companies to tramway proposals, and proceeded: "In the United States matters had been different. There the managers of the railway companies had seen in the tramways something that could be useful and valuable to them; they had supported the extension of tramways, had invested money in them, and had thus been able to arrange those tramways so that they became feeders to their railway systems," and he added his opinion that in the future "the railway people must look to the tramways as supporters, and not as opponents, of their lines."

WAR ITEMS.

Lighting Regulations Infringed.—Two Stirling women have been fined 10s. each for allowing electricity to be consumed after 10.30 p.m. at a dance in a local hall.

Municipal Appointments for Disabled Men.—The Leeds City Council has passed a resolution recognising the special claims of men disabled in the war to employment in the public service, and agreeing that after its former employés' reinstatement claims had been met, preference should be given to such men in filling up vacancies on the Council's clerical, technical, and manual working staffs.

Mertons' Liquidation.—According to the daily Press, Messrs. H. R. Merton & Co., Ltd., have passed special resolutions for the voluntary liquidation of the company, and the appointment of Sir Woodburn Kirby as liquidator. The liquidator is authorised to compensate the company's employés for the loss of their employment owing to the liquidation. It is stated that the liquidation will not affect the actions now pending against the Right Hon. W. M. Hughes and the *Daily Mail*, which will be proceeded with.

A meeting of creditors is called for October 22nd at 2, Metal Exchange Buildings, E.C.

When will the War End?—The "Times" correspondent at Buenos Aires is privately advised that German firms there have recently received information that the war ends this year, and are warned to act accordingly. "Spain is the channel of communication." The writer refers to the unconcealed satisfaction throughout the Argentine at the turn of events, and the prospects of a speedier termination of the war. He goes on to say that German commerce is harder hit to-day than ever before owing to co-operative Allied measures, supported by friendly neutral firms, who display eagerness to obtain the privileges derivable from a status of recognised friends, and make no difficulties about signing guarantees not to trade with Germans."

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Exports to China.—Additions to the list of those to whom exports to China may be consigned appear in the *London Gazette* for October 4th.

U.S. and Reconstruction.—For some time past there has been little disposition in the United States to consider the problems of reconstruction, the general attitude being in favour of concentration entirely on war preparations. The altered situation in Europe has caused a marked alteration, and senators and others are now devoting a great deal of attention to the subject, and according to the *Times'* Washington correspondent, there is a rapidly crystallising conviction that neither Washington nor the country can afford to be caught napping when peace comes.

Trading with the Enemy.—The "London Gazette" for October 4th contains further lists of persons and bodies in the following countries with whom trading is prohibited:—Argentina; Bolivia; Brazil; Chile; Colombia; Cuba; Denmark; Ecuador; Greece; Guatemala; Hayti and Dominican Republics; Honduras; Mexico; Morocco; Netherlands; Netherlands East Indies; Nicaragua; Panama; Persia; Peru; Salvador; Spain, Sweden, and Venezuela.

Electrical Artificers for the Navy.—The Admiralty has instituted a new rating, that of Electrical Artificer, with rank as corporal, in the Royal Marine Submarine liners. The prospects for suitable men between 21 and 45 years of age are excellent, the pay is 2s. 6d. per day with 1s. 8d. per day engineering pay, and "all found." While some knowledge of mechanical engineering is an advantage, what is desired is a general knowledge of electrical engineering, particularly with regard to the operation of small isolated plants, comprising direct-current generators, batteries, and switchboards. Candidates should apply to the Department of Naval Recruiting, 20, Cranbourn Street, Leicester Square, London, W.C. 2.

Postal Workers' Discontent.—At the meeting of the Postmen's Federation at Derby last Friday, Miss Mabel Bray, delegate from the Postal and Telegraph Clerks' Association, said the Post Office was seething with discontent. It was with very great difficulty they had prevented the women employés taking action. Mr. A. Lynes, a delegate from the same body, said that the proposed amalgamation of the Association with the Federation meant the creation in the Post Office of one of the strongest trade unions in the country. He believed that they might approach the miners, railwaymen, and transport workers and establish a quadruple alliance.

Reconstruction in the War Areas.—The "Times" of Wednesday closed an editorial on "The Problems of Housing" as follows:—"The amount of reconstruction to be done in the war areas even before the new fury of destruction started was large enough to absorb all available resources. Now it stretches out to an immeasurable magnitude unless means can be found to stay this most cowardly and spiteful of all German outrages. In any case, the population of the war areas and the occupied countries will have first claim to consideration, nor will anyone dispute it. The initial difficulty is the supply of materials, which will have to be rationed. Then there is labour and finance. The Government's policy of combining the energies of local authorities, utility societies, and private builders seems to us not only the best but the only way of accomplishing the task in hand. But even then patience will be required. The great thing now is to get on with preparations, so that work on a methodical plan may be started at the earliest moment."

Exemption Applications.—At Mitcham, an appeal was made by D. B. Jones (33, Grade 3), working partner in a firm making electrical appliances for the Government, and whose partner has been in the Army since 1914. He was given six months.

Barnsley Tribunal has refused exemption, on a proper substitute being found, to B. Gregory (23, Grade 1), electrician, appealed for by Mrs. Burns; and granted three months' temporary exemption to G. P. Deardon (33, Grade 2), electrical engineer, applied for by Mr. E. Broley.

Dartford Rural Tribunal has granted four months' exemption to F. H. Luff (31), electrician, Stone.

At Dewsbury, P. Flanagan (36, Grade 1), electrician's assistant, Westtown, who has buried his wife and three children during the last 20 months, and is left with three other children at home, was given three months' temporary exemption.

KEY INDUSTRIES.

On Monday last Mr. H. J. Mackinder, M.P., in the absence of Mr. J. Austen Chamberlain, M.P., who was indisposed, opened the New British and "Key" Industries Exhibition, organised by the Industrial Section of the Tariff Reform League, at the Central Hall, Westminster. In a letter from Mr. Chamberlain, which was read, the writer said that the exhibition was one that he would gladly see multiplied throughout the country by any association that had the knowledge and the will to provide so instructive a lesson. It was designed to show in a limited, but carefully chosen field, what we could do to prevent our being again found dependent on foreign and hostile sources of supply for certain articles which are vital to our existence as a nation. Mr. Chamberlain said that his position as chairman of a Government Committee concerned with the securing of supplies showed him that we were at this moment far more dependent upon foreign supplies than he believed any of our countrymen had realised. "We have been living in a fool's paradise, and it is time we awoke to realities." The exhibition showed in a chosen and limited sphere both our past deficiencies and the steps already taken to remedy them, and every thoughtful man interested in the stability of the British Empire and in the development of our industries would welcome it. The exhibition was only a practical illustration of the statement made by Mr. Asquith and Mr. Runciman of our dependence on Germany before the war, and of the necessity for our emancipation. The credit of the Paris resolutions was claimed by Mr. Runciman and for him by Mr. Asquith. "If words have any meaning, Mr. Asquith and Mr. Runciman and the other Liberals who served in Mr. Asquith's Coalition Government are committed to as profound a change in our economic policy as any old Tariff Reformer of us all." If words for them had no meaning, then he, Mr. Chamberlain, admitted that they were free to revert to their pre-war view that dumping was an unmixed blessing, the German monopolist a welcome guest, and dependence on foreign supplies of necessaries a source of strength.

Among those present on the platform with Mr. Mackinder were Sir Joseph Lawrence, who spoke on our patent laws; Sir Thomas Wrightson, and Sir Robert Hadfield. Sir Robert, whose presence was regarded as an illustration of the "non-party," or shall we say "all-party," character of the Tariff Reform League to-day, made some interesting observations regarding our past unwarranted dependence upon Germany, and among other things he mentioned a case from his own early war-time experience. For the purpose of extensive testing operations at Sheffield they employed a certain type of electric lamp for pyrometry. The operations threatened to come to a standstill because those lamps had come from Germany. He, Sir Robert, saw Sir R. Glazebrook at the National Physical Laboratory, who made certain suggestions, with the result that in six weeks we were making the lamp in this country. In the past Germany had done nothing in the scientific and industrial world that we could not have done had we had proper support.

From the observations of Mr. Mackinder it is obvious that the League holds that what are "key" industries for war are equally "key" industries for peace. Science was continually advancing, and we might have a new key industry arising every six months, so that organisation for one industry—say, dyes or magnetos—would not safeguard the interests of other "key" industries. We must not allow any nation to take the keys away from our doors and hold them fast. The exhibition is intended purely for educational purposes; there are no salesmen or agents present seeking "orders." It is limited to some fifteen commodities, and it is desired to tell the British public what was the position before the war, and what has been accomplished since.

In connection with the exhibition, which includes dyes, tungsten, spelter, nickel, manganese, lead, antimony, graphite, magnetos, glass, rubber, electric light carbons, &c., many firms having lent their co-operation. An instructive handbook has been prepared, which it is hoped will be secured by large numbers of readers who may find it impossible to visit the exhibition itself. It can be obtained for one shilling at the offices of the League (7, Victoria Street, London, S.W.).

The exhibition remains open until October 22nd, and is free to all.

Limitations upon Coal Storage by United States Plants.—The increasing demand for coal for special war purposes in the eastern part of the country has made it necessary to draw more heavily on the eastern coal fields than was originally contemplated. In order not to disturb the coal supply moving to other parts of the country, it was decided to limit the amount of coal storage that industrial plants would be allowed to accumulate and to carry on hand, and to fix a uniform amount for each State.

The United States Fuel Administrator, according to the *Electrical Review*, U.S.A., has announced the basic policy of the Fuel Administration as to storage as follows:—

"Coal in excess of that required for current operations shall be delivered to plants not on the preference list of the War Industries Board only when it is not in demand for use before April 1st, 1919, by consumers on said list. In carrying out this policy, allowance shall be made for differences in distance from the mines and for differences in transportation conditions which may require more or less storage at the beginning of winter to ensure uninterrupted operation until the following spring."

It is understood that particular cases may require special treatment by a State Fuel Administrator, either by way of granting more stocks of coal than are indicated by the limits, or by restricting them to a less supply.

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TECHNICAL PUBLICITY: A HOMILY.

By T. BIRKETT.

When peace breaks out, there will break out with it an orgy of advertising and publicity schemes, and vast sums of money will be spent. To the watchful eye the signs are unmistakable. The publicity experts and advertising agencies are already commencing their campaigns.

There can be no question that extensive and well-directed advertising will be valuable, even essential, for the development of our new manufactures, and for their proper introduction to new markets; but the ordinary engineer, who is both a buyer and a seller, as well as a manufacturer, and who has views upon the relation of effort to effect, has some reservations in his mind—and small wonder, when he thinks of the past and present advertising of engineering products.

In looking through the publicity matter issued by the electrical industry, as compared with that of the gas industry, one cannot but feel that there is "something rotten in the State of Denmark." The technical Press appears to be full of advertisements which do not advertise; thousands, nay, millions of booklets, post-cards, leaflets, to say nothing of expensive catalogues, are printed and distributed to but little purpose.

In these days there is a lot of talk and ink wasted upon the subject of efficiency, but is there under the sun a single case where the factor of efficiency is so small as in the field of publicity? Even when it is applied to articles of common utility and general consumption it is bad enough, but when it comes to technical publicity it would seem that even this feebleness becomes more feeble still. Anyone with any experience in the electrical trade knows of the existence of large quantities of printed matter which have been dumped upon contractors, central-station engineers, and others, with but little sense of proportion or regard to fitness. The recipients are at first embarrassed by the gift, and then, as the generous hand which sent it shows no signs of exhaustion, they settle down to use it up in any way which commends itself, generally in a manner which would not be so commendable to the donor of the gift. The present high price of waste paper for pulping has probably cleared many shelves.

The case of the advertisements in the trade journal is but little better. These advertisements are frequently so amateurly written, and so poorly displayed and illustrated, that one sometimes wonders whether they are serious attempts to get business, or whether they have any other motive. It is fairly certain, in many cases, that the only readers to be impressed are trade competitors, to whom the reading affords a pleasing and harmless pastime. Seriously, there is something wrong.

The publicity expert will, I am sure, agree. His explanation will be a simple one—that the principals of engineering firms, when they consider publicity at all important, insist upon writing and planning their own advertisements; and when, as is more usual, they do not consider the matter important, they relegate the work to such members of the staff as have nothing better to do. In either case the work is badly done.

The expert naturally thinks that if one is employed who has studied the "psychology of the public" and knows how to write "copy with a punch in it," and who has the services of a "sketch artist" who can devise appealing pictures, each of which "tells a story," one who understands how to make "type talk," who, in fact, knows all the clap-trap of the American publicity agent, then all will be well. Unfortunately for the expert, most engineers have seen those advertisements, and, of the two, prefer the halting statement of the professional engineer who is an amateur advertisement writer, to the more slick appeal of the professional advertisement writer who is an amateur engineer. The average man who reads current commercial literature, and the advertisements and advice therein, acquires a suspicion that the professional publicity expert has gained his knowledge of the "psychology of the public," and the other terms of his trade, from some of the many American books and journals upon advertising. These books, for the most part, treat obvious and trite matters in such a ponderous—not to say Pecksniffian—manner as really to obscure quite simple truths.

There are published, both in England and America, certain journals which are the organs of the professional publicity men. The American journals of this class make most interesting reading, and throw some illumination upon the psychology of the advertising expert himself. At times they are humorous, and the humour is none the less pleasing because it is often unconscious. The pages are well sprinkled with portraits of Napoleonic-looking young men, with an intense look in their eyes, whose many advertising "stunts" are exploited for the edification of their compeers. There are also instructions in the art of advertising and sermonettes to advertising men.

In a recent number there is a special article on advertising for plumbers which could certainly quite easily be adapted to electricians. The article concludes thus:—

> In homes where the living rooms are bright with beauty and rich in comfort, why should the bathroom be obsolescent and unlovely? Why not have it in keeping with all the rest of the home? Then you show the family how beauty and convenience may be united in a sanitary bathroom at reasonable cost. By these policies, modified, of course, as local conditions demand, may the plumber who advertises expand his business. So may he realise that all chance is direction he cannot see; all discord, harmony not understood; all partial evil universal good.

The English and the moral are both a trifle involved, but the intention seems good.

In another number is some account of one Charles Stelzle, who presumably is well known in certain American advertising circles:—

> For a series of years he was prominent as a Presbyterian minister, and he became one of the governing body of the national organisation of that church. He broke away a number of years ago to establish a business in the way of organising and promoting churches and communities. Mr. Stelzle was very much interested in the proposition of promoting churches by advertising at one period of his development, and he then wrote a book that he called "Principles of Successful Church Advertising."
>
> Mr. Stelzle narrowly missed being a great man. He has exhibited elements of greatness in all of his work. While he has always been regarded as an extreme Liberal, his temperament is that of a standpatter.

One is not quite clear either as to the exact meaning of the last word, or as to the attitude of mind of Mr. Stelzle, much less that of the writer of the note; but one gathers a little illumination as to the point of view of American advertisers.

There is another note about a jeweller in Glen Cove, N.Y., who, probably owing to military exigencies, was closing his shop in something of a hurry, but desired, first, to square accounts.

> Moescha Rosenberg advertised in a local paper that he would publish the names of all who owed him money, and did not settle before the next issue of the paper went to press. "I shall publish the name and exact address and vocation of each of the aforementioned deadbeats, giving, in my usual style, a psychological treatise on their character and make-up," was the language of the advertisement. Results came with a rush.

Most of us know many accountants in the electrical industry who wish that the same methods were usual in England; some of us know one or two who could fill the bill.

Extracts from these journals could be multiplied, but one fears they would not give a fair impression. The journals are amusing, but one cannot but feel that they are also a little humiliating to advertisers. Their general tone, from a literary, intellectual, or moral point of view, is much lower than that of other trade and technical journals; and this brings us to the moral of the homily:—What is to become of technical advertising in the near future, when electrical and engineering firms will want all the publicity they can procure?

The general executive engineer, if not dumb, is usually somewhat halting in his speech, and, if the truth must be told, has just a suspicion of contempt for advertising in any shape. The advertising expert is glib enough, but as the "profession" is a new one, he would appear to be just a shade too anxious to justify his claims as a "copy writer" and "display artist" to be quite able to see the fine points of distinction between a general appeal to the public, and a particular appeal to a highly-technical, well-informed, and generally well-educated class which is

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conservative, and very shy of ordinary publicity methods. It is a real difficulty. One can see in almost any trade journal advertisements of both classes: the one which is but a badly designed and badly printed trade card, and the other much better designed and displayed, but which, instead of appearing to contain information from one intelligent and capable engineer to another, is more like a performance of one publicity merchant "showing off" for the edification of others in the same line of business. It would appear that both groups have much to forget, and much to learn from each other.

The first thing to be learnt is that engineers must open their minds to the newer ideas in marketing their goods, just as freely as they do to the latest ideas on factory practice. The time of the engineer will be much too valuable in the future, solving executive problems, for him to devote much time to writing advertisements, so that there will always be opportunities for the professional publicity man. For certain of the latter there will be a great field, but the work will demand quite special training. The appeal they are to make will be to men whose general level of intelligence and education is very high, and will tend to become higher.

Much of the newer publicity will take the form of the distribution of the latest information upon technical subjects, from firms who specialise in certain groups of work. There is no reason why certain of this information should not be conveyed through the advertisement columns of trade journals, in short telling words—as, in fact, it now is in some cases. Fuller information will demand circulars, booklets, "house organs," &c.

The quantity of actual printing may be less, but its distribution should be more intensive than dispersive, and the quality much higher, both in matter and manner. The very latest developments of the printer's art and craft must be laid under tribute.

The most ambitious publicity expert will find ample business to be done, provided he can forget most of the things he learned in dealing with the general public. It also might be well for him to remember the aphorism given in the American paper already quoted, that "Smart advertising is not the same thing as good advertising." "Not by a jugful."

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Securitas" Fitting.

We have received from Messrs. Ward & Goldstone, Sampson Works, Salford, Manchester, a pamphlet (No. A 24/5) relating to the "Securitas" attachment for fitting immediately above lamp-

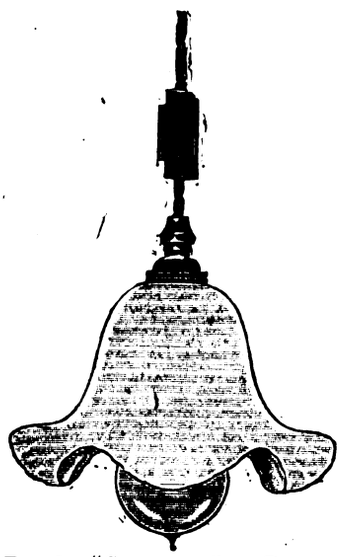

Fig. 1.—"Securitas" in Position.

holder cord grips, for which article we understand the firm has taken over the entire selling rights. It is a well-known device, simple in design and application, and a safeguard against the spread of the area of flame on a flexible cord. The fitment shown (fig. 1) has been adopted by many leading houses, and it is claimed to be equally effective in use as a fire preventer in heating as well as lighting installations. The fitment is asbestos packed. In fixing, the clasp should be thrown well back and the cord firmly placed in the groove before fastening; if the cord is too thick, a little of the lining may be cut out.

Bradawl and Countersink.

Mr. Leoline Edwards, of 81, St. Margaret's Road, Twickenham, has devised a bradawl which, besides making a hole for a screw,

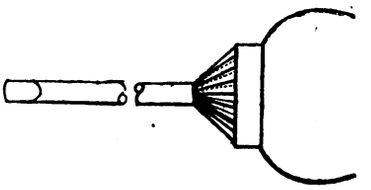

Fig. 2.—Bradawl and Countersink.

prepares the countersink to receive the head of the screw. As will be seen from the figure, it is quite a simple tool, and being a time-saver it is worthy of notice in these days.

BUSINESS NOTES.

The Need for a Mark of Origin.—The Portuguese Chamber of Commerce and Industry in London has taken offices at 20, Budge Row, Cannon Street, E.C., and Mr. Samuel de Lears is hon. secretary. According to the *Times*, Mr. de Lears stated last week that before the war it was a German practice to put many things on the Portuguese market as British goods, simply because the people of that country showed a marked preference for the manufactures of their ancient Ally. Knives were sold with the word "Birmingham" stamped on the blade, when all that was British about them was that the blade was partly manufactured in England. They were sold at cheaper rates than British manufacturers could market the well-made and properly finished article.

A New Swedish Association.—According to a Swedish commercial newspaper, a meeting of representatives of the electrical industry has recently formed a new organisation, under the title of the Swedish Electro-Industry Association, whose object is to protect the common interests of the industry in so far as they are not already comprised within the scope of other organisations. The interests concerned are said to be the commercial policy, the establishment of a sound basis for the settlement of business transactions by making arrangements in regard to the granting of credits and conditions of delivery, and the acquisition of rare raw materials on common account. The Association further intends to devote attention to the standardisation of electrical manufactures and the extension of the use of electricity throughout the country.

Non-Ferrous Metal Industry Act.—The *London Gazette* for October 8th contains a list of further licences granted under this Act.

The Problem of Electrical Supplies for Australia.—According to the *Melbourne Age* of July 18th, an important conference of electrical engineers was begun in Melbourne on July 17th to deal with the problem of ensuring during the next two years a maximum supply of electrical goods from overseas. The delegates were engineers attached to electrical supply undertakings from all over Australia. "It has been shown, by the experience of the Victorian Railway Department, how difficult it is now to secure electrical goods from England and America, owing to the supplying firms being almost exclusively engaged in war work. All the large electrical bodies in Australia are meeting with an ever-increasing demand for power, and this entails the need for increased output and more machinery. The immediate object of the conference is for the representative of each supplying body to compile a schedule of what electrical goods will be needed during the next two years. These needs, it is understood, will be grouped together, and bulk orders will be given to oversea firms, through the Department of Munitions, which will draw the attention of the Munitions Department in London to the needs of Australia. It is anticipated that such grouping and the advice of the Munitions Department in Australia will do a great deal to ensure greater and more adequate supplies. When completed, the result will be reported to the Director of Munitions."

Liquidations.—New Vanadium Alloys, Ltd.—This company is winding up voluntarily, with Mr. T. A. Ward, 25, Great Pulteney Street, London, W. 1, as liquidator.

Venner's Electrical Cooking and Heating Appliances, Ltd.—Meeting November 12th, at 85, London Wall, E.C., to hear an account of the winding up.

Union Electric Co., Ltd.—The Controller in this case of winding-up under the Trading with the Enemy Amendment Act (Mr. P. D. Leake) has applied for his release.

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Bankruptcy Proceedings.—Archibald Maurice Ferguson, electrician, Warrington.—Mr. Registrar Ridgway held a sitting at Warrington, on October 4th, for the public examination of this debtor, whose statement of affairs disclosed gross liabilities of £327 and no assets. In answer to questions by the Official Receiver, the debtor said that, after doing electrical work in his home, he took the shop in Allen Street in August, 1916. He attributed his failure to illness of himself, his wife, and children. He had never kept proper books of account. It was pointed out that the debtor had been on the wrong side since the first day he commenced business. The examination was closed.

Catalogues and Lists.—Messrs. E. Bennis & Co., Ltd., 28, Victoria Street, London, S.W. 1.—Twenty-page catalogue containing an illustrated description of truck tipplers for the rapid discharge of railway trucks. The first tippler built in this country for dealing with standard railway trucks was made by Messrs. Bennis for the Metropolitan Electric Supply Co.'s works at Acton Lane, in 1903. After 15 years' active service the tippler is stated to be as good as ever, though many detail improvements have since been made. This plant, also one installed recently to the order of the Government, is described, as are, briefly, Bennis end truck tipplers and ash-lifting plant. Copies of the list will be sent to any reader who applies for it.

Messrs. E.-C. Grammont & A. Grammont, 220, Route d'Heyrieux, Lyons.—Brochure describing various rail bonds, flexible and rigid, trolley wires, &c., together with technical tables and data.

Wardle Engineering Co., Ltd., 196, Deansgate, Manchester.—Illustrated leaflets giving brief particulars and prices of "Inverlite" electric light fittings, ceiling-type fittings for half-watt and one-watt lamps, and external reflector-type for half-watt lamps.

Messrs. Ward & Goldstone, Sampson Works, Salford, Manchester.—Leaflet describing the "Securitas" attachment for fitting immediately above lampholder cord grips. The firm has taken over the entire selling rights for this article.

Mr. W. J. Hobbs, 121, Victoria Street, S.W. 1.—Leaflet describing the standard motor of Messrs. Portable Electric Motors, Limited, which weighs under 10 lb., and gives out 0·3 B.H.P. on A.C. or D.C. circuits.

Book Notices.—*Faraday House Journal.* Vol. VIII, No. 1. 1918. London: Faraday House, Southampton Row, W.C.—This is the Michaelmas term number of the *Journal*, and it contains, among others, an article on the Percentage Error, which we reproduce on another page, and one on Irish Peat Utilisation. The Summer Term Examination results are also given, and numerous interesting college notes.

"The Applications of Electrolysis in Chemical Industry." By A. J. Hale. Pp. ix + 146; 58 figs. 1918. London: Longmans, Green & Co. Price 7s. 6d. net.

"The Kearney High-Speed Railway." By E. W. C. Kearney. Reprinted from the *Transactions* of the Society of Engineers. London: The Society.

"The Teaching of Physics in Schools." A discussion at a meeting of the Physical Society of London on June 14th, 1918. London: Fleetway Press, Ltd. Price 1s. net.

LIGHTING AND POWER NOTES.

Accrington.—Wages.—An application for the award granted to the engineering trades on August 10th to be extended to the electricity works' employés, has been referred by the T.C. to the Committee on Production.

Australia.—Queensland.—The City Electric Light Co., of Brisbane, is applying to the Minister of Public Works for authority to supply electricity within the shire of Toombul.

With reference to the refusal of the Treasurer to grant an Order empowering the City E.L. Co. to supply electricity to local authorities, it was stated in the Legislative Assembly that the Government considered it inadvisable to grant further Orders to private persons or companies.

The Longreach Council has taken steps to secure a loan of £100,000 for an E.L. installation.—*Tenders.*

New South Wales.—"Some Notes on the Metropolitan Electric Power Supply of the New South Wales Railway Commissioners" was the title of a paper, read on July 5th, by Mr. O. W. Brain, M.I.E.E., before a meeting of the New South Wales Section of the Electrical Association of Australia. Mr. Brain briefly recounted the developments which led to the establishment of the power house at White Bay. The decision to electrify the city railway system made it necessary to build a great generating plant, which, while meeting present needs, should be sufficiently elastic to keep ahead of future demands without tying up capital earlier than necessary. The White Bay power house, when complete, will have cost £1,000,000. The completed power house will burn 1,000 tons of coal per day, which is handled mechanically, while a suction system deals with the ashes. The plant utilises no less than 12,000,000 gallons of water per hour for condensing purposes. This is drawn from a deep level in White Bay, and discharged into Rozelle Bay. The turbine room, when completed, will house turbo-generators of 200,000-H.P. capacity. War and other causes have delayed the completion of the station, and it was not until last May that a full working equipment for ordinary operation was available. The output in KW.-hours in May was 4,926,828, with a maximum hourly load of 15,800.—*Sydney Morning Herald.*

Barrow-in-Furness.—Price Increase.—The T.C. has increased the charges for electricity as follows, from the last September meter readings:—Flat rate and demand system, by 10 per cent.; prepayment meters, flat rate, to 4½d. per unit, plus 30 per cent.; prepayment meters, demand system, fixed charges to be advanced by 2d. per week.

Bradford.—Mains Extensions.—The E.L. Committee recommends an application for power to borrow £2,809 to cover expenditure on mains extensions; the extension of the mains at Bowling Iron Works, including transformer chamber equipment, at a cost of £1,230, has been authorised.

Brighton.—New Plant.—The T.C. has adopted a report of the E.L. Committee recommending that an order be placed for a 4,000-KW. generating set, at a cost of £30,424.

Price Increase.—The Corporation has increased the charges for electricity for lighting to a flat rate of 7d. per unit.

Continental.—Germany.—The Railway Administration at Frankfort has erected a power station, using as fuel the "culm" or dust constituted by particles of coal driven from the fire-box into the smoke-box immediately under the funnel. These particles, which are only partially burnt and coked, give a fuel similar to dross coke, and of 3,000 to 4,000 calories. The engine room of the station includes two sets of steam turbines, and generates three-phase current at 6,600 volts. It greatly relieves congestion at the city electricity works. The cost of generating in this way is low, and results in a considerable saving to the railway authorities.

The *Vossische Zeitung* says that owing to lack of coal the municipal electricity works at Cassel have discontinued the supply to factories and other works. Railway traffic in the district has been completely stopped.

Poland.—The Polish Electrical Co. has been organised at Kielce to construct and exploit new and existing electric power stations in towns and districts. Prominent landowners, industrialists, and engineers are the founders.—*Glos Narodu.*

Falkirk.—Fuel Wastage.—Speaking at a public meeting last week, Councillor Logan referred to the waste of coal in Falkirk. The Corporation electricity works was unable to supply power for all the manufacturing concerns in the town, and the Coal Board Officer, having taken a census of the coal used for power purposes, found that one-half of the concerns in the town were making their own electricity, and using 15,000 tons of coal per year, while the other half were supplied by the Corporation, which used only 5,500 tons annually.

Hereford.—Loan Sanction.—The T.C. has received sanction to a loan of £9,894 for further sums spent in connection with the supply of electricity to a new Government factory.

Ilford.—Extensions.—Messrs. Hughes & Sons have applied to the T.C. for the electric supply mains to be extended to their works at Hainault.

Leeds.—Loan Sanction.—The Electricity Committee has received the sanction of the L.G.B. to the borrowing of £23,330 for the purchase of a 6,000-KW. turbo-alternator and condensing plant, &c., at the electricity works, on condition that £16,670 (less any sum realised from the sale of the superseded plant) be defrayed out of current revenue.

London.—Marylebone.—The Council is seeking power to increase its charges for electricity.

E.L. Charges.—The B. of T. has substituted for the rates prescribed for general electricity supply in the City of London E.L. Order, 1899, the rate of 6d. per unit for one year from October 1st last.

The County of London E.S. Co. has given notice of a further increase in the charges for electricity for lighting purposes of 15 per cent., making 45 per cent. over pre-war charges.

Islington.—Price Increase.—From the commencement of the Christmas quarter the charges for electricity supplied by the B.C. are to be advanced as follows:—Energy sold at 1d. per unit or under, by 50 per cent. (making 100 per cent. on pre-war charges); energy sold at above 1d. per unit, by 16⅔ per cent. (total increase, 50 per cent.); public lighting by ½d. per unit, making the present charge 2½d.

Manchester.—Extensions.—At a meeting of the Corporation, last week, it was stated that it might be necessary to start the scheme for the extension of the electricity works at Barton sooner than was intended, and a clause is to be inserted in the Bill, to be promoted next Parliamentary session, for authority for the E.L. Committee to use the water from the Ship Canal at Barton.

Marsden.—Proposed E.L.—The U.D.C. has decided to meet a representative of the Electrical Distribution of Yorkshire with regard to the application of the company for a prov. order to supply electricity within its area.

Newcastle-on-Tyne.—E.L. Charges.—The B. of T. has informed the Corporation that it is not prepared to reduce the maximum charges which the E.L. companies are allowed to charge. In a report on the matter, the Parliamentary Committee states that no further steps can be taken, and meanwhile instructions have been given for the accounts of the companies to be inspected from time to time by the City Treasurer.

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Newcastle-under-Lyme.—Price Increase.—The T.C. has agreed to the recommendation of the Electricity Committee that, as from October 1st last, the war advances on lighting and power charges be 50 per cent.

New Zealand.—The importance of the Electric Power Board's Bill to agricultural and pastoral interests in New Zealand was the subject of a recent address before a Conference of the New Zealand Council of Agriculture by the President of the Southland League. He stated that the Electric Power Boards Bill, which had already been laid upon the table of the House of Representatives by Sir Joseph Ward, was drafted with two objects in view: first, to make it possible for a Board elected by the ratepayers to generate electric power and distribute it within any district not coming within the scope of any existing or contemplated Government scheme; and, second, to purchase electrical energy from the Government or other available source and distribute it within a defined area. Such a measure would make it possible for farming districts to have equal facilities with the towns so far as electrical energy was concerned. It would also eliminate the present tendency—due to the electrification of the towns—for the people to drift into them from the country.

Provision was made whereby the Board might supply power to consumers within the boundaries of an "outer area" at special rates, and—with the approval of the Governor-General—two or more districts might "link up" their systems or amalgamate their undertakings, to their mutual advantage. A resolution was passed by the Conference urging the necessity for a State hydro-electric scheme.

Plymouth.—Price Increase.—The E.L. Committee has increased the charges for electricity, from October 1st last, by ½d. for lighting purposes, making 4½d. per unit, and by ½d. per unit for power.

Salisbury.—Price Increase.—The E.L. Co. has increased the price of electricity, from October 1st last, by a further 10 per cent., with a maximum of 8d. per unit.

Silsden.—Proposed E.L.—By the casting vote of the chairman, the U.D.C. has decided not to entertain the overtures made by the Yorkshire E.P. Co. for the discussion of lighting projects.

Skelmanthorpe.—Prov. Order.—The U.D.C. has approved the application of the Electrical Distribution of Yorkshire for a prov. order to supply electricity within its area.

St. Helens.—Price Increase.—The Electricity Committee has increased the charges for energy for lighting and power by a further 20 per cent.

Warrington.—Year's Working.—The income of the Corporation electricity department for the past year was £50,334, and the expenditure £35,904, leaving a gross profit of £14,430, compared with £12,626 in the previous year. The net profit was £5,024, against £4,171, and this favourable result was largely due to the enhanced price received for motors and fittings. A sum of £2,000 was appropriated for relief of the rates. The total capital expenditure to date is £146,710, and the debt outstanding, £105,942; the reserve fund amounts to £11,000, and the sinking fund to £11,125.

York.—Price Increase.—The Electricity Committee recommends that the price of electricity be advanced to 50 per cent. above pre-war rates.

TRAMWAY AND RAILWAY NOTES.

Australia.—Queensland.—A Bill has been introduced in the Legislative Assembly providing for the purchase of the Brisbane tramway undertaking by the Government, and its subsequent control by the municipal authorities.

Barrow-in-Furness.—Unsatisfactory Service.—The Corporation has arranged for a deputation to meet the B. of T. respecting the unsatisfactory tramway service in the town, and Messrs. Vickers and the Tramway Co. have been asked to send representatives to the meeting. The Corporation has instructed the Parliamentary Committee to consider the promotion of a Bill authorising the Corporation to run a motor-bus service.

Batley and Birstall.—Unsatisfactory Service.—The local Chamber of Commerce and the Tradesmen's Association are to wait upon the Yorkshire (Woollen District) Electric Tramways Co. to express their dissatisfaction with regard to the service and fares on the company's system.

Birmingham.—Wages.—The Committee on Production has awarded an increase of 3s. 6d. per week to Corporation electricity and car-shed employés over 18, and 1s. 9d. to those under 18. Non-certified department workers are to receive 5s. per week if over 18, and 2s. 6d. if under 18: the award in connection with the traffic department of the tramway undertaking has been deferred pending the national movement between the National Transport Workers' Federation and the Municipal Tramways Association.

Bradford.—Accident Claims.—The compensation claims arising out of the recent tramway accident at Allerton, by which a driver lost his life and a number of passengers received injuries, have been settled. There were 22 claims, and the total amount of allowances was £1,237.

Parcel Service.—The Traffic and Fares Sub-Committee recommends that the advance of 25 per cent. in parcel rates on the tramways, sanctioned by the T.C. on October 10th, 1916, be increased to 50 per cent.

Bristol.—The Corporation has referred to its Docks Committee a suggestion that the railway companies, the Road Board, and the Corporation should construct a tunnel suitable for rail and road transport under the River Avon between Avonmouth and Portishead.

Continental.—Austria.—An advertisement of the Austrian Siemens-Schuckert Werke gives some particulars of the new railway line from St. Pölten to Mariazell. It is 91·3 km. long and of 760-mm. gauge. The greatest gradient is 27 per cent.; the pressure of the line conductor is 6,000 volts, at 25 cycles per second. The weight of the locomotives used is 47 tons, and each is fitted with two 250-H.P. motors. The normal speed is 35 km. per hour, and the normal tractive effort of each locomotive 3,800 kg.

It may interest our readers, says the *Scientific American*, to learn that the Vienna tramway conductresses are dressed from head to foot, including their boots, in paper.

Switzerland.—It is reported in the daily Press that a strike of tramway servants is in progress at Geneva.

Glasgow.—Skip-stop System.—The Tramways Committee, for the purpose of economising power, has adopted the skip-stop system on certain quiet routes.

Hull.—Year's Working.—There was a gross surplus of £41,297 on the working of the Corporation tramway department for the year ended March 31st last, the income being £188,219 and the expenditure £146,922. Passengers carried numbered 63,089,709, and 4,124,851 car-miles were run. In the previous year the respective figures were:—Surplus, £43,411; income, £164,190; expenditure (not including payments to employés with H.M. Forces), £120,779; passengers, 54,125,213; and car-miles, 4,200,426. The working expenses included traffic expenses, £70,004 (4·07d. per car-mile); general expenses, £13,592 (·79d. per car-mile); repairs and maintenance, £37,114 (2·16d. per car-mile); power expenses, £17,740 (1·03d. per car-mile); and allowances to employés with the Forces, £8,470. Interest on loans amounted to £17,820; loan instalments to £16,150; £3,069 was contributed to the borough funds, and £8,751 to the reserve fund.

Ilford.—Electricity Charges.—The Electricity and Tramways Committees, at a joint meeting, decided that electricity supplied for traction purposes, for the year ended March 31st last, be charged for at 1⅛d. net per unit.

London.—A decorated tramcar, lent by the L.U.T., was used as a travelling bank at Ealing and Acton this week in connection with the War Loan campaign.

At Brentford on Saturday night a L.U.T. tramcar failed to take the points and was derailed.

Paisley.—E.S. Failure.—Owing to a breakdown at the electricity works on Thursday, last week, the Paisley and district tramway service was held up for several hours; later, energy was obtained from the Clyde Valley Co., and the cars were able to return to the depôts.

Reading.—Year's Working.—The accounts of the Corporation tramways for the year ending March 31st last show a net capital expenditure of £230,789, against £231,629 last year. The revenue was £44,597, against £56,797, and the expenditure £38,874, against £48,397, leaving a net surplus for the year of £5,723, against £8,400 last year; £1,723 was put to the reserve fund, which now stands at £24,122, and £4,000 went to the relief of rates. The sinking fund stands at £80,183. The passengers carried during the year numbered 10,919,533, a decrease of 2,852,065; the units generated were 1,299,968, a decrease of 101,992, at a cost per unit of 1·38d., against 1·53d. last year.

St. Helens.—Tramway Lease.—The Corporation is negotiating with the Tramway Co. for an extension of the lease for five years.

Stockton-on-Tees.—Proposed Purchase.—The T.C. has decided to co-operate with Thornaby in the purchase of the part of the Middlesbrough, Stockton, and Thornaby tramway undertaking within the borough, and suggests that, in regard to the division of the expenditure and income, the proportions should be: Stockton, three-fourths; and Thornaby, one-fourth.

Turkey.—It is stated that Damascus—the oldest city in the world—was the first city in Turkish territory to have electric tramways and lighting.

Wigan.—Overcrowded Cars.—No tramway car should be carrying 82 passengers when 46 is the proper number, said the coroner at an inquest on a girl who fell from a workmen's car and was killed.

York.—Increase of Fares.—The Tramways Committee recommends that application be made to the B. of T. for powers to advance the tramway fares by 50 per cent.

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TELEGRAPH AND TELEPHONE NOTES.

Italian Wireless Press.—An Italian Wireless Agency has been incorporated for the distribution of news to the Oversea Press. Four steamship companies, two banks, and the Ansaldo Co. are among the shareholders of the new corporation, which will start business the moment the war ends and the Government releases the wireless stations.

Japan.—Owing to a severe storm, telegraph cables and wires to Japan have been almost completely interrupted, and telegrams from Shanghai take four days to reach Tokio.

Panama.—The *Wireless World* records the establishment of a new wireless station at Balboa, at the entrance to the Panama Canal, from which time signals are radiated.

The Poulsen System.—According to *The Steamship*, the U.S. Government has paid the Poulsen Wireless Co. £350,000 for the existing wireless plants of the Poulsen Co. in America, and the right to use the Poulsen patents on all Government wireless stations as well as vessels of the U.S. Navy and ships of the Emergency Fleet Corporation. The high-power plants in the Philippine Islands and Sandwich Islands are equipped with the Poulsen apparatus. The 2½-kw. stations, it is said, have a radius of 1,000 to 1,200 miles. The manufacture of these arc sets of small power for ships and local use has now been made possible on a commercial scale. Formerly the commercial production of arc sets was restricted to high-power plants.

Trunk Telephone Delay.—The Postmaster-General states that, owing to the great number of naval, military, and other calls of national importance entitled to priority on the telephone trunk lines which are now made from London, it is impossible to estimate with any degree of accuracy the amount of time which will elapse before particular private calls can be effected or to give subscribers any reliable information on the subject.

United States.—Mr. Theodore Vail, president of the American Telephone and Telegraph Co., announces the completion of a satisfactory arrangement with the Government for the war-time control of the telegraph and telephone lines. The allowance made by the Government covers fixed charges and dividends at current rates on outstanding stock, or any which may be issued. The allowance, it is expressly stated, is not to be the basis for a valuation of the properties.—*The Times.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Queensland. November 29th. Electric lifts for the Department of Public Works, Brisbane.—*Industrial Australian and Mining Standard.*

Bedford.—November 13th. Two water-tube boilers, mechanical stokers, and induced-draught plant for the Corporation. See our advertisement pages October 4th.

Portsmouth.—October 15th. Tramways Committee. Six months' supply of stores, including various electrical items. See "Official Notices" September 27th.

South Africa.—Johannesburg.—November 27th. Municipal Council. 2,000 copper ribbon bonds, and 2,000 copper solid bonds (Contract No. 424). A copy of the specification can be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence), London.

Stockton-on-Tees.—October 12th. Electrician's work at new maternity home. Borough Engineer, Victoria Buildings.

Warrington.—October 22nd. Water-tube boiler, for the Electricity Department. See our advertisement pages October 4th.

CLOSED.

Australia.—P.M.G.'s Department, Queensland :—
Telephone material, £67.—Western Electric Co. (Aust.), Ltd.; do. £69.—B. I. & Helsby Cables, Ltd.

Commonwealth Naval Dockyard :—
Two Igranic automatic starting panels for 450/550-b.h.p. motors, £1,232; one do. for 60-b.h.p. motor, £139; two do. for 3-b.h.p. motors, £61; two do. for 7-b.h.p. motors, £68; one set of spares, £37.—Noyes Bros. (Sydney), Ltd.

Melbourne.—Electric Supply Committee :—
Six 200-amp., 6,600-volt switches, £330.—Electric Equipment Manufacturers, Ltd.; 200 10-amp. a.c. meters, £360.—Australian General Electric Co.

Electricity Department :—
1,000 condenser tubes, £712.—John Danks & Sons, Pty., Ltd.

Commonwealth P.M.G.'s Department :—
Automatic telephone material for New South Wales, £626.—Automatic Telephones (Aust.), Ltd.

Victorian Railways Department :—
Electric meters for power signalling.—Warburton Franki, Ltd.

Commonwealth Railways :—
Cells for lighting equipment, Port Augusta, £648.—M. C. Coates.

Victorian State Coal Mine :—
Electric flat irons, 20s. each.—Australian General Electric Co.
—*Tenders.*

Belfast.—Electricity Committee :—
Two 6,000-kw. turbo-alternators with condensing plant, &c., and one 300-kw. balancer booster, £74,839.—British Thomson-Houston Co., Ltd.
Four 48,000-lb. water-tube boilers, &c.; four fuel economisers, and two steel chimneys, &c., £82,516.—Stirling Boiler Co., Ltd.
Two electrically-driven boiler feed pumps, £1,566.—Holden & Brook, Ltd.
Accumulators, £4,414.—Tudor Accumulator Co., Ltd.
Rotary converters, £30,613.—Vickers, Ltd.
Static transformers, £9,162.—Siemens Bros., Ltd.
—*Belfast News Letter.*

Barrow.—T.C. Contracts placed in connection with electricity extensions :—
Chequerplates and iron work for turbo-alternator foundations.—Babcock and Wilcox, Ltd., £39.
Feed tank.—Frederick Braby & Co., Ltd., £95.
Wrought-iron pipes and fittings.—Messrs. John Spencer, Ltd., £55.
Cable to turbo-alternator.—B.I. & Helsby Cables, Ltd., £91.
Glazed bricks and tiles.—Leeds Fireclay Co., Ltd., £42.
Alterations and additions to e.h.t. switchgear for turbo-alternator.—B.T.H. Co., Ltd.—£474.
Three ironclad e.h.t. switch panels.—Ferranti, Ltd., £460.
Cables for supply to permanent houses.—B. I. & Helsby Cables, Ltd., £1,205.
Meters.—General Electric Co., Ltd., £467.

Bradford.—Tramways Committee :—
Dick, Kerr & Co., Ltd.—One pair of special traction motors.
Cole Marchent & Morley, Ltd.—60 tons of brake shoes, at 5 per cent. advance on previous price.
Hadfields, Ltd.—Point fittings, &c., £73.
Clay & Atkinson.—Parts of automatic point controllers, £54.
Electricity Committee :—
Clay Cross Co., Ltd.—Cast-iron water pipes for Nos. 5 and 6 turbo-generators for Valley Road works.
Heenan & Froude, Ltd.—Three wet air filters.
Bertram Thomas.—One auxiliary switchboard for transformer chamber.

Ilford.—The U.D.C. has placed an order with the makers of its "Orwell" wagons for an electric tipping gear, at £50.

Leek.—U.D.C. Electricity Committee. Twin cylinder gas engine. National Gas Engine Co., Ltd.

Luton.—T.C. T. & E. Neville, £4,297. Extension of electricity station buildings.

South Africa.—Johannesburg.—T.C. :—
One 500-kw. d.c. generating set, and one 400-kw. do.—Langlaagte Estate and Gold-mining Co., Ltd., £6,000.

Cape Town.—Messrs. Edward A. Shaw & Co. Wiring for electric lighting and bells of "Leeuwenhof," the Cape residence of Mr. Isaac Lewis, of Messrs. Lewis & Marks, Johannesburg, £484.

Stratford.—T.C. Electricity and Tramway Departments: Doulton & Co., 750 yd., 3½-in. diam., 4-way Doulton conduits, 7s. 2½d. per yd. net; 450 brown glazed stoneware tile covers, stamped "electricity," 5d. each net.

Stepney.—Electricity Committee :—
E. Foster & Co.—10,904 tons of coal, at from 28s. 2d. to 29s. 7d. per ton.
A. Blackman & Co.—2,000 tons of coal, at 28s. 11d. per ton.
Rose, Smith & Co.—250 tons, at 26s.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, October 11th. At 8 p.m. Smoking Concert. At the Holborn Restaurant, Venetian Chamber.

Association of Engineers-in-Charge.—Saturday, October 12th. At 7.30 p.m. At St. Bride's Institute, E.C. Address on "Fuel Economy," by Mr. D. Wilson, Technical Adviser to the Coal Controller of the B. of T.

Birmingham and District Electric Club.—Saturday, October 12th. At the Swan Hotel, New Street, Birmingham. At 7 p.m. Paper on "Some Modern Applications of the Gyroscope," by Mr. H. F. Stevenson.

North of England Institute of Mining and Mechanical Engineers.—Saturday, October 12th. At 2 p.m. At Neville Hall, Newcastle-on-Tyne. General meeting.

Manchester Association of Engineers.—Saturday, October 12th. At 6.30 p.m. At the Grand Hotel. Presentation of the Constantine Medal to Mr. C. A. Edwards, for his paper on "The Hardening and Tempering of Steel," and inaugural address by the President, Mr. J. Butterworth.

Institution of Electrical Engineers (Western Centre).—Monday, October 14th. At 7 p.m. At the Merchant Venturers Technical College, Bristol. Address by the Chairman, Mr. H. I. Rogers.

Junior Institution of Engineers (North-Eastern Section).—Tuesday, October 15th. At 7.15 p.m. At the Mining Institute, Neville Street, Newcastle-on-Tyne. Discussion on "The Coal Conservation Sub-Committee's Report," to be opened by Mr. M. Ward.

Electrical Power Engineers' Association (Sheffield and District Section).—Wednesday, October 16th. At the Royal Victoria Station Hotel, Sheffield. At 6.45 p.m. Address by the President and one of the Vice-Presidents of the Association on "Present Activities and Progress of the Association."

Industrial Reconstruction Council.—Wednesday, October 16th. At 4.30 p.m. At the Saddler's Hall, Cheapside, E.C. Address on "Principles of Reconstruction," by the Rt. Hon. Christopher Addison, M.P., Minister of Reconstruction.

Institution of Mechanical Engineers.—Friday, October 18th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. General meeting.

Corrosion by Earth Currents of Electric Railways.—The corrosion of gas and water pipes and of the sheaths of cables has given considerable trouble in Switzerland, and on this account a joint committee of the Swiss Gas and Water Institute, the Institute of Swiss Secondary Railways, and the Swiss Electrotechnical Institute was formed to inquire into and report upon the matter. The first report of the committee has now been issued.—*Bulletin, Schweizerischer Elektrotechnicher*, July, 1918.

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AN URGENT APPEAL TO ALL.

We have occasionally appealed to our readers on behalf of certain funds connected with the electrical and allied trades. Such appeals have been responded to heartily when the justice of the appeal has been realised. During the war we have opened our columns to make known the claims of some funds not exclusively electrical—assisting Belgian refugees, our blinded heroes, the orphans of France, and others who have been made the victims of the Prussian monster. We believe that the sufferings of these have gone home to the heart of every son of British Liberty.

To-day we make no apology for bringing before the notice of everybody who reads these lines the pressing need that exists for a full and free flow of generosity for the replenishing of the coffers of an organisation which has no equal throughout the world—the British Red Cross Society.

It is believed that the citadel of Prussian militarism is tottering to its fall, but with the coming of peace there cannot come a termination of Red Cross activity. Everybody has somebody with the fighting Forces to-day—it may fall to the Red Cross organisation to bind up his wounds, to pour in the oil and wine, to save his life, and ultimately restore him to family and home. He may already be in a hospital in Blighty under Red Cross care. Perhaps he is suffering pain and hardship in the slavery that stamps Germany as hell for ever in the mind of the Prisoner of War; the Red Cross—the only angel of mercy that can help in such a case if the Government fail—steps in to furnish food and clothing, warding off starvation and death and ameliorating suffering, maintaining life and brightening it with rays of hope until the day of rapturous freedom. £40,000 a week is expended by the Red Cross on Prisoners of War work alone. This year £1,500,000 has been spent thus. And in scores of other ways this organisation is spending its energies as "The Greatest Mother on Earth."

We have no need to continue the story or to elaborate its details. Everybody must know of the splendid service that it is rendering wherever our men are fighting and suffering on our behalf. It is not a charity in the ordinary sense. It cannot come to any of us as other than a great National Obligation—to most it comes nearer still as a personal one. We make no apology, therefore, in commending it to the most generous sympathies of all our readers who, we trust, will prepare for "Our Day" in the City of London. If the funds are not forthcoming somebody must suffer—perhaps your boy, your brother—between now and the cessation of hostilities, or after the shudders of war have ended, when the streams of generosity may flow less freely. Therefore, between now and October 24th we trust that the electrical trades, not to be outdone by others of the 60 trade and professional sections of this wealthy metropolis who are co-operating in the movement, will do their utmost in response to the Lord Mayor of London's City Appeal. Small sums from the coppers of the office boy, large sums of the order of £10,000, all are required to build up the million pounds that are asked for.

Contributions towards this City Million should be sent to Major Rothschild.

NOTES.

Enemy Aliens.—The American Institute of Mining Engineers has decided to remove the names of all enemy aliens from the roll of membership. This action will affect the position of 21 Germans and one Austrian.

Aluminium in Germany.—According to an article in *Nature* on "German Industry and the War," before the war Germany was almost wholly dependent on foreign supplies of aluminium; in 1913 she consumed about 12,500 tons, of which 10,000 tons was imported. The exportation of French bauxite being forbidden, Germany had to find other sources of the material; bauxite deposits were discovered in Hungary and Carniola, and works were established which rendered the Central Powers independent of foreign supplies. The manufacture of aluminium is now an established German industry.

Institution and Lecture Notes.—Manchester Association of Engineers.—The following is the syllabus for the 1918-19 session:—

October 12th.—Inaugural address by the president, J. Butterworth.
October 26th.—Paper by A. F. Baillie, "Fuel Oil and its Applications."
November 9th.—Paper by W. F. Rhodes, "Workshop Measurements, with Special Reference to the Limit System."
November 23rd.—Paper by W. H. Atherton, "Conveyors in Relation to Engineering Works."
December 14th.—Paper by J. E. Hurst, "Wood Testing."
January 11th.—Paper by J. Bibby, "Iron and Steel Electric Furnaces."
January 25th.—Topical discussion: "The Past, Present, and Future of Electricity Supply." Introduced by S. L. Pearce and J. A. Robertson.
February 8th.—Paper by G. H. Hey, "Principles in Jig and Tool Design."
February 22nd.—Paper by Prof. C. A. Edwards, "Hardness Determination of Metals."
March 8th.—Paper by H. E. Thomas, "Automatic Machines."
March 22nd.—Annual meeting. Paper by B. Taylor, "Development of Reinforced Concrete."

Institution of Electrical Engineers.—The Committee of the Western Centre has issued its report for the session 1917-18. Owing to war conditions, it was considered advisable to restrict the programme to two meetings. The membership now stands at 276, an increase of 13.

The first ordinary meeting of the session will be held at Bristol on Monday next, October 14th, when the chairman, Mr. H. I. Rogers, will deliver his inaugural address. Other arrangements for the session are as follows:—

November 11th.—Cardiff. President's address.
March 31st.—Bristol. Annual meeting.

Textile Institute.—At the ninth annual congress of the Textile Institute, held at Bradford on Friday last, Prof. Charnock, of the Fuel and Metallurgy Department of the Bradford Technical College, lectured on "Economic Power Production," and made reference to the advent of electrical transmission as contrasted with the use of steam. He emphasised the urgency of economy in fuel consumption as a general principle, irrespective of the immediate war-time need, and showed the huge wastage of heat value involved in the processes of converting heat into work. The proposal to establish combined electricity and heat generating stations was not new, he said, but it deserved far more attention than it had yet received. It was reasonable to assume that a considerable gain would be obtained by centralisation and working on a large scale. Better methods of domestic heating were greatly needed, and the abolition of the smoke nuisance urgently demanded attention. The reports on "Electric Power Supply" involved a scheme which many people regarded as highly Utopian, but he suggested that if it could be shown to be possible of realisation in its main elements, the issues involved were of such supreme importance to the whole nation, that it should receive the sanction and support of the entire community. The question should be carefully considered and discussed by every technical society in the country, so that when any action dealing with the subject was proposed in Parliament, public opinion might make itself felt in no unmistakable manner. It should always be borne in mind that the main object was the utilisation of the fuel supplies to the best all-round advantage.

Dr. Crowley said that all who investigated the matter were agreed that the existing parochial system of local generation and supply was hopeless, and the only proper method, on technical grounds, was by way of large centralised stations dealing with the whole of an area in a comprehensive manner. The point aimed at was to provide a cheap supply of electricity for as many as possible, and not necessarily to produce a cheap supply at any particular point.

At another stage of the congress Mr. J. W. Sanderson, M.A., headmaster of Oundle School, speaking on "Science and Educational Reconstruction," urged that each big school should be equipped with complete chemical, engineering, and biological laboratories and workshops, and the pupils should gain familiarity, before leaving school, with electrical appliances and units. This applied to both the public and the elementary schools.

Electrical Power Engineers' Association.—A smoking concert in connection with the Midland Division will be held at the Imperial Hotel, Temple Street, Birmingham, on Wednesday, the 16th inst., the chair to be taken at 7.30 p.m. All engineers interested will be cordially welcomed. The membership of this Division is still increasing rapidly, new members having been admitted during the past few months at the rate of about one per day.

At a meeting of the Railway Club, on Tuesday last, Mr. E. W. C. Kearney described his proposed system of tube railways, which, operating on the switchback principle, would enable a speed of 60 miles an hour to be attained and save 85 per cent. of the energy now expended in the motors and brakes.

New Industrial Works in Canada.—The *Times* Toronto correspondent reports that 20 industrial concerns are planning new factories at Montreal.

Leakage Current Detector.—The Siemens-Schuckert Works has patented a device for detecting leakage currents in the earth. According to *E.T.Z.* of July 25th, the device consists of two metal plates that are strapped under the boots of the observer and are connected to a battery and switching arrangement carried on a waistbelt and connected to a head telephone receiver. When the observer walks about in the neighbourhood where earth currents are flowing he is able to detect them at distances from 10 to 20 metres from the poles carrying the conductors. The direction of flow of the current is determined by the fact that the telephone becomes silent when the observer's feet are at right angles to the direction of the flow of the current, and gives the loudest indications when the feet are in the direction of the flow of the current. The circuits are able to carry 30 amperes continuously and 40 amperes for short times.

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Nomenclature for Electric Ship Welding.—Under the auspices of the Electric Welding Branch of the Education and Training Section of the U.S. Shipping Board, Emergency Fleet Corporation, a series of discussions has been held by the Engineers' Club of Philadelphia. The first of these relates to the nomenclature of the art, and is reported in the September issue of the *Journal* of the Engineers' Club. An instruction chart has been drawn up, covering the various types of weld, the material employed, &c., and providing a standard symbol for each item; thus a strap joint is denoted by a small circle, a butt joint by a square, a lap joint by an equilateral triangle, and a fillet by the latter inverted. Similarly, the design of the weld, such as single or double v or bevel, its position, the kind of weld—tack weld, caulking weld, &c.—and the finish of the weld, are all furnished with symbols, so that it is possible to specify all the particulars necessary to guide the welding operator by means of a group of hieroglyphics such as the following :—

which means that the edges of two plates are vertically (v) butted (□) together, their edges being prepared with a double v (×), and that the joint is to be a "strength weld" (8) with at least three (3) layers of welding material applied from each side, and furnished with a reinforced or convex (⌒) surface, thereby making the thickness of the weld greater than that of the plates.

With the aid of this code, which has been found indispensable, a drawing can be quickly prepared for the welder, the full instructions for each joint taking up a trifling amount of space compared with that necessary to accommodate a written specification.

In the same issue of the *Journal* is printed the second lecture on "Electric Welding," describing the various methods of welding, and the tools employed. It is interesting to note that spot-welding has been found capable of joining in one operation as many as three 1-in. plates; but the extent to which the process can be commercially applied in shipbuilding has not yet been determined. Views are given of the equipment of a school for arc welding operators, established by the Emergency Fleet Corporation.

Vickers's Peace Preparations.—In the course of his speech at the adjourned annual meeting of Vickers, Ltd., on Tuesday last, Mr. Douglas Vickers, the new chairman, said that his references to the company's Peace proposals at the last meeting had been widely circulated (see Elec. Rev., May 10th, 1918, p. 433). They had actually received suggestions from the United States as to the best way to develop their peace resources. The company expected to get a very largely increased output of ships, railway materials, motor-cars, turbines, electrical materials, gas engines, wood products, sewing machines, and electrical work generally. Their type of sewing machine had been reported upon very satisfactorily, but in the case of developing a business of that character a great deal more capital was required in order to carry the heavy stocks which had to be held at the works and showroom. If the Government ordered a gun from them they sometimes got a deposit with it. But if anybody wanted to buy a sewing machine they did not order it from the manufacturer; they wanted to buy it at once out of stock. In addition they would have to go a good deal further afield in the search for work in the nature of electrical and railway material. And in going further afield they would get into one where the conditions of payment were not quite what they had been accustomed to in this country. Quite probably they would have to do a good deal more in financing undertakings, and they might have to join with banks in doing so, out of which they hoped not only to get a return on the work done, but also a return upon their financing arrangements. The Germans had made a good deal of that form of trade, and it was to be hoped that we should not leave the field to them in the future.

The V.D.E.—The Verband Deutscher Elektrotechniker recently celebrated in Berlin the 25th anniversary of its foundation.

Comparison of Capacities.—In a note from the Westinghouse Research Laboratory by Dr. P. Thomas, published in the *Journal* of the Franklin Institute for September, a novel method of comparing two capacities is described, for which the author claims an exceptional degree of accuracy and convenience. The principle is that of discharging two condensers—one of known capacity, the other to be measured—through a galvanometer in rapid succession and in opposite directions, and adjusting the voltages on the capacities until balance is indicated by zero deflection of the galvanometer. To effect the necessary changes of connections a simple rotating commutator is used, and the voltages are adjusted by taking them off a potentiometer resistance, through which current flows from a battery. When balance obtains, $C_1 R_1 = C_2 R_2$; a correction for the capacity of the leads is easily determined. The method, says the author, is very easy to use, and its sensitiveness is limited only by the current sensitivity of the galvanometer. Neither voltage nor speed enters into the equation giving the result.

Protest against Employment of Unskilled Electrical Men at Melbourne.—Representatives of the Electrical Trades Association waited on the Minister of Railways in July to protest against the employment in the department on electrical work of men who had only received a few weeks' training. It was pointed out that this work could only be efficiently done by skilled electricians, and cases had occurred in which the work of the unskilled man had been condemned and had to be done over again. It was asked that the policy of the Government should be that only skilled tradesmen should be employed. Mr. Barnes said that as far as he was personally concerned, he would not like to see this practice encouraged. He believed it was best in the long run to employ the skilled artisan. He promised to inquire into the matter and discover to what extent the practice prevailed. Either there was very little to learn in electrical work or that done in the department was inefficient.—*Melbourne Age.*

Electric Pig-Iron in British Columbia.—Pig-iron is now being cast from electrically-operated furnaces in several parts of British Columbia, and the experiment has proved a great success. One firm with electric furnaces has received orders amounting to 2,000 tons of pig-iron, a large proportion of which is intended for Japan.

A New Canal in France.—Particulars are given in *Le Génie Civil* of a project for the construction of a canal giving direct communication between Paris and the sea at Dieppe. The idea was first mooted by Vauban in 1694, and has many times been revived; it is regarded as of present importance in view of after-war conditions. The Seine does not suffice to deal with the traffic, and there have been as many as 70 ships in the estuary awaiting their turn to enter Rouen, besides 1,300 barges awaiting their turn to leave.

The canal is designed to accommodate the largest boats at present traversing the French waterways, which carry 1,400 tons and are 88 m. in length, with a draught of 3 m. when loaded. The barges are to be hauled by electric locomotives running on a track alongside of the canal, or on a roadway. The canal would be 165 km. in length, as compared with the route by the devious River Seine, which is no less than 350 km. long (Paris to Havre).

Appointments Vacant.—Distribution engineer (£280) for the St. Helens Corporation electric supply department; shift engineer for the Stretford U.D.C. electricity works; shift engineer (60s. to 75s.) for the Eccles Corporation electricity works; charge engineer (85s.) for the South Shields Corporation electricity department: a professor of physics (£800) is required for the University of Cape Town, also a lecturer for the Department of Physics at the South African School of Mines and Technology at Johannesburg (£450), See our advertisement pages to-day.

Electrical Phenomena Illustrated in a New Manner.—According to the *Electrical Review*, Chicago, motion-picture films are recommended by Charles F. Bishop, of Rochester, N.Y., for the purpose of illustrating such phenomena as are inherently invisible in character, or otherwise difficult to demonstrate in actual visible form. Where electric circuits are involved, he uses parallel lines for representing each conductor, and partly fills in the space between these lines when he wants to picture the flow of current. Likewise he uses parallel lines of varying density to indicate different degrees of magnetisation.

For example, in our illustration (taken from U.S. Patent

Fig. 1.

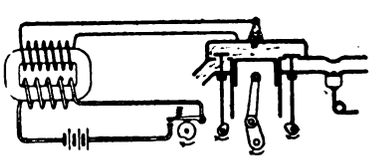


Fig. 2.

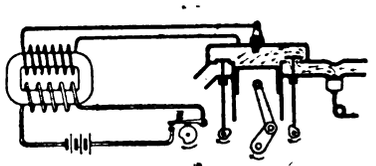


Fig. 3.

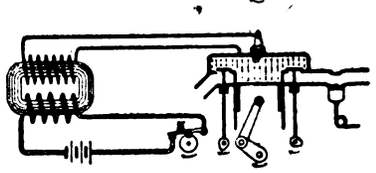
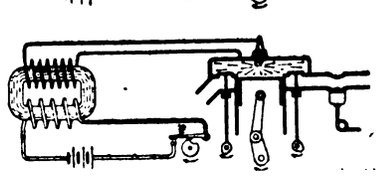


Fig. 4.



1,270,369, which was assigned by Mr. Bishop to the North-east Electric Co., of Rochester, N.Y.) fig. 1 shows the ignition circuit of an internal-combustion engine as it appears when the engine is exhausting, and fig. 2 shows the circuit to be equally inoperative during the intake of the engine. Fig. 3 shows the gaseous charge of the engine as compressed and the battery circuit closed through the transformer forming part of the ignition apparatus, thus magnetising the core of the transformer. Finally, fig. 4 shows the secondary circuit as discharging at the spark plug, while the magnetisation of the transformer core is diminishing. In practice, intermediate views could be shown, so as to illustrate the gradual transition.

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Volunteer Notes.—London Army Troops Companies, Royal Engineers.—Headquarters: Balderton Street, Oxford Street, W. 1.

Corps Orders No. 42, by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Captain of the Week.—Capt. W. Darley Bentley.
Next for Duty.—Capt. E. G. Fleming.
Sunday, October 13th.—Commandant's Parade, at Waterloo Station, 8.45 a.m., for work, "Pontooning," at Esher. Drill order. Greatcoats to be worn. Mid-day and tea rations to be carried.
Monday, October 14th to Friday, October 18th.—Drills as usual.
Sunday, October 20th.—Annual Musketry course at Pirbright. Parade at Waterloo Station, 8.45 a.m. Drill order, with pouches, rifles, and side arms. Mid-day and tea rations to be carried.

C. Higgins, *Capt.* R.E., *Adjutant.*

Ramsay Memorial Fund.—The Prince of Wales has accepted the position of patron of the Ramsay Memorial Fund, founded in November, 1916, to raise £100,000 as a memorial to the late Sir William Ramsay. The Committee has already raised £37,000, and subscriptions from oversea Committees will probably bring the total to £50,000. It is proposed to raise the remaining £50,000 by a million-shilling fund, now opened with a donation of 1,000 shillings from the Prince of Wales. Donations from 1s. upwards should be sent to the hon. treasurer, Lord Glenconner, at University College, London, W.C. 1.

Fuel Economy.—The following letters arrived too late for inclusion in our "Correspondence" columns:—

"I am pleased to note that you have published on page 328 of your issue of October 4th the order and programme announced officially by the United States Fuel Administrator for the standardisation of lamps and the elimination of carbon lamps in the interests of conservation of coal in the United States.

"It would be very desirable for the Board of Trade and the Fuel Controller to issue a similar order for Great Britain. Great Britain uses proportionately a greater number of carbon lamps than the United States does, and, therefore, the proportionate fuel economy to be secured by the elimination of carbon lamps in Great Britain makes such a programme even more important here than in the United States, where for a number of years past, special endeavours have been made to replace the inefficient carbon lamp by the more efficient metal-filament for ordinary economic reasons.

"Some such intelligent programme as this one announced in the United States would be certainly very desirable for the English authorities to announce in place of their present very general and rather crude request to turn out every possible light. Such general programmes are inefficient as compared with a definite, well-considered programme such as the United States authorities have put forward.

"Representing by 100 the consumption of carbon lamps, the saving to be gained by abandoning carbon and substituting metal-filament lamps of equal candle-power, therefore, runs from 65 per cent. to 75 per cent., as compared to a saving of about 35 per cent. to 25 per cent. by turning out metal-filament lamps on the English authorities' programme.

"It should be realised, of course, that the total economy in coal consumption with electric lighting is extremely small. If all the electric lighting in the country were turned off, and no more electric lights permitted, the total coal saving for Great Britain would not exceed 1½ per cent. to 2 per cent.

"As it is impossible to turn off all the electric lighting, and some light must necessarily be used, it is important that such a programme as the United States authorities have laid down should be put forward by the English authorities as well, and it is sincerely hoped that such a step will be taken. This programme goes directly to the root of the matter in pointing out that carbon-filament lamps are wasteful, and should be replaced by the more efficient metal-filament lamps, effecting a gain by such replacement for the same candle-power of 65 per cent. to 75 per cent. in one step.

"Where large candle-power lamps can be used, the substitution of the gas-filled or half-watt type lamps for the ordinary metal or other types of lamps, will effect still further gains, running all the way from 50 per cent. to 80 per cent. or 90 per cent.

"October 9th, 1918. "Atlantic."

"As a careful reader of the Electrical Review, may I be permitted the following commentary on the above subject, as dealt with by Mr. Ed. C. de Segundo in your issues of September 27th and October 4th?

"Considered merely from the point of view of domestic heating, the figures, as presented by Mr. de Segundo, would appear to indicate that, on a cost and efficiency basis, the coal ration, as compared with the 'equivalent' in gas, anthracite, coke, and electricity allowed under the Order, is the best and cheapest medium for heating. This, unfortunately, will be the conclusion arrived at by the majority of householders who have individually been given the opportunity to choose either the manufactured or raw material without, apparently, adequate guidance as to the bearing of their decision upon the question of national efficiency and economy.

"The determination of the 'equivalents' as allowed in Clause 7 of the Household Fuel and Lighting Order was, no doubt, arrived at in the light of a full knowledge of all the more salient factors—labour, transport, military, and political—but, in view of the relatively low gas and coke equivalents allowed, it is difficult to believe that the important bearing of this question upon the problems of adequate food production, the supply of fuel oils for the Navy, 'raw' materials for explosives and industry, and the repair of our highways, received adequate consideration. Had due consideration been given to these factors, it is incomprehensible that gas and coke, except for the purpose of enforcing due economy, should have been rationed at all.

"Allowing for a moderate coal consumption per unit delivered (5·5 lb.), Mr. de Segundo shows that in allowing 800 B.O.T. units of electricity to count as one ton of fuel, the Controller of Coal Mines has to provide the electricity supply works with two tons of coal, which, in the process of conversion, is completely destroyed. Assuming a steam consumption of 33 lb. per unit delivered (an unusually high figure), an average evaporation of only 6 lb. of steam per lb. of coal would, therefore, appear to be obtained from average quality coal used at electricity works.

"Now, in addition to the gas recovered from one ton of coal delivered to a gas works (about 12,000 cb. ft.), there remain the following secondary products:—10 to 11 cwt. of coke, 2 cwt. of breeze, 12 gallons of coal tar, as well as 24 lb. of sulphate of ammonia, of which 1,400,000 tons are required annually in order to ensure the adequacy of the world's harvests.

"Considered as steam-raising fuel, the net evaporative value of the combustible secondary products compared with that of average quality coal slack is as follows:—

	Net evaporative value per lb.	Total evaporation.
11 cwt. coke	9·8 lb.	11,093
2 cwt. breeze	6·0 lb.	1,344
12 gal. coal tar	14·0 lb.	1,558
		13,995
1 ton of coal slack ...	6·0 lb.	13,440

"It will be seen, therefore, that the combustible secondary products of a ton of coal carbonised at a gas works are approximately equivalent in net evaporative value to a ton of coal slack of average quality as consumed at electricity supply stations. In this connection the announcement on page 300 of the Electrical Review to the effect that arrangements have been made for the supply of 1,000 tons of coke per week to an important London power station is particularly interesting. Electricity generated from gas coke, or a blend of gas coke and coal slack of a kind useless for any other than fuel purposes, is a commodity quite different, from the standpoint of national advantage, to that generated by the complete destruction of coal capable of profitable treatment, as it largely is, either in coke ovens or gas retorts. The consumption of coal cannot at the present time be considered merely as a question of so many tons less or more, within limits, being consumed. The stern necessities of the present times demand that the greatest possible proportion of the coal used should be so consumed that its by-products may be available as carbonaceous solid fuel and as the bases of high explosives, fuel oil, and of artificial manures. It is hardly needful to point out that these are only obtainable by the carbonisation of coal, either in gasworks or coke ovens.

"E. W. L. Nicol,
"*Engineer and Fuel Expert,*
"October 9th, 1918. "*London Coke Committee.*"

British Oil.—The *Pall Mall Gazette* states that Lord Hartington will "open" on October 13th the first oil well sunk in the Chesterfield district. It is on the Duke of Devonshire's estate near Hardwick Hall.

An Instrument for Measuring Heat Losses at the Chimney.—An instrument proposed by M. Marcel Chapin records simultaneously the value of temperature and carbonic acid gas content of the smoke and the resultant loss at the chimney. If P is the percentage loss of calorific power of the fuel and T_1 and T_2 are respectively the temperature of the air when entering the grate and of the smoke when passing the receiver of the apparatus; further, if A is the quantity of CO_2 in the smoke, these factors are connected by the relation $P = K \times (T_2 - T_1)/A$, K being a coefficient of proportionality. In the apparatus proposed, the temperature and percentage of CO_2 are represented by two electric currents, of which the strength depends on these variables, the chimney loss being obtained by dividing the value of these currents as in the equation. The electrical equivalent of the CO_2 content is arrived at as follows:—When a constant volume of the gas to be analysed is mixed in a constant volume of a titrated solution of caustic soda, a mixture of soda and carbonate of soda results, the relative proportions of which depend on the CO_2 content. The electrical resistivity of a carbonate of soda solution is three times as great as that of the caustic soda solution from which it is derived. It is only necessary then to compare the electric resistance of the solution before and after absorption of the CO_2 in order to arrive at the percentage of this gas in the sample examined. The apparatus comprises a pyrometer and a moving-coil ammeter giving the percentage of CO_2. The quotient of the two currents is obtained by referring the overlap of the two pointers to curves of equal loss at the chimney. A receiver is used for (1) measuring a constant volume of soda taken from a glass vessel; (2) mixing the CO_2 and the soda; (3) forming a resistance-column of solution between two electrodes forming part of the measuring circuit. Tests made with the instrument show that the method is sufficiently accurate for industrial purposes.—*Comptes rendus de l'Académie des Sciences*, August 26th.

The Imatra Waterfalls.—It is reported that the question of the utilisation of the Imatra waterfalls, which in pre-war times were proposed, partly under Belgian auspices, to be used in connection with the transmission of power to Petrograd, has been resumed by the presentation to the Finnish Government of an application for a concession. The expenditure was estimated formerly at from £1,250,000 to £1,500,000; at present the computations are three or four times greater. The most favourable fall amounts to 21 metres, and it is calculated that the power available is 118,000 H.P. It is proposed to use the power for the establishment of a national nitrogen and fertilising industry. A provisional scheme has also been brought forward for the utilisation of the water power of the Vuoksen.

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Control of Coke.—From October 7th the price of gas coke for household and industrial purposes has been controlled throughout England, Wales, and Scotland by a new order of the Board of Trade. Hitherto, in the Metropolitan area there was an agreed price with the gas companies, and in other parts of the country, although recognised prices prevailed, there was nothing to prevent gas companies or any other dealer charging higher prices. The effect of the order is that the price of gas coke shall not exceed in any district the price of the second list of house coal. Industries which use gas coke to the extent of 50 tons per month on a yearly contract will obtain a discount of 10 per cent. The maximum price of unscreened coke breeze will be 60 per cent. cheaper than that of ordinary large coke. Industrial users of over 600 tons a year will again have a 10 per cent. discount. The prices of second list coal, on which the prices of coke are based, are fixed by the Local Coal Committees in each district.

"Labour and Capital."—The reader has become so accustomed to see the title of this note differently rendered that he may think the printer has fallen into error, but such is not the case. It is the order adopted by Mr. H. Tipper for the title of an address delivered to an American society of engineers in May last. We hardly think we should go far enough if we termed it prophecy. The two parties are really interdependent, but unfortunately men do not always see it so. In the nature of things under the present economic system Capital precedes and prepares the opportunity for Labour, but Labour provides for the return on and the security of Capital. Differences are arising practically every day due to actual or suspected unfair division of the spoils. As we mentioned last week, industrial profit-sharing has received the authoritative sanction of the Italian Government, and no doubt the principle will be approved in other countries as well, as one step toward dealing with industrial revolutions. From Mr. Tipper's address we learn that matters are undergoing somewhat similar developments across the Atlantic.

He says:—"So long as the profits of industry and the profits of labour are the only ideals of industry on the one hand and labour on the other, so long must the question of difference be solved by strife only; for, unless we displace the ideal of the present with the ideal which can be used in the future for better purposes; unless we get into our work the spirit of accomplishment on both sides, instead of the spirit of profits, we shall continue until we get into either a labour or an industrial autocracy. And as this has been brought nearer it is evident that the labour problems have been met during the war. Mr. Schwab himself said, not long ago, something which a few years ago would have been stamped as the rankest socialism, when he said that the worker would rule before very long. The Standard Oil Co., one of the most autocratic concerns in this country, but at the same time one of the most intelligent, began the other day an experiment in democracy in industry. It was arranged that representatives of the workers should sit with the board of directors to consider wages, factory conditions, and other essentialities of the working man."

American Railway Electrification.—The *Financial Times* states that Mr. W. G. McAdoo, Director-General of Railroads in the United States, has made an important statement to the New York *Times* respecting the future of American railway systems. As we stated in our issue of September 13th, he is in favour of general electrification, and conceives it possible that the country may have to resort to conversion even while the war is on. The following extracts give his principal views:—

If the Government were to continue the administration of the railroads of the country for any prolonged period he would be in favour of resorting to the use of electricity.

Notwithstanding the great development throughout the country of water powers, there remained tremendous sources of power yet to be harnessed. This power, now almost entirely the property of the United States, could be commandeered at a cost slight in comparison with the advantages to be derived from it.

The secretary suggested that probably electrification would be actually undertaken while the Government had control of the railroads, and that the problem would be attacked at the most favourable points in the country where the static value of water was most obvious and the cost of making the change from steam to electricity would be comparatively small.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Tonbridge U.D.C. has increased the salary of the electrical engineer, Mr. PLUNKETT, by £25 a year to £400.

Mr. C. V. BENNETT, for 19 years manager of the Herne Bay Gas & Electricity Co., Ltd., who has retired, has been presented by the staff with a silver cake basket. He will be succeeded by Mr. D. H. Davies, of Nantwich.

Mr. F. J. SIMPSON, engineer and general manager of Preston Corporation Tramways, is one of four selected candidates for a similar position at Bradford, at £800 per annum.

Mr. G. W. STUBBINGS has been appointed assistant mains superintendent at the Croydon Corporation Electricity Works.

General.—Prof. W. E. DALBY, F.R.S., has consented to serve on the Expert Sub-Committee of the Gas Traction Committee in the place of the late Colonel Bertram Hopkinson, F.R.S.

Mr. J. W. PLACKETT, who recently retired from the postmastership of Bradford, has undertaken, at the request of the Postmaster-General, special war work in the telephone and telegraphic traffic sections of the secretary's office at the General Post Office, London.

At Blackpool, last week, Sergt. L. C. SPEED, A.S.C., electrical engineer, was married to Miss Dorothy Bateson, daughter of Mr. Wm. Bateson, borough treasurer, of Blackpool.

At the Savoy Hotel, London, last week, Mr. A. RICHARDSON, M.P. (of *Engineering*), was entertained to dinner by a distinguished company of engineers to commemorate his election as M.P. for Gravesend. Those present included:—Sir Alfred Yarrow, Bart., who presided, Mr. G. N. Barnes, M.P., Mr. John Hodge, M.P., Sir William Beardmore, Bart., Sir Charles Parsons, K.C.B., Mr. W. H. Allen, D.L., Sir G. Carter, K.B.E., Mr. W. H. Maw, LL.D., Past President, Institution of Mechanical Engineers, Sir John Hunter, K.B.E., Ministry of Munitions, Sir Herbert Rowell, K.B.E., Mr. A. T. Hollingsworth, Sir John E. Thornycroft, K.B.E., Col. J. M. Denny, Committee of Production, Mr. Andrew Laing, C.B.E., Mr. A. B. Gowan, of Jarrow, Mr. G. Mure Ritchie, London, Mr. D. B. Morison, and Mr. R. W. Allen, C.B.E.

Roll of Honour.—Sergeant H. MARTIN, Manchester Regiment, killed in action, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Private E. R. MARKHAM, Manchester Regiment, killed, was employed by Messrs. Charles Macintosh & Co., Ltd., Hulme, Manchester.

Private H. J. SMITH, County of London Regiment, and of the County of London Electric Supply Co., Ltd., secretarial department, was killed in action on August 22nd at the age of only 18 years and 7 months. He had volunteered to go to the Front immediately, and was killed within a week or so of reaching the firing line.

Sergeant Herbert H. WOOD, aged 21, who died of fever at Basra, Mesopotamia, in September, was a draughtsman with Messrs. Bertram Thomas, Hulme, Manchester. He volunteered with Commander Locker Lampson's Armoured Car Unit, Dunster Force. Sergt. Wood was the eldest son of Mr. H. A. Wood, electrical engineer, Lancashire County Asylum, Prestwich.

Major L. P. AIZLEWOOD, R.A.F., who has been killed, was trained as an electrical and mechanical engineer at the Parkgate Iron and Steel Works, Sheffield. He joined the R.A.F. in January, 1917, and for his services on the Western Front had been awarded the Military Cross.

Able Seaman W. A. TAYLOR, R.N. Division, who has been seriously wounded, was an electrician for Mr. C. V. Fisher, Doncaster.

Sapper A. G. HONEYBONE, R.E., whose death in action occurred on September 26th, was in the electrical department at the Bentley Collieries, near Doncaster.

Private R. S. WEBSTER, Cheshire Regiment, killed in action, was formerly employed by the B.I. and Helsby Cables, Ltd., Helsby.

Ordinary Seaman A. BOARDMAN, R.N., who has died of pneumonia in hospital at the Crystal Palace, joined the Navy in August last, before which he was on the clerical staff of the St. Helens Cable & Rubber Co., Ltd.

Private W. LOWE, South Lancashire Regiment, killed, was employed by the St. Helens Cable & Rubber Co., Ltd.

Private J. THREADER, Cornwall Regiment, killed, was employed by Messrs. C. Macintosh & Co., Ltd., electric wire and cable manufacturers.

Second Lieutenant A. HINDER, aged 22, R.A.F. (Independent Force), who was killed whilst flying on Septemebr 6th, was employed by the Electric Ordnance & Accessories, Ltd. His machine crashed on landing after returning from a raid.

Pioneer W. BOYDEN, Special Brigade, R.E., formerly on the Stamford staff of the Urban Electric Supply Co., has been wounded.

The Military Cross and two bars awarded to the late Flight-Commander L. MONTEAGLE-BARTON, R.A.F., who destroyed 17 German machines, have been presented by the King to his father, Mr. Leonard Barton, M.I.E.E., of Wallington.

Private R. W. BLICK, Norfolk Regiment, who enlisted from the staff of the Premier Accumulator Co., has fallen in action.

Lance-Corporal T. G. SMALE, Somerset Light Infantry, who was formerly with the Bath Electric Tramways Co., has been repatriated after being a prisoner of war in Germany since August 27th, 1914.

Lance-Corporal L. C. SUGGARS, 8th London Regiment, who is a prisoner of war at Limburg, Germany, was an assistant draughtsman with Messrs. Crompton & Co., Ltd. Towards the end of 1917 he won the Military Medal, and correspondence now received by his parents (not from himself) show

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that under circumstances of exceptional danger he saved the life of a paralysed corporal by carrying him under heavy fire to a place 1,000 yards behind the front line. After seeing him safely on a stretcher he went straight back to carry on. The corporal's letter says: "Men have won V.C.'s for a third of what he did that day."

Lieutenant G. Atkinson, Durham Light Infantry, who died of wounds on October 4th, aged 35 years, was, according to the *Times*, for two years with the Tyneside Electrical Development Co. as an accountant.

Obituary.—Mr. W. C. May.—Mr. W. C. May, chief traffic manager and acting general manager of the Great Eastern Railway, passed away on Monday, aged 49.

Will.—Mr. A. T. Keen, chairman of Messrs. Guest, Keen, and Nettlefolds, Ltd., left £71,861.

NEW COMPANIES REGISTERED.

M.P. Manufacturing Co., Ltd. (151,551).—Private company. Registered September 28th. Capital, £1,000 in £1 shares. Electrical, gas, and mechanical engineers, manufacturers of primary batteries, &c. The subscribers (each with one share) are: M. Darsley, 104, Chandos Road, E. (15), audit clerk; O. C. Snelling, 1, North Street, S.W. (10), junior clerk. First directors: J. W. Manley and B. W. Peteers. Registered office: Twyford Hall, Twyford Street, N.

W. G. Ayers & Co., Ltd. (151,564).—Private company. Registered October 1st. Capital, £1,000 in £1 shares. To carry on the business of automobile and electrical engineers, dealers in all kinds of electrical fittings, wholesale and retail dealers in appliances and goods, &c. The subscribers are: W. G. Ayres, 4, Priory Terrace, St. George Street, Northampton, merchant, 97 shares; W. F. Ashley, 1, Datchet Place, Datchet, Bucks, engineer, 3 shares. The first directors are: W. G. Ayres and W. F. Ashley. Registered office: 54, Gracechurch Street, E.C. 3.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Eastern General Welding and Brazing Works, Ltd.—Debenture dated September 19th, 1918, to secure £900 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. E. Shepperd.

Liverpool Galvanising Co., Ltd.—Debenture dated September 24th, 1918, charged on the company's undertaking and property, present and future, including uncalled capital, securing £200. Holder: Mark Shaffer, 199, Hornby Road, Blackpool.

British Mannesman Tube Co., Ltd.—Issued on September 24th, 1918, of £50,000 debentures, part of a series.

CITY NOTES.

Vickers, Ltd.—In their recently-issued report the directors say:—

After four years of war the company now finds itself with an enormously increased plant largely suitable for war material only, and very extensive workshops. Your directors have a peace programme under the most careful consideration, and have made extensive preparations. It is clear, however, that much expenditure will have to be incurred in the replacement of machines suitable for war purposes only, and in carrying the higher proportion of stocks and work in progress that peace trades require.

The extensive connections that have been formed both by the parent company and by the subsidiary companies will be of the greatest use in increasing the company's old peace trades, and in disposing of their new products. In view of these, and possible further combinations, the directors have every confidence in asking the shareholders for their consent to a further increase of the company's capital in ordinary shares to the round figure of £12,000,000.

It is proposed, subject to Treasury consent being obtained, to issue 1,850,000 new shares at 30s., offering these to the present shareholders at the rate of one share for every three now held. When this issue is taken up, it is the intention of the directors to give the necessary notice and to pay off the 5 per cent. third mortgage debentures.

We quote from Mr. Douglas Vickers's speech at the meeting in our "Notes."

Prospectus.—*Newcastle-upon-Tyne Electric Supply Co., Ltd.*—The list of applications closed on Tuesday evening (far earlier than was intended), in an issue of 500,000 ordinary shares of £1 each at 20s. 6d. per share. The proceeds will be used to meet expenditure in respect of extensions to generating stations and to the system generally (part of which has already been met by temporary loans from bankers), and for prospective developments and other purposes.

Callender's Cable and Construction Co., Ltd.—According to the financial Press, it is proposed to increase the capital of this company owing to the needs following increased business and the higher cost of raw material and labour. It is intended early in November to offer 40,000 £5 cumulative preference shares and 10,000 £5 ordinary shares (£250,000 in all). The rate of preference interest will be 6½ per cent., and that on the present preference shares will be increased to the same rate. The ordinary shares will be issued at £2 premium.

Electric Supply Corporation, Ltd.—Presiding at the annual meeting on October 4th, Mr. J. G. B. Stone said that the restrictions had curtailed their private lighting, which in the small towns was their most lucrative business, but in power supply and other ways they had found an outlet. The Ministry of Munitions had issued a letter approving of the suggestion that they should receive increased payment from consumers who were receiving a supply from them under contracts made before the war, but containing no provision for increased prices. The Ministry's views were not readily accepted by the Admiralty for which some of their largest consumers were working. The Statutory Undertakings (Temporary Increase of Charges) Act, 1918, did not permit of increase in rates unless the dividend of the company was reduced 25 per cent. They had now to go into the whole matter afresh, and he did not think it likely that they would get any increase authorised before the end of the current year. Considering the great advance in wages and coal this was a great hardship. The report was adopted.

Rees Roturbo Manufacturing Co., Ltd.—Dividend of 10 5/6 per cent. (2s. 2d. per share), less income-tax, on the preference shares on account of arrears to December 31st, 1911. £18,000 has been placed to depreciation reserve, and £25,000 to general reserve, carrying forward £17,143.—*Financier.*

Stock Exchange Notice.—The undermentioned have been ordered to be quoted in the Official List:—Stewarts and Lloyds, Ltd.—850,000 deferred shares of £1 each, fully paid (Nos. 1 to 850,000).

Cape Town Consolidated Tramways and Land Co., Ltd.—For 1917 there is a debit balance of £540, as against £631 for 1916. The subsidiary companies have not declared dividends.

Direct United States Cable Co., Ltd.—Interim dividend 2s. per share, less tax, making 4 per cent. per annum for the half year.

Brisbane Electric Tramways Investment Co., Ltd.—Interim dividend of 4s. per share, free of tax, on the ordinary shares.

Bell Telephone Co. of Canada, Ltd.—Dividend 2 per cent., less tax.

Cuba Submarine Telegraph Co., Ltd.—Interim dividend 5 per cent. per annum, free of tax, on the ordinary shares.

Lima Light, Power and Tramways, Ltd.—Dividend 1½ per cent.

STOCKS AND SHARES.

Tuesday Evening.

The German peace "proposals" had the effect in the Stock Exchange of giving a decided stimulus to business and leading to a remarkable rise in rubber shares. Concurrently there came a general fall in securities likely to be affected unfavourably by the conclusion of peace; iron, coal, and steel shares in particular. The railway market has been assisted towards recovery by a vivid rise in the price of Consols. Part of this rally in the Funds was subsequently lost, but railway stocks maintained their prices, and the Underground Electric Railways of London shows up well amongst the others. Metropolitans, however, are ¼ down. London and Suburban Traction ordinary fell to 3s. 6d. and the preference to 8s. 6d.

Electricity supply shares look a harder market, as the Stock Exchange phrases it. Citys, Countys, and London Electrics all show improved quotations. With the eagerness to discount what may happen at the end of the war, the supporters of this market are hopeful of attention being directed to its shares. Several of the manufacturing issues are better; Edisons have recovered to 16s. 9d. as an example. Considerable interest has been aroused by the prospectus of the Newcastle-on-Tyne Electric Supply Co. The shares make an attractive industrial investment, and the prices of the existing ordinary and preference have been advanced to 22s. 6d. and 20s. respectively.

Marconis have come back sharply. Peace prospects again. The ordinary gave way ⅜ to 4½ and Americans to 31s. 6d. The latter were 33s. 9d. just lately. Marconi Marines fell from 3⅜ to 3⅜, and Canadians, which shared but moderately in the recent boom, eased off to 15s. Probably the previous rise was overdone to some extent, and the buyers thought it prudent to shorten sail. Otherwise the end of the war might be supposed to open a new vista of prosperity to the wireless undertakings, although they will lose, of course, the Government war orders that are expected to materialise so profitably for the Marconi Company.

Fraser & Chalmers reacted along with others of their class, the price going back to 31s. 3d. Armaments have weakened materially; those operators who had big profits in this market electing to take what they could, and put the money into rubber shares. The rubber market is familiarised with violent changes, but there have been few so dramatic as the

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complete alteration from dulness and stagnation to buoyancy and activity which has taken place during the past few days. The market seemed to go mad with feverish bullishness, and buyers paid prices that a fortnight ago would have been scorned as ridiculously inflated. The inevitable reaction followed.

With many other Brazilian descriptions, Brazil Tractions have spurted because of the advance in the rate of the Rio exchange. Foreign stocks and shares are generally better. The Mexican Utilities braced up substantially under the cheering influence of brisk rises in practically all the stocks of the various railways operating in Mexico. The Argentine group is also better, and interest has begun to stir in some of the lesser-known foreign electricity shares and bonds. The latest intensified War Bonds campaign has placed little check upon the eagerness shown by speculative investors to buy anything that looks cheap, whether it pays a dividend or not. Manifestly there is plenty of money about, and wide scope for the energies of the Publicity Committee in charge of the War Bonds appeal.

Telegraphs are a good market, with the exception of Great Northerns, the price of which gave way sharply to 35. Easterns, Eastern Extensions, and Western Telegraphs all show improvements, demand still being eager for stocks upon which dividends are paid tax free. Oriental Telephones rose 5s. Callender's are dull, the new issue of shares being decidedly unexpected, but the preference advanced 10s. to £5, in consequence of the proposal to increase the dividend. Telegraph Constructions again rose £1. Babcock and Wilcox weakened with other engineering shares. British Insulated are a good market at 2⅜, and improvements have occurred in General Electric ordinary and preference.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Oct. 8, 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6⅜	—	£7 17 0
Charing Cross Ordinary	5	4	3⅛	—	6 8 0
do. do. do. 4½ Pref.	4½	4½	3½	—	6 18 6
Chelsea	8	5	3 1/16	—	7 16 10
City of London	8	8	11½	+ ⅜	6 16 2
do. do. 6 per cent. Pref.	6	6	10	+ ½	6 0 0
County of London	7	7	10	+ ⅛	7 0 0
do. do. 6 per cent. Pref.	6	6	9¾	—	6 3 1
Kensington Ordinary	6	7	5½	—	6 17 7
London Electric	Nil	Nil	1⅜	+ ⅛	Nil
do. do. 6 per cent. Pref.	4	5	3½	+ ½	7 2 10
Metropolitan	8	4	3 1/16	—	6 10 7
do. 4½ per cent. Pref.	4½	4½	3½	—	6 18 6
St. James' and Pall Mall	8	9	6½	—	6 18 6
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	6⅜	—	7 7 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	99¼	—	6 0 6
do. Def.	1½	1½	23½	— ½	6 9 0
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	16	+ ⅜	*5 0 0
Eastern Tel. Ord.	8	8	160½	+2	*4 19 8
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 5
do. do. Pref.	6	6	10⅜	+ ⅛	5 17 1
Great Northern Tel.	24	22	85	—3	6 5 8
Indo-European	13	—	57½	—	5 12 6
Marconi	15	20	4⅞	— ⅜	4 9 0
Oriental Telephone Ord.	10	10	8⅜	+ ½	2 19 4
United R. Plate Tel.	8	8	7⅞	—	*5 3 3
West India and Panama	6d.	1/8	1⅞	—	*8 6 8
Western Telegraph	8	8	16⅞	+ ⅛	*4 14 10
Home Rails.					
Central London Ord. Assented	4	4	62½	—	6 8 0
Metropolitan		1	26	— ½	3 17 0
do. District	Nil	Nil	25	—	Nil
Underground Electric Ordinary	Nil	Nil	2⅞	+ ⅛	Nil
do. do. "A"	Nil	Nil	7/9	+9d.	Nil
do. do. Income	6	4	85½	+1	*4 13 8
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅜	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3⅜	+ 1/16	—
do. do. 2nd Pref.	5½	—	2⅝	+ 3/16	—
do. do. 5 Deb.	5	5	71	+3	7 0 10
Brazil Tractions	—	—	56	+5	—
Bombay Electric Pref.	6	6	10⅜	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	59½	+1	8 8 0
do. do. Preferred	Nil	Nil	41½	—	Nil
do. do. Deferred	Nil	Nil	37¼	+1	Nil
do. do. Deb.	4½	4½	59½	+2	7 2 10
Mexico Trams 5 per cent. Bonds	Nil	Nil	55	+5	Nil
do. 6 per cent. Bonds	Nil	Nil	44	+2	Nil
Mexican Light Common	Nil	Nil	32	+4	Nil
do. Pref.	Nil	Nil	44½	+4½	Nil
do. 1st Bonds	Nil	Nil	66	+4⅓	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅜	— ⅛	4 0 0
British Aluminium Ord.	10	10	1⅝	—	5 6 8
British Insulated Ord.	20	20	2⅜	+ ⅛	4 4 2
British Westinghouse Pref.	7½	7½	2⅝	— 1/16	5 14 1
Callenders	20	25	10½	—	5 19 1
do. 5 Pref.	5	5	5	+ ½	5 0 0
Castner-Kellner	22	20	3 1/16	—	5 8 4
Edison-Swan, "A"	—	—	1 1/16	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	10	1⅜	—	7 5 6
Gen. Elec. Pref.	6	6	10⅜	+ ⅛	6 2 4
do. Ord.	10	10	18½	+ ½	*5 6 8
Henley	25	25	2½	—	5 11 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	—	*5 16 9
Telegraph Con.	20	20	48½	+1	*5 0 0

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, October 9th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£100	..
a Ammonia, Muriate (large crystal)	,,	£77	..
a Bisulphide of Carbon	,,	..	..
a Borax	,,	£48	..
a Copper Sulphate	,,	£64	..
a Potash, Chlorate	per lb.	3/4	..
a ,, Perchlorate	,,	3/-	..
a Shellac	per cwt.	£17 10/-	5/- inc.
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	,,	£34	£1 dec.
a ,, Lump	,,	£16	£2 dec.
a Soda, Chlorate	per lb.	1/1	..
a ,, Crystals	per ton	17£/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c ,, Tubes (solid drawn)	,,	..	..
c ,, Wire, basis	,,	..	..
c Copper Tubes (solid drawn)	,,	1/8½ to 1/9	
g ,, Bars (best selected)	per ton	£161	..
g ,, Sheet	,,	£161	..
g ,, Rod	,,	£161	..
d ,, (Electrolytic) Bars	,,	£137	..
d ,, ,, Sheets	,,	£161	..
d ,, ,, Wire Rods	,,	£145	..
d ,, ,, H.C. Wire	per lb.	1/5⅝	..
f Ebonite Rod	,,	3/-	..
f ,, Sheet	,,	2/6	..
n German Silver Wire	,,	2/6	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	3/2	2d. dec.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£37	..
g Lead, English Pig	,,	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	6d. to 3/-	..
e ,, ,, ,, medium	,,	3/6 to 6/-	..
e ,, ,, ,, large	,,	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/10	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	,,	..	..
n ,, Wire, Nos. 1 to 16	per lb.	5/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Conductors for River Span.—A 66,000-volt transmission line, 7½ miles in length, connects the Powerdale station of the Pacific Power and Light Co. to the Conduit station of the North-Western Electric Co., and makes possible interchange of power between any combination of three companies. An article in the *Electrical Review*, Chicago, describes the line construction and the use of telephone and earth wires for transmitting energy in case of emergency. The river crossing requires three steel towers, one of which is on a rock that is in itself 126 ft. above high water. The centre tower is 220 ft. high, and the two spans are 1,993 ft. and 623 ft. (2,616 ft. total). The conductors at the crossing comprise six ⅝-in. 19-strand special high-strength steel cables. Normally three of these are used for power transmission, two for telephone purposes, and one as overhead earthed conductor; but in case of a fault or breakdown on one line, the jumper connections may be altered so as to restore the service through either the earth wire or one of the telephone cables.

Standards for Empire Trade.—A meeting recently took place between the Prime Ministers of Canada, Australia, New Zealand, and Newfoundland, and certain representatives of the Federation of British Industries, to discuss questions relating to the standardisation of the laws and procedure affecting British trade, and the form of British products (such as machinery, engineering products, and building materials), throughout the Empire. The first subject of discussion was the desirability of establishing throughout the Empire a standard form of the declaration which British manufacturers must make to secure the advantage of preferential Customs rates. A model form of declaration has now been drawn up by the Federation. The discussion with regard to the standardisation of laws and regulations affecting the form of British products disclosed many difficulties, owing to the great diversity of legislation, federal, State, municipal, and otherwise, and the conclusion reached was that though the subject is one of great importance, it can hardly be dealt with as a whole, but can best be approached through the medium of the British Engineering Standards Association and its oversea committees, whose work is directly affected by the diversity of legislation. The co-operation of the British Standards Association is being invited for the purpose.—*The Times.*

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UTILISING WASTE HEAT, AND THE FUEL SHORTAGE.

Most of us view with concern the effect of the fuel rations, and are devising various schemes by which our supplies of coal and gas may be augmented or supplemented.

A large untapped source of heat of which little use has been made hitherto, and which costs nothing, is to be found in the waste heat of internal-combustion engines, in which, as is generally known, some 70 per cent. of the total heat of combustion is carried off by the exhaust gases and water jackets; although there are many hundred thousand gas and oil engines in the United Kingdom, the use of their waste heat has been confined to a very limited number of installations.

Some details of a system which has been devised by Mr. F. A. Wilkinson, M.I.E.E., M.I.Mech.E., of Hatfield, Herts, for heating his house in conjunction with his electric lighting plant, will be of interest. In effect, it comprises the connection of the exhaust piping, which is fitted with a patented silencing device, to lengths of pipes in the rooms in such a manner that the temperature can be regulated, while, in addition, a branch pipe is taken to the kitchen, heating a jacketed cooking range, which is also fitted with electric heating elements. The piping from the water jacket of the engine is run to hot-water radiators, and terminates in the bathroom. Electric radiators will absorb any surplus electrical energy that will be generated on very cold days.

The electric lighting plant is normally run at a load of about three kilowatts, and can be started by hand or from the house by means of the battery, which is of 200-ampere-hour capacity, at a pressure of 50 volts.

There are six rooms heated by means of the exhaust gases and water from the jacket of the engine; a bath of hot water can be obtained in eight minutes direct from the engine, and when desired by-passed through the radiators. The installation has cost little to carry out, as the piping is ordinary gas barrel; in view of the difficulty of obtaining hot-water radiators, these are composed of lengths of piping made in rectangular form and fixed to the walls.

In mid-winter the plant is run about 1½ hours per day, and the time of running can be chosen to suit that when the baths are required.

Mr. Wilkinson is installing a controlling thermostat, by means of which the engine will be started and stopped automatically.

The system of utilising the waste exhaust gases for cooking purposes is of especial interest. An ordinary electric oven is employed, fitted with electric heating elements in the usual manner. It is of cast-iron lagged with slag wool, and is one of Mr. Wilkinson's design. A receptacle is placed in the bottom of the oven, which is directly connected through a valve to the exhaust piping, while the boiling elements comprise hollow rings through which the exhaust gases pass. In the centre of the rings are fitted electric heating elements, which can be used either in conjunction with the waste heat or separately when the engine is not running.

The inside dimensions of the oven are 13 in. wide by 13 in. deep by 20 in. high. A cooking temperature can be obtained from waste heat in 35 minutes, whereas when heating up by electrical energy a consumption of 1,350 watts is required for 50 minutes. Obviously better results would be obtained from a properly designed jacketed oven, but the difficulty in obtaining such an article at the present time prevents its adoption.

There are aspects of this scheme that make one wonder whether the proposed system of supplying the country with electrical energy from huge power stations may not with advantage be modified, at all events, for small residential towns and for groups of buildings that are close together, where internal-combustion engines could supply the electrical energy as well as the heat and hot-water supply, and could be run cheaply on tar oils or heavy fuel.

The use of tar oil, which is a home-produced fuel, at its present cost of £4 10s. per ton, or 5d. per gallon, has opened up an entirely new field for small internal-combustion engines, which can be run satisfactorily on this heavy fuel with a minimum of alteration, as described in our issue of August 9th last.

The fact that the capital cost of an ordinary engine is so much lower than that of a Diesel or semi-Diesel engine, and its extreme simplicity, are points not to be lost sight of.

THE DUTIES OF THE PROGRESS DEPARTMENT.

By W. J. Hiscox.

(*Continued from page* 334.)

The Machine Shop—The Inspection Department.

(*b*) *The Machine Shop.*—This is the pre-eminent department of the factory, and in consequence claims the greatest share of the Progress Department's attention. This department has a tremendous influence on the output of the factory, the reason being that it has to deal with (in varying degrees) fully 98 per cent. of the whole of the component parts. Many of these component parts have to pass through long and varied operations, and the Progress Department, therefore, has to be closely associated with the activities of the machine shop in order to cope with the multitudinous situations which arise in connection with the production of these parts.

Although the machine shop may be said to be virtually the home of the progress man, it does not mean that he is domiciled there, or even spends the greater portion of his time inside the department, for his interests in connection with the other departments of the factory have to be considered. The Progress Department, however, is so involved in the problem of machine-shop production that personal representation is necessary, and so the progress chaser is installed in the department, and this individual, representing the progress man, must see that the parts go through the shop in proper sequence, from operation to operation, guarding against delays, and ensuring that the whole of the details in connection with any one order are completed by the date given on the programme.

The machine shop has to depend upon other departments for its supplies of raw material, bar material from the stores, castings from the foundry, &c., and the progress chaser must see that these supplies are in the machine shop early enough to permit of the complete machining being accomplished by the date given, any delay in this connection being reported to the progress man concerned.

The art of the progress man, and also of the progress chaser, consists in arranging for the completion of the whole of the details in connection with any one order by a certified date, irrespective of the number of operations involved. The progress man studies this from a broad aspect, and arranges for the completion date of each department to permit the complete unit being dispatched by the date required. The machine-shop progress chaser has to perform the same duty, within the confines of his department, by ensuring that the whole of the component parts are completed by the date given to that department in connection with any specific order.

In order to allow the machine-shop section foreman to grasp the importance of any particular part, the chaser should, each morning, compile a priority list for every section foreman in the department, showing exactly what work in each section requires preferential treatment, and this list should be amended by the chaser if other work of an important character is received in the section during the day. This list would be of great benefit to the foreman, as, with the hundreds of parts on various orders in his section needing attention, it is impossible for him always to know the exact sequence in which the jobs are to be put in hand, unless the necessary information is given, whilst it also ensures for the chaser that the parts in which he is particularly interested are being (or will be) attended to. This applies especially to small details, which are apt to be overlooked by the departmental officials, whose attention is absorbed in the task of producing parts of greater magnitude.

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The machine shop progress chaser must see that sufficient work is always in the department to keep the whole of the machines fully employed, and he must advise the Progress Department when he considers a shortage is likely to occur. If business is brisk, and the Progress Department is working on the right lines, this possibility is very remote, the delivery dating system guarding against this to a very great extent. Still, it does happen that a certain type of machine occasionally gets ahead of its commitments, and it is in this respect that the chaser must look ahead, and take the necessary steps (by reporting early enough) to ensure the trouble being obviated at the earliest possible moment. The ideal principle to work on is for each machine to have one job in operation, a second job standing by to follow on, and a third job (in the sub-store or elsewhere) to follow in sequence. If this procedure is adopted, there need be little fear of a possible shortage not being reported early enough.

Whilst priority must be accorded to the urgent production orders in the machine shop, the fact that the bulk of component parts covered by stock orders has to be dealt with in this department must not escape notice, and in concerns which maintain a large stock of such parts, for use in connection with rapid production, a special chaser should have charge of this line in the machine shop. He will work in accordance with the store's requirements, and any question of priority arising in connection with an urgent stock part and a part required on a production order must be referred to the Progress Department. It must be remembered that many parts covered by stock orders are actually required for urgent customers' orders, but as the shortage of available stock required in connection with any one order has already been reported to the Progress Department by the stores (as instanced in the article dealing with the general store), the progress man concerned will pass this information on to the chaser, who will thereupon accord the part in question the necessary preferential treatment to ensure a quick delivery.

It will thus be seen that in connection with the machine shop the progress man (assisted by the chaser) has a never-ending duty to perform, for in no point whatever must this department be neglected. Failure on the part of the department concerned to deliver material supplies by the programme date must be promptly reported by the chaser, and machine breakdowns, non-receipt of the necessary tools, work held up in transit, and all other matters affecting the completion date for the department, must also receive his prompt attention.

(*l*) *The Inspection Department.*—Although this department is connected with every productive department in the factory, it is more closely associated with the machine shop than with any other department, and it is proposed, therefore, to deal with it at this stage, for the purpose of showing its connection with the Progress Department.

It is not considered advisable for the Progress Department to issue a separate delivery date with respect to this department, on account of the many times a specific detail may have to pass through the inspector's hands before reaching its final stage ; but it must be understood by all concerned that a delivery date given for the guidance of any department must cover time for inspection. The departmental chaser is, therefore, responsible for getting the details through the Inspection Department, treating the inspection of the article as an operation in connection with the department in which he is interested.

The inspector, like the toolmaker, must be allowed adequate time in which to do his work efficiently ; but there is no reason why he should not work the details through in strict order of priority. A good idea is to have a list displayed in a prominent position in the department, similar to the one recommended for the use of the section foreman in the machine shop, recording the order of precedence in which the details are required, such list to be amended by the chaser as further items arrive in the department, and modified when they are completed. The list could be changed daily, and the inspector would have the assurance that he was working in connection with the most important parts, from a delivery point of view.

When an article is rejected, or returned to the shop for rectification a copy of the inspector's report on the subject should be promptly sent to the Progress Department, to enable the progress man interested to take the necessary steps which will ensure the replacement, or the operation necessitated by the rectification, being completed with a view to minimising any delay with regard to the completion date on programme. A record of all rejections should be kept by the Progress Department in connection with any specific order, as this will be found most useful in compiling the report necessitated by the delays occasioned in connection with the order.

(To be concluded.)

TRADE OF SOUTH AFRICA.

A report on the trade of South Africa for the year 1917 from the pen of H.M. Trade Commissioner (Mr. Wickham) has just been issued by the Department of Overseas Trade.

Mr. Wickham gives first place to the steps taken in connection with the development of national industry, viz. :—

1. The first census of industrial production.
2. The formation of a Federation of Industries.
3. The formation of the Industrial Development Co., Ltd., for financing new industrial enterprises.
4. The operations of the Industries Section of the Department of Mines and Industries.
5. The flotation of companies to establish vitally important primary industries, notably the production of iron.

New Industries.—The following among the new industries which have recently been, or are on the point of being, established, will be of interest to the electrical trades :—

Manufacture of carborundum, calcium carbide, alcohol motor fuel, asbestos sheet and goods, casting shoes and dies (of steel from electric furnaces), refining of arsenic and antimony, tin smelting.

Undoubtedly, by far the most important of all the Union's industrial developments, the success of which must be awaited with interest, is the iron industry. Two companies are erecting blast furnaces, one at Pretoria, and the other at Vereeniging. It is understood that one of the chief difficulties in this way is the rarity of a good coking coal. Coke, consequently, has hitherto been expensive, and the supply barely adequate for the foundries. Very considerable extensions have been brought about recently.

Public Works.—As regards municipal enterprises, in the case of electricity, normal expansion has had to stop, all the more important municipal generating stations being already fully loaded, and some actually overloaded, and additional plant on order being unprocurable or, at least, delayed. The same consideration applies to the telephone service, for which new instruments are unobtainable. Copper cable has, of course, been on the list of prohibited exports from the United Kingdom for some time, and this fact has given the Japanese a chance of having their cable tested in use by the Post and Telegraph Department, mines, and public bodies. The accumulation of overdue orders and of postponed development in regard to electricity, water supply, and sanitation will probably, by the time normal trade conditions are once more in sight, represent a very large amount of business. This is equally true of mining, since, while production is being pressed on, both development work and the opening up of new enterprises are being largely postponed.

Mining Supplies.—In connection with mining requirements an important alteration in purchasing procedure has been introduced. The contracting for goods from oversea for the mines has been focused in one buyer's hands. This system has been adopted because it was found in the early days of the war that material for the mines, other than special machinery and apparatus, was being accumulated by merchants, manufacturers' agents, and mines engineers and storekeepers to an extent which was not merely uneconomical, but was also improper having regard to the need for the manufacture of such goods being limited to what was actually essential to the carrying on of the mining industry. Stocks have now been reduced to a minimum without risk of exhaustion. The possibility of this centralised buying continuing after the war has to be faced. Another factor which is likely to have a still greater effect on trade with the mines, is the possibility of the successful local production of pig-iron. Cheap coal, lime, and high-grade supply is available in the gold mining area, against which imported goods have a long expensive haul 500 miles from the coast.

Imports Last Year.—The imports of all classes of machinery and hardware, with the exception of mining machinery and tools, have been very much affected by the war, but even here the fall in 1917 is more pronounced than in the previous years. The reduction of imports under the head of iron and steel and machinery—mining machinery being practically the only exception—is explained by war necessities and prices, but a very great deal of it may also be regarded as deferred expenditure which must be undertaken at as early a date as possible. The following are some of the more notable items of decrease in imports into South Africa :

Machinery, electrical.—The pre-war value of £451,000

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(of which a little more than half was German) falls to £150,000. Agricultural and water-boring machinery, cranes and lifts, fire and traction engines, manufacturing and printing machinery, and pumps alike show a big falling off. Similarly, rails, both light and heavy, and locomotives and rolling stock have been imported in very much smaller quantities—the imports of British as well as, of course, German, makes being much reduced, while the remains of the business were left practically to the United States. It may be noted that light rails are now being rolled on the Witwatersrand.

New Competition.—The expansion of Japanese trade with South Africa has been more marked and continuous, though even now Japan's total imports into South Africa are less than those of Sweden. The range of goods which Japan is now exporting is, however, interesting, and it would be most unwise to discount her initiative or minimise her potentialities as a competitor. At the same time, it must not be taken for granted that Japan has been completely successful in the manufacture of all this wide range, or that Japanese makers will hold the field indefinitely, even at lower prices, unless quality is very much improved. It is noticeable that, at present, machinery and hardware, with the exception of cheap cutlery, are hardly represented in the list. An agency for electric cable and wire (plain and insulated) has been placed in the hands of a Johannesburg firm, but the import statistics for 1917 do not record any shipments as having arrived.

Increases are recorded to the credit of Japan in imports of brass manufactures and electric fittings (probably insulators). Denmark and Holland, too, are credited with satisfactory business in machinery for manufacturing purposes.

The most noteworthy gains made by Canada in contributing to the import trade of the Union are in hardware.

The American share of the machinery trade is very much larger than that of Canada, being more than one-half of the total. In iron and steel manufactured goods, imports from the United States increased by £250,000. To this amount must be added £45,000 increase in fencing and baling wire, and £13,000 in railway material, South Africa having had to depend almost entirely on the United States both for light railway material and wire, instead of Germany, which had an important share of both trades.

Selling Methods.—Reference may be made to a system of representation which appears to be excellent, and particularly well devised for any class of goods, such as machinery, for the selling of which technical knowledge is desirable, if not essential. Reference has often been made to the difficulty of finding agents with adequate technical knowledge for negotiating with buyers of machinery. The necessity of finding a trained man to represent manufacturers of goods which are to be sold to customers who are themselves technical experts, has led some firms to send out their own man or staff. Where the market is comparatively small, it may be that the turnover of one manufacturer would hardly be sufficient to pay the cost of such a selling branch. To get over this difficulty, firms secure the representation of other manufacturers of kindred, but not conflicting, lines which can be handled efficiently and with little, if any, additional effort or outlay by the same agency. This is to all intents and purposes the system which has been recommended on previous occasions, namely, co-operative selling through organisation of groups of manufacturers. It is a system which brings the manufacturer into touch with, and knowledge of, his market efficiently and with economy; and particularly for those who find difficulty in finding agents with the qualifications that are necessary, it is to be recommended.

Manufacturers of machinery tend to specialise on a type of product. "Boilers for all purposes," "Centrifugal machinery of all kinds," "Pulverising and grinding machinery for all industries," are samples of titles from machinery catalogues. A firm makes grinding machinery for making cement, for pulverising bones, for a chemical works, &c., but does not touch the drying or burning plants required for the same purpose, or the prime movers. It may be that this specialisation on one class of machine results in a more perfect product for particular purposes than the product of a works specialising on, say, cement-making plant, and confining attention entirely to that particular purpose for each particular part of the complete plant. Whether such is the case or not, attention is called to the need for considering the difficulty involved in selling overseas when no one of the makers of plant is in a position to draw up a specification or working drawings of a complete plant. It is all very well as regards the home market to rely on getting orders for individual machines or apparatus to take their place in existing factories and works, or to depend on a consulting engineer to do the assembling of 10 or a dozen items into a complete specification. It is, however, very far from being an ideal system for oversea business, and very much business has gone to foreign countries just for the reason that manufacturers in so many lines do not profess to know about the manufacturing system as a whole for which they want to supply one part of the plant. In many instances it is almost impossible to arrange adequate representation, or even to interest a representative.

The advantages of specialisation on, say, vacuum pans, or drying machinery, may be very great, but it seems evident that the drawbacks are also of sufficient importance to merit study by engineering associations in order to obviate these. Some development of organisation seems to be called for. Possibly firms making pumps, air compressors, and machinery, such as are referred to above, could, in relation to each of the various purposes for which their products are used, arrange small combinations of the makers of all different items going to make up a complete plant with a joint drawing office and selling organisation. Possibly firms of structural engineers who already undertake much work of assembling could cover the whole ground of industrial plant more completely, and so fill a gap. That there is a gain anyone who looks into the matter cannot seriously doubt.

The above notes refer to industrial machinery in general use, and not to mining machinery. The mines constitute a market in themselves, the requirements of which are met by a special and highly-organised system of distribution, to which reference has already been made.

System of Agency.—Nowadays, if manufacturers want permanent business, they must establish permanent relations with the consumer. They must keep in direct touch with their market in a way that they can only do through a local trading branch of their own, or through a loyal representative. For smooth working, for efficiency, for economy, or for successful pushing of new lines there is only one course. There must be representation, with a recognition of common interests, as well as mutual goodwill and confidence.

Before concluding his report, H.M. Trade Commissioner suggests that very much more useful work could be done if manufacturers in the United Kingdom would more freely indicate directions in which they want help, and the class of information which is of value.

TRADE STATISTICS OF SOUTH AFRICA.

The following statement, showing the imports of electrical and similar goods into the Union of South Africa during the year 1917, has been taken from the recently-issued official trade statistics. The figures for 1916 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1916.	1917.	Inc. or dec.
Asbestos manufactures.—	£	£	£
From Great Britain ...	9,000	4,000	– 5,000
,, Other countries ...	2,000*	1,000	– 1,000
Total	11,000	5,000	– 6,000
* Switzerland £1,000.			
Brass manufactures.—			
From Great Britain ...	24,000	17,000	– 7,000
,, United States ...	2,000	2,000	—
,, India	2,000	1,000	– 1,000
,, Other countries ...	—	3,000*	+ 3,000
Total	28,000	23,000	– 5,000
* Japan £2,000.			
Copper, plate and sheet.—			
From Great Britain ...	4,000	1,000	– 3,000
,, United States ...	—	1,000	+ 1,000
Total	4,000	2,000	– 2,000
Copper manufactures.—			
From Great Britain ...	3,000	1,000	– 2,000
,, United States ...	1,000	3,000	+ 2,000
,, Other countries ...	—	1,000	+ 1,000
Total	4,000	5,000	+ 1,000
Electrical cable and wire.—			
From Great Britain ...	228,000	42,000	– 186,000
,, Italy	1,000	1,000	—
,, United States ...	5,000	10,000	+ 5,000
,, Other countries ...	3,000*	1,000	– 2,000
Total	237,000	54,000	– 183,000
* Holland £3,000.			
Electrical fittings, including posts.—			
From Great Britain ...	200,000	110,000	– 90,000
,, Canada	1,000	1,000	—
,, Holland	22,000	24,000	+ 2,000
,, United States ...	62,000	61,000	– 1,000
,, Japan	2,000	6,000	+ 4,000
,, Other countries ...	11,000*	5,000	– 6,000
Total	298,000	207,000	– 91,000
* Denmark £4,000.			
Lamps and lampware.—			
From Great Britain ...	28,000	11,000	– 17,000
,, United States ...	19,000	15,000	– 4,000
,, Sweden	17,000	5,000	– 12,000
,, Other countries ...	2,000	1,000	– 1,000
Total	66,000	32,000	– 34,000

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	1916. £	1917. £	Inc. or dec. £
Electrical machinery.—			
From Great Britain ...	112,000	82,000	– 30,000
,, Sweden	3,000	7,000	+ 4,000
,, United States ...	63,000	61,000	– 2,000
,, Other countries ...	2,000	—	– 2,000
Total	180,000	150,000	– 30,000
Cranes, elevators, and lifts.—			
From Great Britain ...	17,000	6,000	– 11,000
,, United States ...	2,000	1,000	– 1,000
Total	19,000	7,000	– 12,000
Mining machinery.—			
From Great Britain ...	473,000	461,000	– 12,000
,, Sweden	2,000	2,000	—
,, United States ...	253,000	244,000	– 9,000
,, Other countries ...	1,000	4,000*	+ 3,000
Total	729,000	711,000	– 18,000
* Canada £3,500.			
Machinery not specially mentioned (other than agricultural, manufacturing, &c.).—			
From Great Britain ...	256,000	174,000	– 82,000
,, Sweden	4,000	6,000	+ 2,000
,, United States ...	59,000	57,000	– 2,000
,, Canada	6,000	6,000	—
,, Other countries ...	3,000	1,000	– 2,000
Total	328,000	244,000	– 84,000
Telegraph and telephone material.—			
From Great Britain ...	8,000	6,000	– 2,000
,, Sweden	2,000	1,000	– 1,000
,, Other countries ...	1,000	—	– 1,000
Total	11,000	7,000	– 4,000
Tramway rails.—			
From Great Britain ...	2,000	—	– 2,000
,, United States ...	4,000	4,000	—
Total	6,000	4,000	– 2,000
Tramway rolling-stock.—			
From Great Britain ...	10,000	2,000	– 8,000
,, United States ...	2,000	1,000	– 1,000
,, Other countries ...	1,000	—	– 1,000
Total	13,000	3,000	– 10,000
Other tramway materials.—			
From Great Britain ...	2,000	1,000	– 1,000
,, United States ...	2,000	1,000	– 1,000
,, Other countries ...	1,000	1,000*	—
Total	5,000	3,000	– 2,000
* Madagascar (sleepers) £1,000.			

In addition to the above the following goods were imported as "Government Stores":—

Brassware.—			
From United Kingdom ...	4,000	1,000	– 3,000
Copper, plate and sheet.—			
From United Kingdom ...	6,000	4,000	– 2,000
Electrical cable and wire.—			
From United Kingdom ...	22,000	24,000	+ 2,000
Electric fittings.—			
From United Kingdom ...	13,000	6,000	– 7,000
,, Other countries ...	1,000	2,000	+ 1,000
Total	14,000	8,000	– 6,000
Lampware.—			
From United Kingdom ...	2,000	2,000	—
Cranes and elevators.—			
From United Kingdom ...	—	3,000	+ 3,000
Electrical machinery.—			
From United Kingdom ...	5,000	2,000	– 3,000
Other machinery.—			
From United Kingdom ...	7,500	17,000	+ 9,500
,, Other countries ...	4,500*	3,000	– 1,500
Total	12,000	20,000	+ 8,000
* United States mainly.			
Telegraph and telephone material.—			
From United Kingdom ...	21,000	13,000	– 8,000
,, Sweden	5,000	19,000	+ 14,000
,, Other countries ...	—	3,000*	+ 3,000
Total	26,000	35,000	+ 9,000
* United States.			

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

15,410. "Electric pocket flash-lamps." W. J. Woodman. September 23rd.

15,433. "Electro-magnetic switches." British Thomson-Houston Co. and H. C. Hastings. September 23rd.

15,434. "Automatic telephone systems." Automatic Telephone Manufacturing Co. September 23rd. (United States, February 4th.)

15,450. "Electric drive for ships' screw propellers." Akt.-Ges. Brown Boveri et Cie. September 23rd. (Germany, July 3rd.)

15,457. "Electric switches." R. K. Hearn. September 23rd.

15,461. "Electric contactors." British Thomson-Houston Co. (General Electric Co.). September 23rd.

15,462. "Disposition of conductors in electric distribution systems." British Thomson-Houston Co. & E. B. Wedmore. September 23rd.

15,550. "X-ray apparatus." British Thomson-Houston Co. (General Electric Co.). September 24th.

15,508. "Field magnets of dynamos and motors, and method of construction." A. H. Avery & G. Kent, Ltd. September 24th.

15,523. "Methods of treating filaments for incandescent lamps." Westinghouse Lamp Co. September 24th. (United States, October 15th, 1917.)

15,529. "Ignition apparatus." Remy Electric Co., September 24th. (United States, September 19th. 1917.)

15,541. "Spark plugs." E. J. Taylor. September 24th.

15,548. "Electric furnaces." H. Etchells, H. A. Greaves & T. H. Watson & Co. September 25th.

15,586. "Electric furnace, and method of operating same." F. T. Snyder. September 25th.

15,587. "Electrodes or plates for electric accumulators of the alkaline type." W. N. Stewart. September 25th

15,592. "Alternating electric current motors." British Thomson-Houston Co. (General Electric Co.). September 25th.

15,600. "Electric furnaces." E. L. Crosby. September 25th.

15,602. "Ignition systems for internal-combustion engines." General Motors Corporation & P. C. Rushen. September 25th.

15,603. "System for instantaneous and electrical heating of water." L. E. Seimbille. September 25th. (France, September 28th, 1917.)

15,614. "System for instantaneous and electrical heating of water." L. E. Seimbille. September 25th. (France, January 28th.)

15,652. "Diaphragms." Automatic Telephone Manufacturing Co. & S. R. Smith. September 25th.

15,672. "Incandescent electric lamp holders, &c." Benjamin Electric, Ltd. September 26th. (United States, October 16th, 1917.)

15,700. "Telephone apparatus for one common line." Aktieselskabet Electrisk Bureau. September 26th. (Norway, November 15th, 1917.)

15,701. "Ignition dynamos." C. T. Mason. September 26th.

15,709. "Electro-magnetic switches or contact makers." Soc. Anon des Etablissements L. Bleriot. September 25th. (France, November 7th, 1917.)

15,714. "Utilising static and dynamic coaxial impulses generated by efflux of liquids." O. Angelini. September 26th.

15,728. "Portable electric cable controller." R. D. Fairclough. September 27th.

15,762. "Electricity meters." G. Casolini. September 27th.

15,769. "X-ray apparatus." M. B. Rodriguez. September 27th.

15,782. "Diaphragms for gramophones, phonographs, telephones, &c." A. T. Collier. September 28th.

15,794. "Electric bells." W. E Clifton, J. H. Cowell & H. W. Cox. September 28th.

15,795. "Polishing-iron for electric or gas iron in laundry work." J. Bath. September 28th.

15,812. "Electric furnaces." T. A. D. Lawton. September 28th.

15,831. "Synchronisers for internal-combustion steam or electric motors." N. Collins. September 28th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

3,531. Machine switching telephone system. Western Electric Co., F. R. McBerty & L. Polinkowsky. March 10th, 1917. (118,644.)

10,244. Electric heaters. A. A. Buck. July 16th, 1917. **(118,652.)**

12,854. Controlling-means for electrically-operated feed reel brakes. H. V. James. September 7th, 1917. (118,681.)

13,172. Electrodes for electric furnaces and like purposes. W. B. Hamilton, H. A. Blackwell & W. L. Turner. September 14th, 1917. (118,690.)

13,191. Automatic telephone system. A. E. Stevens. September 14th. 1917. (118,691.)

13,372. Multiple-fuse cartridges for electric circuits. F. A. Feldkamp. November 6th, 1917. (111,096.)

13,425. Speed-controlled electrically-operated machines. H. H. Jeffcott. September 19th, 1917. (118,694.)

13,741. Electrical transmission arrangements specially applicable for motor-vehicles. W. A. Stevens & J. Sankey & Sons. September 24th, 1917. (118,699.)

14,824. Telegraphic apparatus. C. Domanico. October 12th, 1917. (118,716.)

14,976. Means for the production and control of current for X-ray tubes. G. Pearce & F. D. Owen-King. October 16th, 1917. (118,720.)

15,404. Electric clocks. W. G. Kent & L. W. Pullman. October 23rd, 1917. (118,726.)

16,136. Electric accumulator boxes. C. R. D. Pritchett & Pritchett and Gold & Electrical Power Storage Co. November 5th, 1917. (118,733.)

16,439. Aerodrome lighting for the landing of aircraft. J. I. Hall and Callender's Cable and Construction Co. November 9th. 1917. (118,739.)

18,700. Electric current rectifiers. H. Wade (Mills, H. S.). December 15th, 1917. (118,762.)

1918.

615. Electric starting-apparatus for motor-vehicle engines. H. Lucas and C. L. Breeden. January 10th, 1918. (118,775.)

951. Self-starters for internal-combustion engines. W. Holt & B. Brooks. January 17th, 1918. (118,779.)

3,267. Cord connections for electric appliances. Naamlooze Vennootschap Fabriek Van Instrumenten en Electrische Apparaten "Inventum." October 18th, 1917. (118,792.)

3,709. Slip ring short-circuiting and brush contact releasing gear. Phœnix Dynamo Manufacturing Co. & A. H. Bennett. March 2nd, 1918. (118,797.)

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ELECTRIC RAILWAYS.

ALTHOUGH the existing conditions are not favourable to progress in the conversion of steam railways to electrical operation, a good deal was accomplished in the earlier years of the war both at home and abroad, and directly circumstances permit there will be great activity in this branch of engineering. We commence in this issue an account of the electrification of an important section of the Central Argentine Railway, which, like the rest of the railways in that country, was built and is owned by a British company; the section referred to is only the first instalment of a total of 100 miles that is to be converted, in order to cope with the heavy suburban traffic of the great city of Buenos Ayres—a city much larger than any in the British Empire except the metropolis itself. This is a conspicuous example of the way in which British industry should profit by British enterprise abroad; where we provide the capital for the construction of engineering works in foreign countries, it is but reasonable that we should also carry out the work. Too often in the past, however, this principle has been ignored, and great undertakings, such as those in South Africa and India with which our readers are familiar, have been financed mainly from this country, but equipped by rival manufacturing nations. In the future, we have no doubt that every effort will be made to prevent the recurrence of this procedure, which not merely deprives our workshops of employment, but also robs our designers of the invaluable experience which is to be gathered from every undertaking of the kind, and which constitutes a stepping-stone towards still greater achievements.

It is particularly desirable that no opportunity should be lost of harnessing the great water powers with which the British Empire is so richly endowed, as well as those which abound in South America and other foreign lands. We recently quoted at some length the report of the Water-Power Committee of the Conjoint Board of Scientific Societies on the resources of the British Empire; considering these in conjunction with the pressing demand for railway communication in all parts of the Empire, it will be seen that there is an immense field of activity opening before our civil, mechanical, and electrical engineering industries. The railway famine in South Africa has reached an acute stage, for it has not been possible during the war to fulfil the orders received by British firms for locomotives and rolling stock, and the rapidly developing industries of the Union urgently call for improved railway transport facilities. The alleged proposal of Mr. McAdoo to electrify the United States Railways on a gigantic scale, to which we recently referred, has directed attention in that country to the enormous potentialities of the water powers of the United States and Canada—the former estimated at no less than 60 million H.P., and the latter at about 18 million H.P. The successful electrification of

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some 440 miles of the St. Paul Railroad is but a beginning; 450 miles more are to be converted on this line alone, and thousands of miles remain to be electrified. According to the *Railway Gazette*, Mr. McAdoo has recently explained that his remarks were misinterpreted; he only meant that if the railways of the United States were permanently in the hands of the Government, he would probably give the idea considerable attention. But obviously the process of conversion is already in full swing. In France great progress has been made with the electrification of the lines of the Compagnie du Midi, in the region of the Pyrenees, with the aid of water power, and the same procedure can be readily adopted in the Alpine districts. We need not labour this subject, to which we drew attention not long ago, but in closing, we must not omit to refer to an aspect of the question which is of equal importance—namely, the economic point of view. To reduce the unnecessary consumption of coal is one of the most pressing problems before the world to-day—and the electrification of railways by water power would obviously contribute enormously towards that end. Last year the United States steam railways consumed 150 million tons of coal, and the Canadian railways 9 millions. But even if the power must be supplied by steam-driven plant, the use of electric traction will save from half to two-thirds of the coal at present required by steam locomotives, which consume something like 6 lb. per H.P.-hour. The additional advantages derived in practice from the adoption of electric haulage are too well known to need recapitulation. We trust, therefore, that all concerned in the construction and equipment of railways will give the most earnest attention to this important subject, in order that no time may be lost in developing the modern system when the opportunity arises.

Methods of Trading in Canada.

Elsewhere we give a short review of the report by His Majesty's Trade Commissioner in Canada. It is satisfactory to note that an optimistic view is taken regarding the general attitude of the Canadian buyer towards the United Kingdom manufacturer. The report sets forth in some detail the conditions which the latter should strictly observe when he sets about making an earnest effort to obtain such share of the trade as it may be possible for him to obtain, in spite of the proximity of the United States competition.

So much has been written regarding the lines of goods, particularly heavy goods, which the Dominion's next-door neighbour is succeeding in selling in place of British goods, that there is little need to dwell further on this phase of the question. Prior to the entry of the United States into the war, they naturally succeeded in further strengthening their hold upon the Canadian market. It would be ungracious to our Ally to express unreserved satisfaction at the information vouchsafed in the Trade Commissioner's Report that since April, 1917, this competition had fallen off, and it would not be safe to say with any degree of confidence that this falling-off would result in Great Britain's recovering, in the face of the natural advantages of the United States as a source of supply, the position which she previously held. Certain special lines—for example, small motors, the lighter industrial machinery, particular types of electrical apparatus where some special design appeals to Dominion taste—will be saleable in the Canadian market, provided manufacturing exporters in the United Kingdom will set about their business in a practical manner.

The personal touch is the distinguishing feature of the Canadian market. If a manufacturer decides to combine forces with others who produce similar but not competitive goods, he should, after the market has been thoroughly investigated, either appoint a reliable selling agent to handle the goods of the combination, or open a branch office (a central selling agency), the expenses of which should be borne by the affiliated firms. In the case of the manufacturer whose goods are of such a character as to indicate no individual course of action on his part, he may either sell through an export agent in the United Kingdom who already has Canadian connections, or investigate the Canadian market personally.

Finally, the Commissioner still finds it necessary to advise manufacturers to make a closer study of the technicalities of the Canadian export trade—such as freights, insurance, exchange, packing, preferential Customs duties, terms, and credits.

Unions at Issue.

Our readers will have observed with regret, which we share, that the hostility displayed towards the Electrical Power Engineers' Association by the leaders of the London Committee of the Electrical Trades Union continues unabated; it is very unfortunate that their differences cannot be reconciled and their animosity dispelled—there is ample room for both organisations to exist side by side in harmonious co-operation. We fear, however, that this happy consummation can hardly be hoped for, so long as the E.T.U. in London remains under the control of the existing leadership; the attitude evinced by the London district secretary, Mr. W. J. Webb, in the letter which we published in our last issue, is compatible only with war *à outrance*, and the form of words with which he threatens to deprive his "brother" of his livelihood, as the penalty for the exercise of his free will, is a ghastly mockery of the principle of fraternity which the writer affects to uphold.

On this question there cannot be two opinions. It is the undoubted and immemorial right of a British citizen to go his own way without interference, provided that he does nothing to his neighbour's detriment, and complies with the regulations laid down by the State. To controvert this fact is to rebel against the most fundamental principle of citizenship, and to substitute tyranny for liberty—the most precious possession of an Englishman. Those who deny this right to their fellow-citizens would be amongst the first to assert it were their own privileges assailed. The threat of the E.T.U. Secretary, therefore, is utterly indefensible and unworthy of a free man, and will do far more harm to his own cause than to that of the E.P.E.A. We do not believe for a moment that the members of the Union approve of the policy which is put forward in their name—but, unfortunately, irresponsible leadership is the curse of Trade Unionism, which in itself is an indispensable and beneficial institution.

Is it not possible for representatives of the two societies to meet and talk over the situation, with a view to arriving at a friendly settlement of the questions at issue? We are sure that each side would find the other far less unreasonable than it had appeared to be, so long as the discussion had been carried on at long range; the members of both parties are of the same race and in the same industry, their personal interests do not clash with one another, and there is no insuperable obstacle in the way of their arriving at a good understanding. Continued strife will benefit no one.

We have received from a North Country member of the E.T.U. a letter which, unfortunately, makes an unmerited personal attack upon an honourable and patriotic engineer, and therefore will not be published in our columns.

Apprentices in the Army.

One of the most difficult of the many industrial questions that will have to be solved when demobilisation commences is that of the position of apprentices who joined the Forces before their training was completed. Many of these have been with the Colours for three or four years, and will come back as full-grown men, who cannot be expected to resume their training at a nominal wage, while they will not be qualified to rank as journeymen and draw the wages of skilled artisans. To allow these men to become unskilled labourers would be a gross injustice. They have fought our battles, and are entitled to be restored at least to the positions that they would have occupied had they remained at work. The problem, therefore, is how to provide them with the training which is their right. Much may be done towards this end by individual employers; but the matter is really one which concerns the State, and it should receive the earnest attention of the Minister of Labour.

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ELECTRIC TRACTION ON THE CENTRAL ARGENTINE RAILWAY.

The Central Argentine Railway, with a present mileage of 3,300 miles, serves the northern portion of the Argentine between Tucuman, Cordoba, and Rio Quarto on the west and Santa Fé, Rosario, and Buenos Ayres on the River Plate. The number of passengers carried on the system during the 12 months ending June, 1914, was 23 millions, of whom 16 millions were carried on the three sections which serve the north-western suburbs of Buenos Ayres. The explanation of the large ratio which the suburban traffic bears to the total traffic is found in the fact that Buenos Ayres, with a population of over one and a half millions, contains more than one-fifth of the whole population of Argentina. The city handles more than half in value of

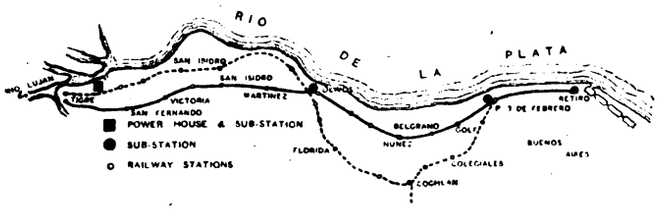

Fig. 1.—Plan of the Electrified Section.

the total imports and exports of the country, and new docks are under construction which will increase the capacity of the port by more than 50 per cent.; all the great railways, British engineered and British owned, converge towards it; it is the centre of government, and its climate is good. During the last 20 years its growth has been at the average rate of 7½ per cent. per annum, and there is every reason to believe that this rate will be maintained.

Realising the importance of dealing economically with the development of their suburban traffic, the directors of the Central Argentine Railway decided to electrify the suburban sections, and the work was put into the hands of Messrs. Merz and McLellan, who were instructed to act in co-operation with the consulting engineers of the company, Messrs. Livesey, Son & Henderson, the two firms being jointly responsible for the design and supervision of the whole equipment.

On August 24th, 1916, the President of the Republic, Dr. Victorino de la Plaza, inaugurated electric traction on the line from Retiro Terminus, in Buenos Ayres, to Tigre on Las Conchas River, *viâ* Victoria. The Central Argentine Railway thus had the distinction of being the first of the great railway lines in the Argentine to adopt the modern method of dealing with suburban traffic.

The service on the branch has operated with marked success not only from the engineering, but also from the traffic, point of view, the passenger journeys in the first six months of the year 1917 being some 11 per cent. in excess of the figures for the corresponding period of 1916.

The complete electrification works for the suburban system include a power station of 15,000 kw. capacity, 57 miles of high-tension transmission cables, four traction sub-stations with 14,000 kw. of converting plant, and the electrical equipment of 100 miles of single track. Power is produced in the generating station as three-phase current at 20,000 volts, with a periodicity of 25 cycles, which is transmitted to the sub-stations, converted to direct current at 800 volts, and supplied to the trains through a third rail. The suburban route of the Central Argentine Railway already electrified is shown in fig. 1, with the location of the power station and existing sub-stations.

The whole of the apparatus used in connection with the electrification was manufactured in Great Britain, and the principal contracts covered the erection of their plant by the various contractors; they are set out as follows:—

Power station buildings and complete boiler house equipment.	Babcock & Wilcox, Ltd.
Turbo-alternators, transformers, and motors.	C. A. Parsons & Co., Ltd.
Condensing plant and pumps ...	British Westinghouse Electric and Manufacturing Co., Ltd.
Switchgear in power station, auxiliary motors, &c.	British Thomson-Houston Co., Ltd.
High-tension transmission and low-tension track cables.	W. T. Henley's Telegraph Works, Ltd.
Structural steel work for power station entrance way, test room, offices, and sub-stations; also the cranes for the sub-stations.	David Rowell & Co., Ltd.
Electrical equipment of sub-stations.	Brit. Thomson-Houston Co., Ltd.
Rolling stock—bodies, underframes, and bogies.	Metropolitan Carriage, Wagon, and Finance Co., Ltd.; Birmingham Carriage and Wagon Co., Ltd.
Ditto, Electrical equipment ...	Brit. Thomson-Houston Co., Ltd.

The provision of the foundations for the power station and sub-stations, the walling of the sub-stations, excavation for cables, and the erection of the third rail were carried out by the railway company with its own staff.

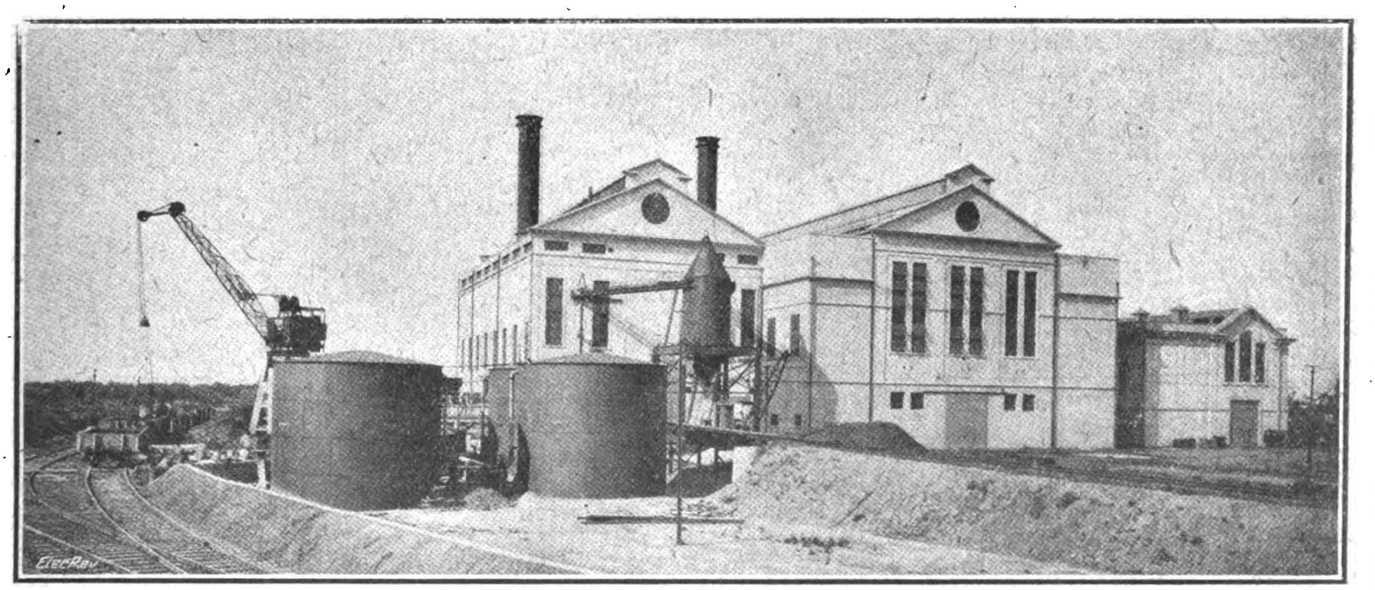

Fig. 2.—The Power House and Coal Yard.

The power house (fig. 2) has been placed at the station of Canal San Fernando. The site was swampy, and, in order to make a sound foundation, some 3,000 ferro-concrete piles were driven down 33 ft. till they reached the hard clay (tosca), which is found at varying depths all around Buenos Ayres. On the top of the piles a concrete raft, 2 ft. 6 in. thick, reinforced with old rails, was formed, in which pipes were laid for the cables.

The engine room and boiler house are arranged parallel to each other, with coal and ash-handling sidings behind the latter. In front of the engine room are a rotary

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converter sub-station, laboratory, and offices. A fitting shop and workmen's accommodation are provided at the permanent end of the engine room. There is space on the site to double the capacity of the station by extending the buildings towards the river.

The buildings are steel-framed structures, panelled with armoured concrete and finished with a white cement. The roofs of the sub-station and offices are of concrete; that of the boiler house is of corrugated iron. The engine-room roof consists of a wood ceiling covered with waterproof felt and with corrugated iron on top; this construction was required to avoid the condensation of moisture from hot humid air striking a cold corrugated iron roof.

Particulars of the principal plant in the boiler house are as follows:—

Number and type of boilers ...	Six Babcock & Wilcox marine-type water tube boilers.
Normal evaporation of each boiler	20,000 lb. of water per hour.
Working steam pressure and temperature	210 lb. per sq. in.; 600° F.
Heating surface of each boiler...	4,170 sq. ft.
Grate area of each boiler ...	98 sq. ft.
Type of stokers	Underfeed.
Type and size of economisers ...	Green; 200 pipes in each.
Number of fans	Eight "Sirocco" fans.
Number and type of feed pumps	Two impulse turbine-driven centrifugal pumps.
	Two vertical reciprocating, Nichols type.

Capacity of each feed pump, 75,000 lb. per hour.

fuel consumption figures for a recent week are:—Coal, 72·5 tons; oil, 15·5 tons; wood, 690·0 tons.

The wood burnt is red and white quebracho and algarroba, and the relative values of the different fuels are, roughly, as follows:—1 lb. of coal (calorific value 15,000 B.TH.U.) is equivalent to 0·8 lb. of oil, 2·5 lb. of red quebracho, 3·3 lb. of white quebracho, or 3·3 lb. of algarroba.

Labour and transport difficulties have become very acute recently, and the supplies of oil and wood have become so precarious that experiments have been made in burning maize. The results obtained indicate that maize is a slightly better fuel than red quebracho.

The combined efficiency of the boilers and economisers works out at about 85 per cent. when Welsh coal is being burnt.

The feed-pumps draw their supply from hot-well tanks in the pump house, and make-up water comes from a storage reservoir constructed alongside of the power station to two storage tanks erected above the hot-wells. Water is pumped from the River Lujan through a 6-in. pipe to the reservoir, and is there treated with alumino-ferric to precipitate the sediment which the river water contains.

The steam piping consists of a range of solid-drawn pipes, the flanges, of forged steel, being riveted in the case of pipes of 7-in. diameter and over, and screwed in the case of smaller pipes. The blow-off piping is solid-drawn steel, and connects to a blow-off sump formed of a boiler drum. The exhaust and escape-steam piping is lap-welded.

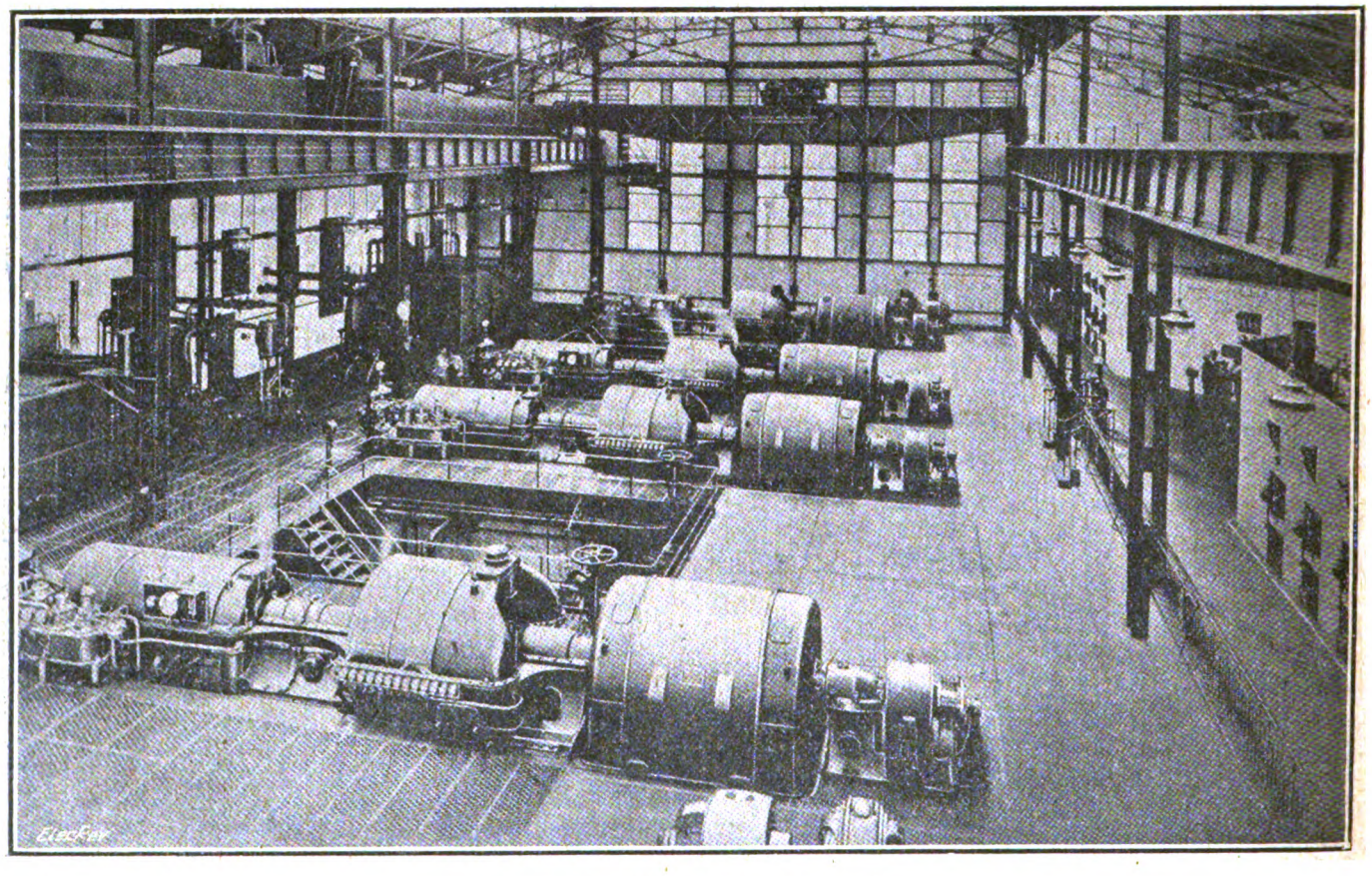

Fig. 3.—Interior of Engine-Room.

The boilers are arranged four a side, grouped in pairs, each boiler having its own superheater and economiser. One steel chimney with an induced-draught fan serves each pair of boilers, and forced draught is supplied to the furnaces by four fans in the basement.

The furnaces are lined with Glenboig bricks, and are suitable for burning either Welsh or Durham coal. The stokers are of the underfeed type, operated by steam rams. In anticipation of a shortage of coal, two of the boilers were arranged for oil firing, and a complete equipment of the Wallsend-Howden system has been put into operation, with storage tanks, filters, and pumps. As the shortage of both coal and oil, due to war conditions, became more acute, other boilers were adapted for wood firing, and the

The storage and handling of coal is provided for by means of an elevated railway track running alongside of the boiler house at firing-floor level, a gantry parallel to the buildings and carrying a level-luffing jib crane with a grab of 2 tons capacity, and two sidings at ground level. The coal trucks are brought on the site from the main line at Canal San Fernando Station, and the coal can be grabbed from them and either filled direct into two 15-ton receiving hoppers or into bottom discharge wagons which can be hauled along the elevated siding by a winch till they come over the receiving hoppers; thence the coal passes through crushers to gravity-bucket conveyors. These elevate it to a tray conveyor which takes it to coal bunkers above and between the two ranges of boilers. The coal bunkers have

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a capacity of 1,000 tons ; they are built of mild steel plates lined with armoured cement, and the bottoms are "V" shape in section. Alternatively, the arriving trucks can be pushed direct up the 1 in 25 incline to the elevated siding and the fuel—coal or wood—can be discharged direct on the firing floor by hand. The stock coal is grabbed from the trucks and stored below and around the gantry in a coal deposit floored with sleepers and constructed within range of the jib crane, which can plumb to a radius of 50 ft. The capacity of the store is 10,000 tons. The ash-handling arrangements comprise a suction ash plant with two 38-H.P. exhausters, which take the ashes from the furnace ashpits through electrically-operated crushers and specially heavy cast-iron pipes to a mild steel ash bunker of 80 tons capacity, lined internally with armoured concrete. The bunker is erected at the end of the boiler house at such a height that railway trucks can pass underneath to receive and remove the ashes. Alternatively, the ashes can be taken from the ash-pits by half-ton wagons along rail tracks laid along each side of the boiler-house basement, and deposited outside on the site.

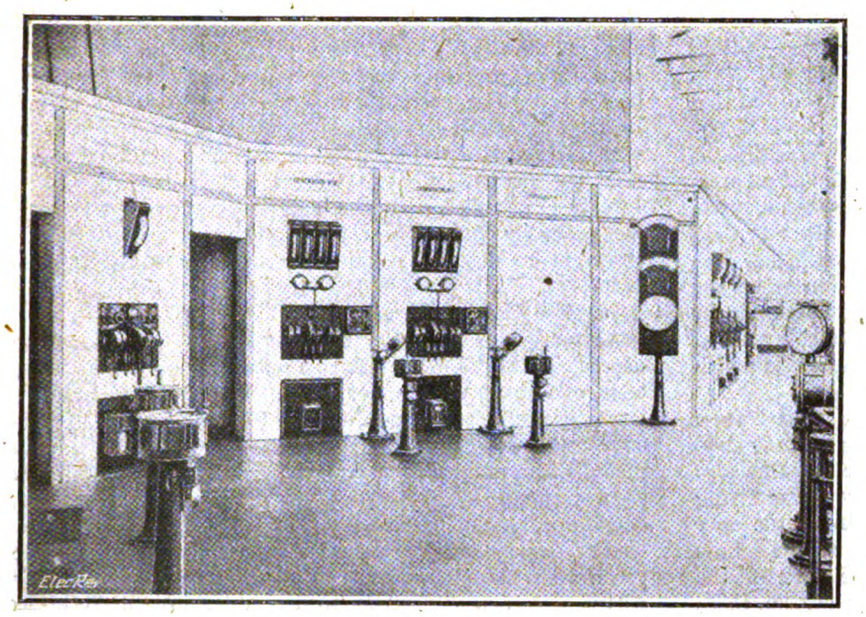
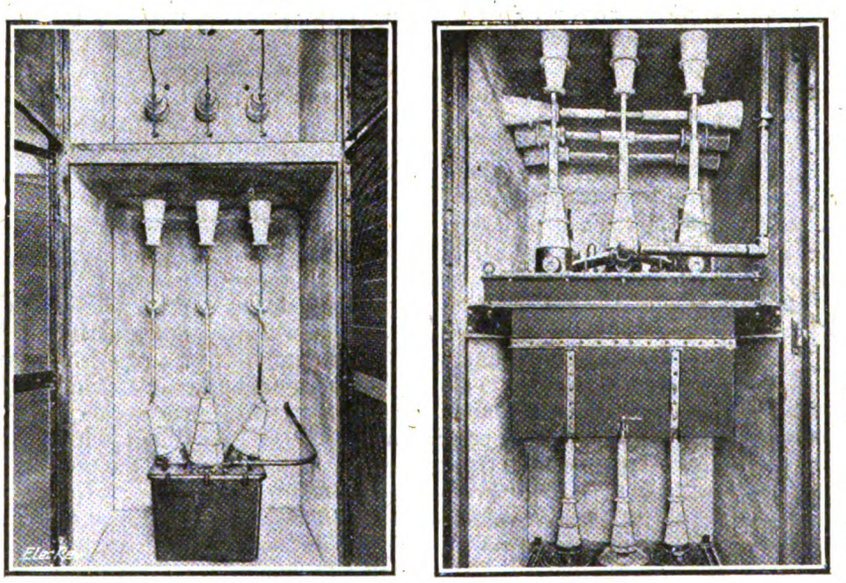


Fig. 4.—Part of the Main Switchboard.

The generating plant is so arranged that provided one boiler is steaming, any one of the turbo-alternators can be started up and can give a supply to the main bus-bars and to all the station auxiliaries. In addition, the break-down of anything comprised in one generating set will not prevent the operation of the remaining sets. There are four turbines in the engine room (fig. 3); each has its own steam-driven oil pump for use when starting up, its own condenser with air and water extraction pumps, and an independent circulating water pump. On the electrical side it has a self-excited exciter direct-coupled to the alternator shaft : leads from the alternator run direct to the "unit" transformer, which steps down the generated voltage from 2,500 to 440 volts, and gives a supply to the unit distribution board. From this board are fed the motors which operate the auxiliaries definitely belonging to the generating set to which it is attached, viz., those driving the air pump, exhaust valve, step-up transformer oil pump, and circulating water pump. The other station auxiliaries which are common to the whole station, *e.g.*, economiser and fan motors, are fed from a station distribution board divided into four sections, each of which can be isolated at will and fed from one of the unit boards, the feeders to the auxiliaries being so distributed among the sections that failure of one section will not put out of operation all the individual pieces of any auxiliary gear. The main leads from the alternator (1 sq. in. single-core cable) run to a step-up transformer, housed in the same compartment as the unit transformer, which raises the generated voltage from 2,500 to 20,000 volts, at which pressure the power is supplied to the station bus-bars. The station equipment, as a whole, is divided into two independent parts, either capable of running without the other. The main bus-bars are divided in the middle by a bus-bar sectioning switch ; two generators feed each half, and from each half a supply is given to a "station" transformer. Either of these station transformers can feed the station distribution board, the four sections of which are normally run coupled up. Connected to the extreme sections of the station distribution board are two motor-generators giving a supply for lighting the station and for charging the two batteries, which form a duplicate source of power for the tripping coils on the switches and the indicating lamps on the switchboard. The main outgoing feeders are distributed between the bus-bar sections, so that failure of one section will not shut down any sub-station.

The engine room contains four Parsons turbines with high and low-pressure cylinders, running at 1,500 R.P.M., and coupled to generators each giving 3,000 KW. at the most economical load, 3,750 KW. at maximum continuous load, and 5,500 KW. momentarily ; the condensers were made by the British Westinghouse Co., and have each a cooling surface of 8,250 sq. ft., dealing with 45,000 lb. of steam per hour with 6,800 gallons of cooling water per minute at a temperature of 80° F. The air and water extraction pumps are of the Westinghouse-Leblanc type, direct-driven by 40-H.P. motors at 1,440 R.P.M., and the four circulating-water pumps are of the Gwynne vertical rotary type, driven by Westinghouse motors of 240 H.P. at 720 R.P.M., and each delivering 6,800 gallons of water per minute. Similar pumps are provided for the purified water, bilge, and emergency pumps, and Gwynne air pumps for the air exhausters.



Figs. 5 and 6.—Switchgear Cubicles, Containing Potential Transformer and Oil Switch.

A 40-ton crane, with a 5-ton auxiliary hoist, of 60-ft. span, was supplied by Messrs. Babcock & Wilcox, Ltd.

(To be continued.)

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THE DUTIES OF THE PROGRESS DEPARTMENT.

By W. J. HISCOX.

(*Concluded from page* 358.)

The Fitting and Erecting Shops—The Testing Department—The Dispatch Department.

(*m*) *The Fitting and Erecting Shops.*—The term "Fitting Shop" is here intended to denote the department responsible for the fitting and assembling of the various sub-sections of the unit, just prior to the final erecting stage, and it is, therefore, necessary for the details required in connection with the sub-sections to receive priority at the hands of the preceding departments, a fact which must not be lost sight of by either the progress man or the departmental progress chaser. It is usual for the Progress Department, when compiling the delivery programme, to give a separate date for the completion of the sub-sections, apart from the date given for the delivery of the erected unit, even when the fitting and the erection shops are run in conjunction, under one head, as this ensures priority of treatment being meted out to those details which are required in connection with the first-named department.

In a well-organised factory, all details, no matter from whence they come, must be received in the fitting-shop component store before being issued to the fitters, this also applying to those parts which require an intermediate fitting operation prior to the final machining. This is the only way by which an accurate record of the whole of the details received can be kept, and it also simplifies the work of the fitting-shop foreman, seeing that, under this system, there is only one place from which he can draw the whole of his supplies.

This component store, like every other departmental component store in the factory, should be under the control of the Progress Department, instead of being controlled by the departmental foreman, the storekeeper working in conjunction with the progress chaser. The reason for this is obvious, since if this store is subservient to the authority of the departmental foreman, the component parts, upon arrival, immediately become the property of that department, and can be drawn upon indiscriminately, regardless alike of the requirements of specific orders, and the necessity for accurate record-keeping. Under such circumstances, a chaotic state of affairs exists with regard to the department's commitments, and it is, therefore, essential that the store be quite independent of departmental influence, so that all details may be issued to the fitters in the correct sequence, and every item recorded in a systematic manner.

It frequently happens that the fitting-shop under-foremen spend a great deal of their time chasing up details required in connection with the work they have in hand. This is regrettable, and should not be necessary. Neither should it be necessary for the progress chaser to personally interest himself in the fitting shop except in connection with those details which require further machining operations after fitting. The chaser should work to get the parts in which he is interested to the component store, and this should be done in such a manner as will ensure all the details required in connection with a specific sub-section being in the component store in accordance with the programme date.

The storekeeper should keep a correct record of all parts received, and issue the same to the fitting section concerned, upon demand, or advise the section foreman immediately all the details required in connection with a certain sub-section are available. All goods issued to the fitters should be signed for by the section foreman, and no detail should be issued in excess of the quantity covered by the specification list. It sometimes happens that a component part is scrapped in the fitting shop, and the section foreman, knowing that further quantities of the same article are available in the component store (in reserve for other orders), will demand a replacement. Such a demand should not be acceded to unless accompanied by a copy of the inspector's reject note, which, upon being presented, would be duly recorded by the storekeeper, and then sent for the Progress Department to be dealt with, and, under such circumstances the rejected article could be replaced from the available stock.

In factories where the fitting and erecting departments are run as separate concerns, the various sub-sections, when completed, would be sent to the erecting shop store, to be recorded and stored until required in connection with the final erecting, but where the two departments are under one head, the foreman would be responsible for all the sub-sections being completed to ensure the erected unit being completed at the appointed time.

The interest of the progress man with regard to the fitting and erecting departments is centred in the component store, as the records kept there will advise him as to the necessity of exerting pressure in any particular direction, and it is obvious, therefore, that too much attention cannot be given to ensure the strict accuracy of these records, upon which so much depends. The storekeeper must be a live man, not merely content to receive and issue parts, but to keep in close touch with the progress men and the chasers, and promptly advise them when any shortage of material threatens to delay the completion of any sub-section or unit.

(*n*) *The Testing Department.*—The completed unit, duly inspected, passes from the erecting shop to the test, which department has also been given a date for completion. The tests, of course, vary in connection with different lines of manufacture, but the progress man should be sufficiently conversant with the special requirements of the line of manufacture under his control, to be able to estimate fairly accurately the time necessary to perform this important operation. As many types of apparatus pass through the testing department, the progress man must keep in close touch with this department, to ensure that no unnecessary delay occurs with regard to the unit in which he is interested.

In the event of a unit failing on test, necessitating its return to the Erecting Shop, a fault sheet or other record accompanies it, and a copy of this should be sent to the Progress Department. The progress man interested would thereupon get in touch with the Erecting Shop and the other departments concerned, and, if necessary, issue a revised completion date to each of the departments handling any part of the returned unit, all work of this description being put on a preferential basis, with a view to minimising delay in connection with the dispatch of the article in question.

(*o*) *The Dispatch Department.*—When the completed unit has successfully passed the test, the Testing Department, or the official responsible for the final inspection, will enumerate the necessary particulars upon a shipping note, and this, together with the unit, will pass to the Dispatch Department. Here the unit will be packed, the dispatch note or advice note made out, and the unit then forwarded to its destination, the date upon which it leaves the factory coinciding with the final date appearing on the programme. The Dispatch Department should notify the Progress Department in good time should the shipping instructions not be to hand, and it should be understood that the progress man's responsibility does not cease with regard to the order until every item in connection with the same has actually left the factory.

We have traced in this article the Progress Department's connection with the departments handling a specific order, from the instructional to the dispatch, and it will be seen that the progress man's assistance at every stage is a vital necessity to ensure a speedy delivery. The article has, of course, been written from a progress point of view, and departmental systems and practices have not been commented upon, except so far as they affect actively the mode of procedure suggested. Although, for the purposes of this article, to prevent multiplicity of detail only the main departments, representing distinct phases of work in progress, are commented upon, the policy advocated can be extended to all intermediate departments, such as the Winding Department, special Machining and Fitting Departments, &c., by means of the delivery date system, the article being inspired for the express purpose of setting forth the duties of the Progress Department in connection with the various departments concerned in the execution of the order.

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THE ELECTRICAL EQUIPMENT OF KEADBY BRIDGE.

A bridge over the Trent at Keadby, 14 miles north of Gainsborough, on the Great Central Railway, was opened in May, 1916. This bridge, of more than ordinary interest, forms part of an elaborate deviation and widening scheme, is known technically as a "combined railway and highway Scherzer rolling-lift bridge," and has replaced the old swing bridge which carried the railway for nearly 60 years, whilst it also bears a public highway. Its most remarkable feature is the opening span, which weighs over 2,900 tons, and is the largest in Great Britain, if not in the world.

When the question of the improvement of the railway line first came under consideration there was a strong desire that the span of the new bridge should be very much greater than that of the old structure, and that ample facilities for traffic across the river should be provided. The Scherzer system recommended itself not only as a complete structure entirely suitable to the special needs of the situation, but for the ease with which it could be built without interference with the traffic on the Trent.

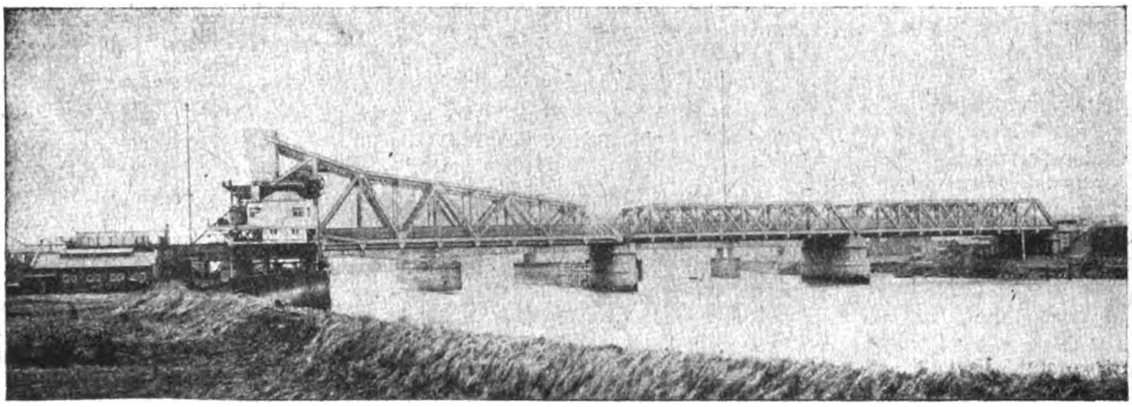

Fig. 1.—General View of the Keadby Bridge.

The old swing bridge provided two navigable channels, each 60 feet in width, whereas the lifting span of the new bridge gives a clear waterway 150 feet wide, equal to the two openings of the old bridge, including the central dolphin and piers. The roller-lift principle enabled the constructional steelwork of the opening span to be built in a vertical position, leaving the river between the abutment and the pier in the river free for the passage of river craft.

The provision of a public roadway, parallel to the railway, together with new road approaches on both sides of the river, constitutes an inestimable advantage to the public. The old bridge was a railway bridge pure and simple, and there were no facilities for the crossing of the river within a distance of 15 miles.

The new bridge, as shown in figs. 1 and 2, consists of five spans of the following dimensions: Two fixed river spans of 135 feet each; a lifting span of 160 feet, giving, as already mentioned, a clear waterway of 150 feet; a track span of 40 feet on which the lifting span rolls; and an approach span of 70 feet on the east bank of the river. The bridge has a width of 53 ft. 6 in. between the centres of the outside girders, of which 29 ft. 3 in. is occupied by the railway and 24 ft. 3 in. by the roadway. Each span consists of three main girders, the central one dividing the roadway from the railway.

The three main girders of the track span form a path on which the lifting span rolls, and together have to sustain the weight of the lifting span. The lifting span consists of three main trusses spaced at the same distance apart as the main girders in the fixed spans, and is counterweighted at the rear end in order to secure balance at all angles of lift. The counterweight consists of a rectangular steel shell extending across the full width of the bridge, and is heavily braced internally by lattice frames and strengthening girders. Its internal capacity is 24,780 cb. ft., and it contains 1,800 tons of concrete.

On either side of the lifting span heavy frames are built up alongside of the track girders and anchored down to the supporting piers of the bridge. At their upper extremity these frames carry horizontal girders, to which are bolted the main operating tracks. The clearance between these frames allows the span to move freely as the bridge is raised or lowered.

The position of the racks coincides with the centre of the rolling circle of which the segmental girders form part, and the rotation of the pinions attached to the gudgeon pins of the moving leaf, as they travel horizontally along the racks, rolls the leaf backwards or forwards, so opening or closing the bridge. A horizontal platform at the level of the fixed racks is constructed on the leaf itself, and on this platform the lifting machinery is accommodated.

Owing to the absence of power in the neighbourhood, a special plant for the generation of electricity was installed consisting of two 70-b.h.p. 4-cylinder petrol engines, running at 700 r.p.m., and direct-coupled to two B.T.H. direct-current 6-pole shunt wound generators of 50-kw. capacity at 220 volts. A storage battery of 128 cells is provided, capable of supplying the motors with current for about 30 operations of the bridge before recharging is necessary. The arrangement of the generating plant and switchboard is shown in fig. 3.

The whole of the operations involved in the lifting and lowering of the moving leaf are normally controlled by electrical equipment designed and installed by the British Thomson-Houston Co., Ltd., of Rugby.

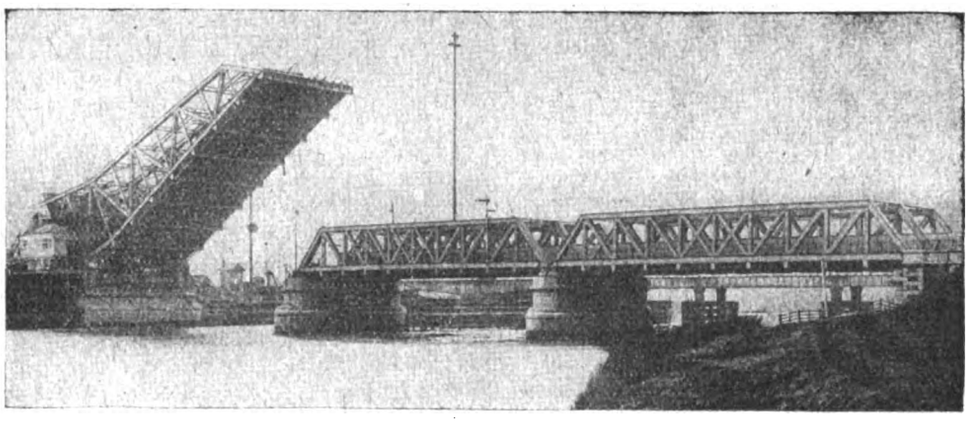

Fig. 2.—Rolling-lift Span being Lowered.

The moving leaf is worked by means of two direct-current 115-h.p. 220-volt motors, having a normal full-load speed of 380 r.p.m. and an overload capacity of 100 per cent. These motors are compound wound with shunt starting fields, and are carried on the leaf itself; they are coupled back to back, and arranged so as to work either singly or in parallel.

The method of control is such that by operating suitable switches either of the two motors can be used independently of the other, and all safeguards apply to either arrangement; thus in the event of the breakdown of one machine it is

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possible to use the other under all but the most abnormal conditions.

The driving power is transmitted through independent trains of gearing to the main pinions on each side of the moving leaf. The angle of maximum elevation of the bridge when fully open is 81 deg. 51 min., and the time taken to open or close it electrically is less than two minutes.

Owing to the very exacting weather conditions to be met, and to the fact that it is essential to interlock the railway signal system with the operating gear for the bridge leaf, the control gear is somewhat complicated. In a bridge of this description it is essential that the interlocking arrangements shall obviate all possibility of either rail or road traffic using the bridge in any position but completely down. Further, it is essential that all safety devices shall be operated in such

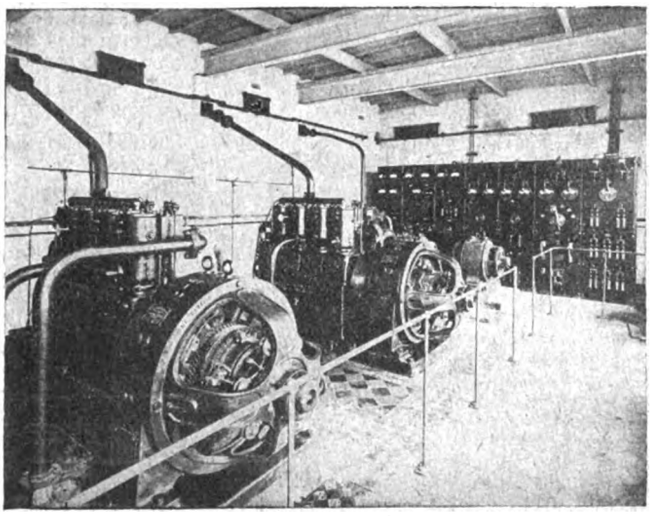

Fig. 3.—Interior of Power House, showing B.T.H. Generators and Switchgear.

a manner that they act automatically in the event of failure of the power supply.

Arrangements are made so that when a circuit breaker opens, either in the operating cabin or in the main machinery house, all brakes are applied automatically.

The conditions to be met in the actual operation of the bridge leaf itself are very stringent. The leaf must be under the full control of the operator at all times, and under all wind conditions, and it must be possible for an unskilled operator to open or close the bridge without causing damage. The system of control adopted enables these conditions to be met quite easily in spite of the great mass of the moving elements.

The method of control adopted when lowering the bridge comprises series resistance control for the greater portion of the travel, and diverter control, with limited power, for the last few feet of the travel. For this purpose limit switches are arranged in such a manner that at a pre-determined angle of the bridge when lowering, certain contactors are opened, thereby inserting series resistance in the armature circuit of the driving motors, while at the same time a diverter circuit is made to give a positive slow speed, practically independent of the load on the machines. At a slightly later period of the travel another limit switch operates, cutting off power entirely, and causing the bridge to stop a few feet above the ground level. The operator can then, by means of a special pedal switch equipment, inch the bridge down under diverter control with a limited amount of power; the provision of an oil buffer ensures that the leaf can be brought to the fully closed position without a perceptible jar. Further provision is made so that, by moving the controller handle at the same time as operating the pedal, it is possible to vary the amount of braking effect given by a special motor-operated brake, thus giving a variation in speed corresponding to the limited power already mentioned.

The braking arrangements are very complete, and comprise two sets of brakes operated by a direct-current, 1-h.p., 220-volt, series-wound motor, and two sets of solenoid brakes operating on drums geared to the driving motor shafts. All brakes are arranged to set automatically in the event of voltage failure, irrespective of the position of the controller handle.

The method of control for raising the bridge is similar to that already described for lowering, except that no diverter control is provided; this is unnecessary, as the bridge is not usually opened to the full extent of its lift, and consequently the amount of over-run allowed is much in excess of that actually required.

There is one important factor in connection with the lifting, however, which has to be taken care of, namely, the effect of wind pressure. Under certain conditions a strong wind will actually run the bridge backwards, and special limit switches are arranged so that when this happens all brakes are applied when the bridge reaches a predetermined angle. This safeguard also comes into operation when starting to lower the bridge from the fully open position. This is essential, as under certain conditions a strong wind may take control and run the bridge backwards when the brakes are released, and before power is applied.

The contactor equipment for the control of the bridge movements is located in the machinery house. It consists of a panel for each separate motor, containing the various line and resistance contactors, overload relay, isolating main switch, and fuses. This panel is controlled by a special controller comprising two parts, the first operating the contactor gear which makes the connections for raising and lowering the bridge, and the second varying the amount of resistance in series with the motor operating the brakes. Thus, by moving the controller handle, it is possible first to free the solenoid brakes, and then to vary the effect of the motor brakes from maximum near the off position to zero when the first power position is reached. A coasting point is provided between the last braking position and the first power notch so that, if desired, wind pressure can be used to lift the bridge, the motor and solenoid brakes being brought into action when it is desired to stop.

With the controller is incorporated a special locking magnet, operated from the signal circuits, which ensures that the controller handle cannot be moved to open the bridge until the signals are set to "danger." Further, the signals cannot be set clear until the bridge is in the fully closed position. A special motor is used in connection with the locking bolts between the rails on the moving leaf and those on the fixed span. These rails are locked in the down position by means of steel bolts controlled from the signal cabin. The bridge itself is locked in the down position by two heavy forged steel bolts worked electrically by means of a direct-current, 1½-h.p., 110-volt, series-wound motor operated from the control cabin. These steel bolts engage with castings anchored to the pier, and arrangements are made so that it is impossible to operate the contactors for lifting until these bolts are withdrawn; the bolts cannot be closed when lowering until the bridge is right down and control has been cut off from the contactor panel.

Provision is made for reversing the motors by means of a special reverser situated on the moving leaf, and the special limit switches referred to in the foregoing description are operated by means of sprocket gearing which is driven from the main motor shaft. These limit switches are situated in the machinery house on the moving leaf.

Electrically operated gates, opened and shut by a direct-current, 4½-h.p., 220-volt, compound-wound motor, are provided for the protection of the railway traffic. These gates

Fig. 4.—Operator's Cabin, showing Master Controller in Background.

are interlocked with the railway signals which, in turn, are interlocked with the control gear on the bridge.

This bridge was built to the designs, and under the supervision, of Mr. J. B. Ball, M.I.C.E., chief engineer of the Great Central Railway, by Sir Wm. Arrol & Co., Ltd., of Glasgow; the electrical equipment was supplied by the British Thomson-Houston Co., Ltd., of Rugby.

The "Key" Industries Exhibition.—At the request of the Board of Trade, the New British and "Key" Industries Exhibition, Central Hall, Westminster, S.W., will remain open until October 24th, to enable the Greek Minister of Agriculture and the influential party representing Greek commercial interests, which is now touring the leading industrial centres of the United Kingdom, to pay a visit to the Exhibition.

Mr. W. M. Hughes, Prime Minister of Australia, was to deliver an address at the Exhibition on Wednesday last.

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CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

"Fraternity"—or Tyranny?

I have read with amazement the letter sent to a proposed member of the E.P.E.A. by Mr. Webb, London Secretary of the E.T.U., and for undiluted impudence this letter takes some beating.

Is Mr. Webb aware that in his acting capacity as secretary he is actually the servant of the members of his union? and for a servant, honorary or paid, to write insulting letters of this type is, in my opinion, degrading the prestige of the union to a level lower than that of the gutter.

I do not know the exact purposes and aims of the E.P.E.A., but I do know that if engineers, whether members of the E.T.U. or not, like to join and maintain another association they are free to do so, in spite of the lordly overbearing manner of Mr. Webb, who, I take it, is responsible to his members for his utterances.

I thank heaven I am not a member of the E.T.U., nor would I associate myself with it, but there is no more ardent trade unionist than myself if a union is properly conducted, and in view of the amount of unenviable notice the E.T.U. has brought upon itself at different times, it is time the members got a new administration or the whole thing was disbanded, for the mightiest motto for a trade union should be the free use of one's personal inclinations, at least as far as voluntary membership is concerned, and after all, is the loss of one member of such moment to Mr. Webb that he must needs threaten to deprive a fellow being of his living? where does the E.T.U. get its power from, weird hallucinations of its executive?

However, I have never been in sympathy with the union at all, mainly on account of its administration, and if the news is of value to Mr. Webb I do not employ E.T.U. men, and would not, although I pay their rates, and if he thinks my staff any the less skilled he is talking "through his hat."

In conclusion, I have brought the matter before the editor of *John Bull*, and I sincerely hope that it will get wide publicity.

J. Shaw.

Glasgow, *October 12th*, 1918.

Technical Publicity.

I am sure many of your readers must have read your leading article "Sales Promotion" and Mr. Birkett's "Technical Publicity," both of which appear in your current issue, with considerable interest. One is complementary to the other, each bearing on the vital subject of commercial expansion. I am glad to see that both writers emphasise the importance of "quality" (or what for want of a better term I call dignified distinction) in catalogues and in Press advertisements. The value of this should be obvious. No good business man would employ a shabby representative. He would insist on his travellers being well groomed and well educated, in fact he would require men of breeding, with experience requisite to their calling.

As the advertisement is a salesman, albeit a silent one, though not less efficient on that account, there is every reason why it should be suitably garbed, the dress in this case being the way in which it is displayed. Appropriate display is a form of layout which will give distinction to the advertisement and cause it to attract the reader's attention by its dignified and arresting appearance, a feature which may be due to its well-considered originality—and by the interesting information conveyed by the text.

The creation of advertisements of this order is not, and cannot be, the work of the amateur. It requires the experience of a person who has made a special study of modern advertising, and in the case of technical publicity, a practical knowledge of engineering.

It is the firm which gives its advertising the consideration it deserves, and which uses the best in the way of copy and display, which reaps the maximum benefit from its expenditure. As long as advertisers treat their advertising as of little account, and delegate the writing of the copy and the designing of the display to any member of the staff who likes to try his hand at it, they get indifferent results.

Advertisement designing is a highly specialised business, a craft demanding experience. Some seem to look upon it as the boy did who was asked if he could play the fiddle, "I've never tried," he said.

In passing his strictures upon American advertising, surely Mr. Birkett does not include the American technical Press. Let anyone glance through the publicity sections of the motoring papers, the engineering journals, or the *Saturday Evening Post* pages devoted to mechanical or electrical appliances, and he will be impressed by the way in which these advertisements are set out. Not for one moment do I suggest that the wording is of a type to be adopted in this country. It is far too racy; too breezy altogether. At the same time, it is the style of language which Americans use in ordinary conversation and understand. In their case it is appropriate. With us a quieter and more sober form is current. It is the skilled writer who drafts his "copy" in the style which will appeal to and interest his particular class of reader.

In the past few years the advertising pages of our engineering journals have shown that many firms are employing qualified assistance in the preparation of their announcements, and in the immediate future many more will follow suit. And it will pay them handsomely.

Too many look upon an advertisement as a means of keeping their name before the public, nothing more. They write their names and addresses large, give a list of apparatus they sell, but leave out the one thing of vital importance, and this is information about the goods. They assume that engineers know every type of machine and appliance made, which is a mistake. Take the average central station engineer as an example. He has had two or three makes of engines under his control, not more than two types of turbines, rarely more than two styles of boiler plant, the same with electrical equipment and switchgear. How *can* he know every kind? It is impossible. It is your advertisement which must tell him the advantages of *your* apparatus. Interest him in your specialities, then he will get in touch with you, and your representative can do the rest.

Believe me, engineers do read advertisements. Only the other week I was asked by an engineer superintendent if I could tell him anything about a certain appliance. He had looked through the trade papers, but could not find from these what he wanted to know. By no means is this an isolated example. There are thousands of engineers similarly situated. If you are an advertiser it lies with you to tell these men about your manufactures. Tell them in the right way, by means of good copy and distinctive and refined display, and you will have every reason to congratulate yourself on the adoption of modern and efficient methods of advertising. A factor that the advertiser who uses indifferent copy will have to contend with in the near future is, that as his competitors improve the style of their advertisements, so his will decrease in interest, attraction, and strength.

Ernest Ingram Hill.

Wimbledon, *October 14th*, 1918.

Patent Law Reform.

Apropos of the criticism of the two proposed new Bills, *i.e.*, the Trade Marks Bill and the Patents and Designs Bill, "1917," towards the end of last year and during the present year, it may be interesting to your readers to know that these Bills have now been withdrawn and are dead.

As the result of the question being raised, conferences were held in the larger cities of the kingdom which culminated in the formation of a General Committee in London which ultimately adopted a comprehensive report drawn up by the Institution of Electrical Engineers for presentation to the President of the Board of Trade. By arrangement, a large and influential deputation, consisting of doctors of science, inventors, electricians, patent experts, and representatives of technical and scientific societies, and some of the principal progressive industries in this country, was formed and appointed to wait upon Sir Albert Stanley to place before him its views on the imperfections of our patent system, and the grievances under which inventors in this country suffered.

It was ultimately settled that Sir Albert Stanley would receive the deputation last Thursday, 10th inst.; it was rather unfortunate, however, that though the meeting had been arranged for with Sir Albert a considerable time ahead, and even after the day and hour had been fixed and confirmed the time of meeting was put back one hour at Sir Albert's request by telephone, he (Sir Albert) was not present, but sent a deputy in his place, much to the regret of the deputation, many of whom had come so far to lay their views before the Right. Hon. gentleman on a matter so important to "*the commerce and industry of the country after the war*," upon which Sir Albert had been lecturing lately throughout the United Kingdom.

Some of us, old enough to remember being present in the same room in 1883, when the late Mr. Joseph Chamberlain as President of the Board of Trade met a somewhat similar deputation, and eloquently spoke to us on the benefits of invention and its encouragement, just before introducing his own revolutionary Patent Bill of 1883, could not very well help comparing our reception *then* and *now*, with so much more at stake in competition after the war.

Anyone who knew the late Mr. Chamberlain, with his proud, imperial, and patriotic spirit, and who magnified every public office he ever held, could scarcely conceive his delegation of the reception of any such representative deputation to a deputy. Apart from that, however, the deputation was led inferentially from the chair to understand that no new Bills had yet been drafted, while the various speakers of the deputation urged with considerable force, an automatic moratorium or prolongation of patents to meet war conditions, the protection of inventions relating to food, medicinal or surgical products, the importance of product claims to chemical and other industries, the extension of the term of patents, the period of provisional protection, the period of acceptance of the complete specification, the reduction of patent fees, the protection of patentees in relation to utilisation of their inventions by the State, the limitation of provisions for revocation of patents, the abolition of the com-

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pulsory working of patents which principally benefited foreigners, and especially Germans, the safeguarding of patents of addition, the formation of a special tribunal to deal with patent cases, and the adoption, if possible, of a British Empire patent system. In regard to the latter, Sir Robert Hadfield graphically pointed out the absurdity of the present Canadian patent system (part of which system was incorporated in the proposed Bill of last year), under which he found he had to pay the sum of eight guineas for a type-written copy of a Canadian specification, while the British printed specification of same only cost here some 2½d. As regards the moratorium, patentees do not want any one-sided favours, but they desire justice. In my own knowledge there are patents for apparatus, say, for street and other lighting, &c., on which renewal fees are being regularly paid, which have been turned into dead letters by the Government war restrictions, and surely it is only fair that an extension of time should be given these in the proposed new Bill? Then as to the necessity for compulsory working clauses, why should these be required here any more than in the United States, unless to prevent us getting so good terms from other countries as the Americans do get because they have no compulsory working under their more perfect patent system? Unquestionably, our principal competitors after the war (Germany, let us hope, being barred) will be our American friends, and it is very desirable in the interests of invention, commerce, and industry in this country, that we should have equal opportunities with our American Allies, to say the least. We were promised by the Board of Trade representative that all these various matters would receive earnest consideration in the preparation of the new Bill, but, to my mind—the end of the war being now at least in sight—the question comes to be, would it not be better now to wait till the war is over, and then if possible secure a new Bill on American lines, formed on Democratic principles to suit our conditions for the whole British Empire, in order that Britishers here and throughout the Dominions could have had an opportunity of holding our own in the race for the coming world's business?

James Keith.

Leigh-on-Sea, *October 12th*, 1918.

The Electrical Industry in Russia.

We have read with interest the article by Mr. Allan Monkhouse on "The Electrical Industry in Russia," which appeared in your journal of September 20th.

In this, reference is made to Mr. H. Ledward, of Moscow, amongst others, having developed workshops for the construction of electromedical apparatus.

We should like to say that Mr. Ledward is our agent in Moscow, where, by arrangement with us, he manufactured certain apparatus of this type, in addition to the goods we exported to him.

Owing to the Russian situation, this work has, of course, had to be suspended for some time, but we have every hope of resuming business with Mr. Ledward as soon as national circumstances permit.

We shall be obliged if you will insert this letter in the next issue of your journal.

Newton & Wright, Ltd.
E. E. Burnside.

London, W., *October 9th*, 1918.

The Electrical Power Engineers' Association.

The Marylebone branch will be glad if you will allow it, through the medium of the Review, to ask Mr. Jones four questions:—

1. Is his union a registered trade union?
2. By whom was this particular "union"(?) formed?
3. From what cause was it formed?
4. For what purpose and with what intent do the sponsors and members allow it to continue in existence?

The Marylebone branch feels that there are enough unions in existence to cater for every shade of thought and opinion, and some of the members have viewed with some misgiving the efforts of small and unknown bodies. In the circumstances, therefore, the branch will be glad to have the particulars asked for.

John Vincent,
Secretary,
National Amalgamated Union of Enginemen, Firemen, &c.

London, N.W., *October 14th*, 1918.

WAR ITEMS.

German Army Electrical Plant in Galicia.—The Governor of Galicia, as the National Central for the Economic Reconstruction of Galicia, acting with a group of electrical engineers, has bought from the German Army all the electric plant (machinery, wires, and installation materials) constructed by the Army in East Galicia, on the River Seret, while this was a theatre of war. The German Army built an electric power station on the Seret, and constructed a network of H.T. cables of 1,500 volts extending from Tarnopol to Borszczow. Transformers set up in towns and villages reduced the voltage to 220 and 110 volts. The energy was supplied either by water or by special steam-engine plants.—*Nowa Reformer*, September 4th.

Restoration of Trade Union Conditions.—In the course of a leading article on the War Pledges Bill, under which the Government proposes to give effect to its war-time agreement with the trade unions, the *Manchester Guardian* says: "The passing of the Act is the first stage in the series of constructive measures without which the war will be followed by industrial chaos."

Second-hand Boilers.—By order of the Ministry of Munitions second-hand steam boilers of any type "not being a boiler for use in any locomotive, motor car or vehicle, or on a ship or other vessel," may not be purchased or sold or otherwise dealt in without a permit obtainable from the Controller, Department of Engineering, Charing Cross Embankment, W.C. 2.

Blinded Soldiers at the Siemens-Schuckert Works.—According to a German paper, an experiment was made with 39 blinded soldiers at the Siemens-Schuckert small-wares factory, and as they proved a success the number was more than doubled. The men begin with six hours' work, which is later increased to 8½ hours. Most of them prefer machine work to hand work, because it gives them more control over the progress of the work. The machines are provided with ingenious protective arrangements, and the men soon learn to use them very skilfully. Some are able to work two machines at once. They have been very successful even with the turning lathe. So far as possible an employment resembling their former occupation is found for them.

A hostel for unmarried blinded men has been established, by private enterprise, near the works, which are in Siemensstadt, Berlin, and a row of houses with gardens has been provided near the same factory for the married men employed there.

Industrial Conditions after the War.—The general question of the position of women workers after the war has just been considered at an unofficial conference between leading trade union women and employers of labour arranged by the National Alliance of Employers and Employed, Mr. F. Huth Jackson presiding. The first question discussed was whether the one and three-quarter million women who, in addition to the three million in industry before the war, now compose the women's industrial army, could be retained in industry after the war. The general opinon was expressed that, while there would be a temporary period of dislocation, during which time the whole community would have to be patient and work on a give-and-take basis, there was little doubt that there would ultimately be work for all, and the whole of the women at present in industry could be retained. The possibility of a minimum wage was discussed, and the meeting was unanimous that such a thing was advisable, and that it should be based on a reasonable standard of life, but would have to vary in different areas. It was also agreed that during the period of demobilisation it would be better to institute a system of part-time work, so that the whole of the workpeople should be employed for part of the day, or part of the week, rather than that some should be employed full time and the rest turned out on the unemployment market. It was anticipated that this period would be only temporary, and ultimately all would be reabsorbed.

Dissatisfaction was expressed at the delay in the production of definite and co-ordinated plans by the Government, and the conference adjourned, agreeing to meet again either to consider the Government's demobilisation proposals or, failing that, to formulate its own on the nearer approach of peace.—*Daily Telegraph.*

Wages after the War.—An official statement was issued last week as follows:—

The situation which may result at the end of the war, in regard to the various wages awards which have been made during the war, has for some time been under the consideration of the departments concerned. The present scale of wages in many occupations depends upon the compulsory enforcement of awards which were made in view of circumstances arising out of the war; but the machinery for enforcing these awards will not continue after the war. It is necessary, therefore, to consider whether the compulsory operation of such awards should be continued during a period of transition after the war, and also whether the power to make such awards should be extended so as to cover the same period. With a view to immediate action on the subject the Minister of Reconstruction is appointing a committee with the following terms of reference:—

1. Whether the compulsory operation of awards made under the Munitions of War Acts, of orders extending such awards, and of orders regulating wages made under those Acts, should be continued after the war.
2. Whether the power to make such awards or orders should be continued after the war.
3. The manner in which awards and orders if made or continued should be enforced after the war and for what period.

Sir John Simon, K.C., M.P., is chairman of the committee, which will consist of representatives of employers and trade unions, besides representatives of Government departments.

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The Urgency of Reconstruction Problems.—In the course of its leading article on "Reconstruction Problems" last week *The Engineer* says: "The work of reconstruction must no longer be regarded as a subject for discussion, but a case for action. Until now, except for the formation of a few of the Whitley Industrial Councils, and the work of some trade organisations, little has been done. The peace for which we have fought, and are fighting, may, however, come in the end as suddenly as the war cloud burst in 1914, and we dare not be found unprepared for the change of load on the industrial machine which will then occur. A fairly accurate general idea can even now be formed as to the character of the new duty, and the heavy peak demands which will have to be met, and it is time that the task of modifying the design of the industrial machine to carry the load was taken seriously in hand. There are still some perhaps who imagine that the old machine stripped of the auxiliaries made necessary by war service will suffice for our needs, but the majority are convinced that considerable, and perhaps radical, changes in design are necessary. The real point now at issue turns on the modifications which will best meet the peace needs of industry, and how they can without further delay be embodied in a design which the majority will accept as a genuine attempt to solve the problem."

Exemption Applications.—At Castleford, William Burrow, tramway inspector, Grade 2, made a personal appeal, and had the support of the manager of the tramway company, who stated that he was in a certified industry and could not be called up until decertification by new regulations. He was granted three months' temporary exemption without volunteer drill.

At Maidstone, the Corporation Tramways Committee appealed for A. E. Chittenden (40, Grade 2), driver and assistant inspector, claimed to be indispensable. Three months were conceded, with no volunteer service.

At Ilfracombe, the Electric Light and Power Co. appealed for H. J. Stewart, resident electrical engineer; T. H. Sanders, electrician, and A. J. Rudd, relief stoker, &c. Sanders was given until March 1st, and as the others hold protection certificates, the appeals were refused, with leave to re-appeal if the certificates were withdrawn.

Exemption until March 27th has been granted at Windermere to J. Reed, foreman shift engineer, engine driver, and switchboard attendant at the electricity works.

At Trowbridge, six months' exemption was conceded to E. T. Charnbury (32, Grade 1), electrician to Messrs. J. and T. Clark.

Romford Urban Tribunal has refused exemption, with one month's grace, to H. North (31, Grade 3), electrical engineer.

At Rotherham, exemption until January 3rd was granted to W. Martin (41, Grade 1), tramway track layer, engaged with the Corporation.

Maidstone Tribunal has granted six months' exemption to A. T. Lambert (42, Grade 2), manager of the Corporation tramways.

At Castleford, the manager of the Tramway Co. appealed for W. Burrows (Grade 2), inspector, claiming that he was in a certified industry, and would not be called up until decertified by new regulations. He was granted three months' temporary exemption.

At Dartford, on October 7th, a review was made of the case of E. Vane (41), electrician, and the exemption certificate was withdrawn.

A MOST UNPLEASANT STORY.

By "IMPERIAL."

It was, I believe, Lord Avebury of whom it was said that bankers thought him a great scientist, while scientists believed him to be a great banker. The *Times* Literary Supplement, in reviewing Mr. Oliver Onions's latest book, "The New Moon—A Romance of Reconstruction," says that too much is made of the development of electricity, and too little of the development of human nature. We agree that so far as human nature is portrayed in this book, its development is unpleasant and undesirable. Apparently the surviving types are to be successful business men of the Birmingham calibre, journalists who run the political affairs of the country with open flippancy, the worst class of Ministry of Munitions official, and masculine young women with a deplorable lack of reticence in their marital affairs and sense of humour. It is at least to be hoped that if the girls of ten years hence are to broaden their humour as well as their outlook, they will find some better story to tell than that of vivandières being *hors de combat*.

The development of electricity is perhaps not so obvious to the technical mind as it may be to the detached literary observer. Apparently it consists of two things, the first of which is the use of our rivers to run generating stations. It seems to be a common idea that because a river in Norway, or Italy, or India can run a generating plant of 100,000-kw. capacity, the same can be done in England. At a lecture to a learned society on the Tata hydroelectric scheme, I once heard the question asked: "Why are all these hydroelectric stations in the hills, where the laying of pipe-lines and the erection of overhead transmission is difficult and costly? Is there not as much water in the plains?" This question seems to be unanswered in the minds of many people, including Mr. Onions. In connection with these hydraulic schemes, there is apparently also some intention of "trapping the tides," but we are not given any clear conception as to how it is to be done. This perhaps is not difficult to understand, since engineers in this book multiply five-figure numbers without slide rules, and express head of water in foot-pounds.

The second development is in the direction of household electrification. One presses a button in the kitchen, and a washing-up machine does all the work of a scullery maid, while in other similar ways all household labour is abolished. It is not clear whether this machinery never breaks down, or whether there is a large and expensive staff of mechanics and electricians to keep it in working order.

It is this sketchiness which is the damnation of the book. The conversation, when it is not laborious lecture, is in half-finished snatches, with incomplete sentences concluded by suggestive dashes. In two pages the question of the evangelical and the ritualistic church is dismissed with airy patronage and contempt—and so is the fact that the whole scheme of post-war reform will only be started because the returning soldiers began murdering munition workers.

It is on this latter point in particular that the whole book falls. Its faults of conversational style are to be expected in a frankly propagandist novel, it is perhaps better to leave explanations of hydroelectric schemes to the technical Press, and religious dogma is always better left alone, but a forecast of the future which leaves all industrial reform, and all reconstructive effort, to be started because the masses have broken into open murder is, we hope and pray, totally false. And yet perhaps in this Mr. Onions is a true prophet. Amongst business men, how frequent is the remark, "There is bound to be a revolution when the war is over." One responsible engineer has even added that we shall fortunately have a large Army to keep order. It is a very prevalent opinion that when peace is restored, events will happen far too quickly for us to cope with them, and that there is bound to be a period of upheaval, from which we, being more lucky than Russia or other nations, shall emerge triumphant, cleansed and revivified. A medley of forces run riot is to accomplish reforms that have been dreamed of for centuries.

We must recognise now that our war measures will last for a while at least when the war is over. We must also realise that the object of reconstruction is not to revert as rapidly and as completely as possible to the conditions of July, 1914. Thirdly, we must deduce from this that although we are now directing every effort towards winning the war we must always direct our industrial policy so that it shall be applicable, with reasonable modifications, after the war is over. If we confine our thoughts to the present we undoubtedly shall achieve chaos when we reinstate the returning troops. The industrial structure we have erected to win the war cannot be cast down and a new one built up while our transports bring men from France. Moreover, much that has been done is on too solid foundations, or, to vary the metaphor, has its roots too deeply into our daily life, to be easily removed. Many reforms have been introduced unnoticed, or in some cases amidst a chorus of praise, which in other times would have been resisted in the last ditch. July, 1914, was not, except by comparison, a happy time. Looking back on it now, we envy its freedom from care—there was no war on. If, however, the end of the war could land us back there again, it would be an unmitigated disaster. We want to win something out of the war—we want a happier, cleaner, pleasanter world. We do *not* want to continue under the present restrictions on personal liberty. We do *not* want each man to be ticketed, labelled, and started off to run steadily along a groove from which he can never escape. We do *not*, we most *certainly* do not, want to live so that each man does the maximum of work, and has the minimum of liberty to devote to his home and his personal happiness. The knowledge that someone else is striving so to order the world that the streets are clean, your home is well built, and the sanitation is perfect, is no recompense for the loss of your own individuality. Every man must work to keep himself, perhaps, but work is only a means to an end, and is not a god to be worshipped.

That is one side of the picture—the other is that the work each man does must be useful, not only to himself, but to the community. We do not want to go back to the time when the advertising agent who could talk was the most successful, and thought himself the most important, man in the world. We do not want to go back to the time when the paid agitator was a power in the land, and was regarded as the voice of labour. Unproductive effort should not be profitable—and most men know, and are sufficiently honest to admit to themselves, whether their work is useful, or whether they are merely looking busy, churning up mud in a backwater.

If only the urgency of the question be recognised, we can so model our present actions that the task of reconstruction shall be half accomplished before war ends, and so that the return of our armies shall not involve chaos. In this way, we may achieve progress and attain a state which shall be a fitting memorial to those who have fallen. We may also avoid the incarnation of the worst elements of the Civil Service which Mr. Onions has foretold as our ultimate fate, and we may even create such a world that in years to come we may look back on "The New Moon" and say, "Thank God it was a Romance."

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BUSINESS NOTES.

The Board of Trade Provisional Advisory Council.—It is announced in the *Board of Trade Journal* that pending the formation of an Advisory Council for the Board of Trade on a permanent basis, the President of the Board has invited the chairmen (or other representatives) of various Committees, including those on Trade After the War, the Presidents (or other representatives) of the Association of Chambers of Commerce and the Federation of British Industries, and representatives of Labour interests, to form a Provisional Council to advise the Department of Commerce and Industry. The Council also includes representatives of the Foreign, Colonial, and India Offices, and the Dominion Governments have been invited to nominate members. The Council consists of :—

Sir Henry Birchenough, K.C.M.G. (Empire Cotton Growing Committee).
Sir Alfred Booth, Bart. (Shipping and Shipbuilding Committee).
Lord Colwyn (Empire Flax Growing Committee).
Sir Herbert Dixon, Bart. (Cotton Control Board).
Lord Faringdon (Financial Facilities Committee).
Sir Algernon F. Firth, Bart. (Sub-Committee of Commercial Intelligence).
Mr. James Gavin (Labour).
Mr. Harry Gosling, C.H. (Labour).
Mr. G. Grindle, C.M.G. (Colonial Office).
Right Hon. F. Huth Jackson (Trade Relations After the War Committee).
Mr. L. J. Kershaw, C.I.E. (India Office).
Mr. E. Manville (Association of Chambers of Commerce).
Mr. G. A. Moore (Advisory Committee to the Department of Overseas Trade).
Sir Gerard A. Muntz, Bart. (Non-Ferrous Metal Trades Committee).
Mr. J. W. Murray (Advisory Committee to the Department of Overseas Trade).
Sir Adam Nimmo, K.B.E. (Coal Trade Committee).
Mr. J. W. Ogden (Labour).
Hon. Sir C. A. Parsons, K.C.B., F.R.S. (Electrical Trades Committee).
Mr. G. Scoby Smith, C.B.E. (Iron and Steel Trades Committee).
Sir Richard Vassar Smith, Bart. (Federation of British Industries).
Mr. Douglas Vickers (Engineering Trades Committee).
Sir H. A. Walker, K.C.B. (Railway Executive Committee).
Sir Frank Warner, K.B.E. (Textile Trades Committee); and
Mr. Victor Wellesley (Foreign Office), together with the representatives of the five Self-Governing Dominions as soon as nominated.
Mr. S. J. Chapman, C.B.E., and Mr. Percy Ashley, Assistant Secretaries to the Board of Trade, will act as General Secretaries to the Council.

Cable Urgently Needed.—We are glad to learn that the wants of the Guildford Electricity Supply Co., Ltd., of which we made brief mention in our issue of October 4th, were very promptly met by the kindness of an electricity works in the North of England.

Copper Wire in Australia.—The manufacture of copper wire has been commenced at the works of the Metal Manufactures, Ltd., Port Kembla, which cover an area of about one acre.

Swiss Export Trade Problems.—In the course of a recent report, the Association of Swiss Machinery Manufacturers referred to the fact that the loss of export trade after the war would be fraught with dire consequences to the economic life of the country. In case Switzerland as a neutral country should succeed in concluding favourable commercial agreements allowing of Swiss products receiving here and there perhaps a certain degree of preferential treatment, there was a danger that Switzerland would have to be used by other countries as a transit country. First of all, therefore, the "neutralisation" of foreign products by commercial firms, assembling workshops, and the like would have to be prevented. But the removal of actual manufacture from foreign countries to Switzerland and her too great industrialisation would also be undesirable.

Trade Announcements.—With the object of meeting the increased demand for their A.C. motors, Messrs. F. Parkinson and Co., of Wells Works, Guiseley, Leeds, have considerably enlarged their business under the title of F. & A. Parkinson, Ltd., and their manufacturing capacity is being rapidly extended.

As a beginning, the output of small standard polyphase motors up to 10 H.P. or thereabouts has been greatly improved, and stock is now available. This will be extended to include larger sizes of polyphase motors, together with Parkinson single-phase commutator motors, built under Creedy's patents. London stores have been opened, and stock motors and spare parts are held there, as well as at the works. A list of stock motors will be supplied on application.

List No. 2 of 16 pages, which has just been issued, covers the small size polyphase motors. Details are fully tabulated, technical information and specification are included, prices are plainly shown, and excellent half-tone illustrations appear. At the London stores there is a complete machine shop equipment for repairs.

The new address of Messrs. Watson & Sons (Electro-Medical), Ltd., is Sunic House, Parker Street, Kingsway, W.C. 2. New telephone numbers: "Regent 1227 and 1228."

Liquidations.—Weaverham Electricity Supply Co., Ltd.—A petition for the winding up of this company, presented by Messrs. Johnson & Phillips, Ltd., judgment creditors, will be heard at Nantwich on November 30th.

New Vanadium Alloys, Ltd.—Creditors to send particulars of debts, &c., to the liquidator, Mr. T. A. Ward, 25, Great Pulteney Street, W. 1, by November 20th.

Plant for Disposal.—Rochdale Corporation Electricity Committee invites offers for one Belliss-Morcom-B.T.H. 220-kw., three-phase, 3,000-volt steam alternator. Particulars are given in our advertisement pages to-day.

Greek Works Visit.—The Greek Delegates who, as already stated here, are on a tour of business and industrial centres in this country under the auspices of the Federation of British Industries, visited Carron Works on Wednesday, October 9th. The party were conveyed in motor-cars from Larbert Station to the Dobbie Hall, where they were entertained at lunch by Carron Co. under the chairmanship of the company's manager, Mr. Geo. Pate, supported by Bailie King, chairman of the National Light Castings Association; Mr. Robert McFarlan, C.A. (of Messrs. Kerr, Andersons and McLeod, the organiser for Scotland of the Federation of British Industries); and by Mr. G. E. R. Young, assistant organiser. After lunch the party proceeded to Carron Works, and were conducted through the various departments of the Low and Mungal Foundry. Tea was served in the company's canteen at Mungal Foundry, after which the party proceeded to Glasgow.

Book Notices.—*Technology.* Vol. IX.—The "Journal of the Manchester Municipal College of Technology," which records investigations undertaken by members of the college for the year 1915, is one of those works which we cannot but regard with pride. Printed in the Department of Printing and Photographic Technology of the College itself, its production leaves no loophole for criticism—it is equal in typography, illustration, and paper to any of the most high-class periodicals with which we are acquainted; it is a pleasure merely to turn over the pages and to observe the excellence of the work. Its literary contents are, of course, extremely diversified, dealing with educational questions, physics, electrical engineering, chemistry, textile processes, civil engineering, the smoke problem, printing, &c. They include Prof. A. B. Field's I.E.E. paper on the design of high-speed generators (in which, by the way, fig. 4 is printed upside down); papers by Mr. S. Butterworth on the coefficients of self and mutual induction of coaxial coils, and on electrically maintained vibrations; an inquiry into the possible existence of mutual induction between masses, a gravitational problem, by Prof. Miles Walker and Mr. W. W. Stainer; an article by Mr. S. Lees on the theoretical efficiency of the Diesel engine, and one by Mr. S. Evans on some metal failures. The volume reflects the greatest credit on the College and all concerned in its production.

"Steel Structures." (*Journal* of the Steel Structural Section of the British Engineers' Association.) July, 1918. London: The Association. Price 6d.

The *M. & C. Apprentices' Magazine* for October contains the usual variety of interesting articles, including one on the Murman Coast, reminiscences by Alderman Duncan Watson of his joining the firm of Muir, Mavor & Coulson 30 years ago, a thrilling account of a trip in a biplane, and a variety of cadet notes, camp notes, &c. The high quality of the magazine is well maintained.

Control of Rubber.—In view of the necessity for saving ocean freights, the rubber trade has been officially notified that the Minister of Munitions has appointed a Committee, under the chairmanship of Sir Clarendon Hyde, to advise him as to the control of rubber. In the meantime, it is deemed necessary to issue a warning that it may become necessary to fix maximum prices for transactions in rubber, and to point out that the Minister may be compelled to make orders rendering inoperative any forward contracts or transactions entered into after the publication of this notice.

Kynoch's and After-War Plans.—In their report, the directors of Kynoch, Ltd., say that the company is directly pledged to very little in the way of new manufactures after the war. They consider that the future is so speculative that a "wait and see" policy is better than one of choosing now a number of new trades and trusting to luck that the choices made will turn out to be happy ones. More especially do they believe this to be sound, as, in their opinion, opportunities after the war of coming to the assistance of businesses with assured prospects will not be at all infrequent.

Catalogues and Lists.—Messrs. Johnson & Phillips, Ltd., Charlton, S.E. 7.—Booklet (10 pages) giving data and net prices, revised, of their V.I.R. cables, for the use of trade friends in their estimating work.

Broom & Wade, Ltd., High Wycombe.—Pamphlet describing the Hyatt roller bearings as applied to cranes, trucks, &c. The essential feature of these bearings is the hollow flexible roller. Dimensions and loads are given.

Messrs. Higgs Bros., Summer Hill Street, Birmingham.—Stock list of shunt-wound protected motors.

Industrial Council for the Brass Trade.—According to the *Birmingham Post*, an important conference will be held in Birmingham on November 12th between representatives of the Ministry of Reconstruction and representatives of the brass and copper trades, the object being to discuss the formation in the brass and copper trades of an Interim Industrial Reconstruction Committee.

Non-Ferrous Metal Industry Act.—The *London Gazette* for October 15th contains a list of further licences granted by the Board of Trade under this Act.

Women in Industry.—A Conference on Women in Industry will be held under the auspices of the Reconstruction Council, on Tuesday, October 22nd, at 6 p.m., in the Hall of the Institute of Journalists, 2 and 4, Tudor Street, E.C. 4. The subject will be introduced by Miss Lilian Dawson, secretary of the Fabian Society, Women's Group, after which the discussion will be open. No tickets are necessary.

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LIGHTING AND POWER NOTES.

Aberdeen.—Year's Working.—The annual report for the year ending July 31st last, shows an income from the sale of electricity of £97,512, an increase of £25,924; total income, £102,492, an increase of £26,123; total working expenses, £58,448, an increase of £11,233, leaving a gross profit of £44,044, an increase of £14,890; interest on capital, £13,840, an increase of £2,846; instalment to sinking fund, £19,624, an increase of £1,119, leaving a profit for the year of £10,580, an increase of £10,925, which was placed to the reserve fund, which now stands at £49,327. The revenue account increased by £25,924 and capital charges by £2,846. 103 new consumers were added during the year, making the total 3,660. Motors connected increased by 2,826 H.P.; the total now represents 16,855 H.P. The number of heating and cooking utensils hired out was 1,598, an increase of 193. The total units sold numbered 17,408,147, an increase of 3,320,856; private lighting increased by 181,522 units; public lighting by 2,753; power by 2,599,816; tramways by 370,664; and heating and cooking by 166,101. The delay in delivery of the new 5,000-KW. set and its subsequent breakdown shortly after its installation placed the city's supply in danger during the months of February and March. The 3,000-KW. set had to continue to deal with the bulk of the load when very much in want of general repairs at the time of the breakdown. The shortage of boilers to steam the older and uneconomical generating plant was a further source of weakness. A bad breakdown on a 750-KW. engine, just before the 5,000-KW. set was again in commission, added to the difficulties of supply. With the exception of two days, when large consumers arranged to use half their normal load, and the reduction of one large consumer over the morning and evening peak loads for about a month, supply was fully maintained. The 5,000-KW. set was put into commission after repairs on April 9th, and has been practically continuously in use since then. Two new 18,000-lb. boilers were ordered in January, and are now in course of erection. A further 5,000-KW. generating set is now on order for delivery in the spring. To enable this to be installed in the existing engine room, three reciprocating sets of 420 KW. each have been sold.

Ashton-under-Lyne.—Wages.—The wages of semi and unskilled employés have been increased by 20s. and 12½ per cent. over pre-war rates by the Electricity Committee.

Australia.—New South Wales.—The Balmain Council has had under consideration the question of taking over the undertaking of the Balmain E.L. and P. Supply Corporation, but, owing to financial difficulties, the proposal has been abandoned. The assets of the concern were estimated at £200,000, which would be nearly doubled when the value of the goodwill was added.

E.L. Schemes.—The municipal authorities of Gulgong and Glen Innes (N.S.W.) are seeking authority to install E.L. undertakings within their areas. The Ithaca (Q.) Council has requested the city engineer and the consulting engineer to report upon the E.L. schemes before the Council. The Murwillumbah (N.S.W.) Council has accepted tenders for the supply of plant for the new electricity works, at a cost of £7,026. Tenders have been invited for the supply of equipment required for the proposed power stations at Harden and Murrumburrah (N.S.W.).—*Tenders.*

Electrolytic Zinc.—The plant of the Amalgamated Zinc Co. for the production of electrolytic zinc, at Risden, is turning out about 10 tons of zinc per day, with the use of a little more than half the power expected to furnish that output. Owing to the difficulty of securing the necessary machinery, the Hydro-Electric Department, so far, has been unable to supply the company with 2,500 H.P. in place of 4,000 H.P. which was considered necessary to operate the 10-ton plant, which forms the first unit of the works. The company proposes to use eventually about 30,000 H.P. in the production of zinc, and subsidiary metal-working industries which it is hoped to establish.—*Sydney Herald.*

Sydney.—As the demand for electricity has proved greater than the supply generated at the municipal power stations, the supply to certain districts is now cut off for periods of from a quarter of an hour to an hour and-a-half each day.

Barnes.—Extensions.—The Lighting Committee reports having received five tenders, ranging from £3,682 to £4,200, for plant in order to meet the increased load for factory purposes. As the plant cannot be secured in time for this winter's load, steps are being taken to restrict the demand for domestic purposes. The Council has agreed to apply to the L.G.B. for sanction to borrow at interest £5,500 for the above extensions.

Subject to the consent of the Ministry of Munitions the U.D.C. has provisionally accepted the tender of the British Thomson-Houston Co. for a 500-K.V.A. rotary converter, complete with transformers and switchgear, at £3,682.

Wages.—A letter from the E.P.E.A., applying for an increase of salary of 20 per cent., plus £90 per annum, for any electrical engineers employed by the Council, has been referred to a Committee.

Barnsley.—Loan Application.—The T.C. has applied to the L.G.B. for sanction to borrow £12,500, for capital expenditure at the electricity works.

Bexhill.—Year's Working.—In his annual report for the year ended March 31st last, the borough electrical engineer states that no mains extensions were carried out during the year, but 51 new consumers were connected, and the units sold increased by 23 per cent. Owing to the armature of the 500-KW. generator burning out last November, the whole of the winter load was carried by the smaller generators, at an extra cost for fuel. The total revenue amounted to £13,471, against £11,745 in the previous year, and the working costs to £7,869, against £6,551. Capital charges were £5,404, leaving a net profit of £197. The coal cost per unit was 1·4d., against 1·35d., and the total cost per unit sold was 5·1d., against 5·7d. The revenue was 5·2d. per unit, against 5·6d.; 619,821 units were sold during the year, against 501,961.

Bolton.—Mains Extensions.—The T.C. has applied to the L.G.B. for sanction to the borrowing of £1,500 for the extension of the mains between the Back-o'-th'-Bank generating station and the Duncan Street sub-station.

Brierfield.—Price Increase.—The Council has decided that the following charges for electricity be made to consumers as from October 1st, 1918:—Lighting, up to 1,000 units per annum, 6d. per unit; between 1,000 and 3,000, 5½d.; between 5,000 and 8,000, 5½d.; over 8,000, 5d.; power, 3d. per unit for the first hour and 2d. per unit for subsequent hours. The first hour for power purposes represents 36 units per 1-H.P. motor.

Carlisle.—Price Increase.—The T.C. has increased the charges for electricity, except to consumers under agreement, by 25 per cent., making a total increase of 50 per cent. over pre-war rates.

Carnarvon.—Price Increase.—The T.C. has agreed to an application of the National Electric Construction Co. for permission to increase its charges for electricity from 6d. to 7d. per unit; the pre-war rate was 5d. per unit.

Chile.—Government Control.—A decree issued through the Ministry of the Interior declares everything related to permits for the installation of electricity stations, their working and maintenance, to be an exclusive faculty of the President of the Republic, and municipalities are to have no power of intervention in such matters.—*Review of the River Plate.*

Clacton-on-Sea.—Price Increase.—The U.D.C. has increased the price of electricity for lighting to 7d. per unit and for power to 3½d.

Cork.—Wages and Increased Prices.—The dispute between the Cork Electric Lighting Co. and its employés on the question of increased wages, was dealt with in arbitration by Sir Plunkett Barton, who intimated that representation would be made to the B. of T. to enable the company to increase its charges, with a view to meeting the men's demands.

Doncaster.—Prov. Order.—The R.D.C. has agreed to the granting by the B. of T. of a prov. order authorising the Electrical Distribution of Yorkshire to supply electricity for all purposes within the parishes of Cadeby, Conisborough, Denaby, Edlington, Sprotborough, and Warmsworth.

Dover.—Boiler Improvements.—The T.C. has decided to have two boilers at the electricity works fitted with induced-draught apparatus, at an estimated cost of £735 each, so that Kent coal may be used. It is estimated that by one furnace there will be a saving of £630 a year on coal. One apparatus is to be fixed at once, subject to the consent of the Ministry of Munitions, and a loan is to be applied for for the second.

Dublin.—E.L. Charges.—The Corporation has referred to a special meeting the question of an increase in the charges for electricity. It has also decided to borrow, at 5 per cent. interest, such sums as the L.G.B. may certify to be necessary to provide working capital for the electricity undertaking.

Glasgow.—Proposed Restrictions.—The question of effecting economies in the consumption of electricity and gas has been considered at a joint meeting of the Electricity and Gas Committees. Various suggestions were made, and the matter was remitted to a Sub-Committee to bring the proposals to the notice of the persons affected.

Hamilton.—Price Increase.—The T.C. has agreed to an application of Edmundson's Electricity Corporation for an increase of 20 per cent. on electricity charges, making 50 per cent. over pre-war rates.

Lancaster.—Year's Working.—There was a deficit of £655 on the past year's working of the Corporation electricity undertaking. The charges have since been increased by 25 per cent., and the income of the first quarter of the current year shows an increase of £900.

Limerick.—E.L. Charges.—The question of an advance of 50 per cent. on electricity charges has been referred to the law adviser. The Corporation already charges 8d. per unit, and the overdraft on the undertaking amounts to £2,500, against £1,567 last year.

London.—St. Pancras.—The L.C.C. Finance Committee recommends the sanction of the Council to the borrowing of £17,076 by the B.C., for electrical plant, &c.

Newbridge (Co. Kildare).—Proposed E.L.—The T.C. is considering a scheme for the installation of electric light, and it is proposed that the water power of the Liffey should be used for the purpose.

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New Zealand.—Water Power.—A conference of representatives of Borough Councils, Industrial and Farmers' Associations, Chambers of Commerce, &c., has formed a league for the promotion of the hydro-electrical development of the North Island. The conference urged the Government to proceed with the work at Mangahao, for which it promised to find the labour, so that the scheme can be completed as soon as machinery is obtainable.

The Mayor of Auckland has received a report from the city electrical engineer dealing with the proposed hydro-electric scheme. The Mayor stated that the cost would be between £1,500,000 and £2,000,000.

Plans of the proposed hydro-electric scheme at Waikaremoana have been completed by Mr. S. C. Hay, and forwarded to Wellington, where estimates will be prepared.—*Tenders.*

Rochester.—Public Lighting.—The street lamps are not lit for six days before, and five days after, full moon, and when lamps are actually lit they are put out by the Corporation between 9.30 p.m. and 10 p.m.

Rotherham.—Cost of New Plant.—The borough electrical engineer has reported that the British Thomson-Houston Co. has applied for an increase of £3,000 on the contract price of the 30,000-kw. set condensing plant, on account of the extra cost incurred through Government awards for increased wages to date. Subject to the consent of the Electricity Committee, it has been arranged to increase the price by £1,500, on condition that no further claim be made against the Corporation in respect of past or future claims with regard to Government awards.

Shepley.—Proposed E.L.—The U.D.C. has decided to raise no objection to the application of the Electrical Distribution of Yorkshire for powers to supply electricity within its area.

Stratford-on-Avon.—Price Increase.—The T.C. has granted permission to the E.L. Co. to increase its charges for electricity to 7½d. per unit for the duration of the war.

South Africa—*The British and South African Export Gazette* states that in the mines and industries of the Transvaal, Cape Province, Orange F.S., and Natal there are in use 782 D.C. generators, of a total capacity of 65,039 kw., and 240 A.C. generators of a total capacity of 255,697 kw.; there are 4,367 D.C. motors, of a total capacity of 85,347 H.P., and 7,377 A.C. motors, totalling 462,848 H.P. Apart from the power generated at the mines, 836,437,817 units were supplied during 1916 by the municipalities and supply companies in the Union. Of the total, 784,847,599 units were A.C., of which 783,689,784 units were used for lighting and power, and 1,157,815 converted to D.C. for use on tramways.

Durban.—Although the Municipality has been unable to obtain all the new plant it requires, enough has been secured to maintain a satisfactory supply. Among the new plant recently installed is a condenser, complete with accessories, and two 500-kw. transformers, for transforming from 6,000 volts, three-phase, to 2,750 volts, two-phase, by the British Westinghouse Co., and a centrifugal type steam feed pump, running at 6,000 R.P.M., by G. & J. Weir. An order for a Curtis turbine has been placed with the B.T.H. Co.

Johannesburg.—The Municipality has increased the charges for electricity by 10 per cent.; the tramway fares have also been increased.

Cape Town.—Owing to the difficulty in obtaining cables, the E.L. Department has prohibited the use of radiators, and will not entertain any fresh applications for the installation of heating or cooking apparatus; additional motors only will be installed, provided the existing cables are not overloaded.

York.—Fuel Consumption.—At a meeting of the T.C., last week, it was stated that, owing to the difficulty of effecting repairs to plant, the coal consumption per unit during the past year increased by 25 per cent., representing 4,000 tons of coal. The repairs have now been completed, and greater economy is expected during the current year.

Windsor.—Extensions.—The R.D.C. has given permission to the Egham and Staines Electricity Co. to lay a main from Bishopgate to Windsor Great Park.

Wolverhampton.—Bulk Supply.—The T.C. has sealed an agreement with the Midland Electric Corporation for Power Distribution for the supply of electricity to the Small Heath and Heath Town pumping stations, for the period of the war and 12 months afterwards.

TRAMWAY AND RAILWAY NOTES.

Australia.—Loan.—The Braybrook Shire Council proposes to borrow £10,000 for tramway developments.

Blackpool.—Tramway Purchase.—The agreement for the purchase of the undertaking of the Blackpool and Fleetwood Tramroad Co. by the Corporation has been signed and sealed by both parties, and awaits the approval of a meeting of the shareholders and debenture-holders of the company, which is called for October 22nd. It is stated that the purchase price to be paid by the Corporation is £278,000, and that the shareholders will receive approximately £18 for each £10 share. It is the intention of the Corporation to promote a Bill in Parliament during the present session for power to acquire and work the undertaking.

Bolton.—Track Renewals.—The Tramways Committee has decided to proceed with the relaying of the track on Chorley Old Road, between Whitecroft Road and the terminus.

Burton-on-Trent.—Extensions.—The T.C. has decided to extend the tramways from the Branstone Road terminus to the Leicester Lane railway bridge, at a cost of about £3,500.

Dundee.—Bulk Supply.—The Dundee, Broughty Ferry and District Tramway Co. is closing down its power station at Monifieth, and in future will take a supply of energy from the Dundee Corporation at 1½d. per unit; the charge per unit for the Corporation tramways is at present 1·6d. The electricity department will benefit in additional revenue to the extent of at least £900 per annum.

Douglas.—Year's Working.—The auditor's report to the T.C. states that the loss on the tramways for the past year was £4,276, compared with a debit balance of £6,671 in the preceding year.

London.—A tramcar ran off the lines near Balham Station on Wednesday morning, last week, and traffic was disorganised for a considerable time.

L.C.C.—During the 11 weeks ended October 2nd, 1918, the total number of passengers carried on the Council's tramways was 136,127,709, an increase of 8,782,748 passengers, as compared with the corresponding weeks of 1917; traffic receipts during that period amounted to £765,412, an increase of £129,998, making a total increase in traffic receipts from April 1st, 1918, of £240,651.

New Zealand.—Electric Vehicles.—The Tramway Board of Christchurch has put in service an electric omnibus to serve as a feeder for one of the tramway extensions. The chassis was imported from America, and is equipped with an Edison battery and a New Zealand-built body.

Reading.—Year's Working.—We regret that, due to an error, the statistics given last week under the above heading were not correct, the order of things being reversed. They should read as follows:—Capital expenditure £231,629, against £230,789; revenue £56,797, against £44,597; expenditure £48,397, against £38,874; leaving a net surplus for the year of £8,400, against £5,723; £4,400 was put to the reserve fund, which now stands at £28,749, and £4,000 went to the relief of rates. The sinking fund stands at £87,293. The passengers carried during the year numbered 13,771,598, an increase of 2,852,065; the units generated were 1,400,960, an increase of 101,992, at a cost per unit of 1·53d., against 1·38d. last year.

Salford.—Year's Working.—The annual report for the year ending March 31st last shows a gross income of £350,102, against £284,444; gross profit, £110,333 against £80,217; net profit, £26,970 against £967; £16,970 was placed to the relief of rates and £10,000 to the depreciation and reserve fund. Working expenses amounted to £220,709; traffic receipts increased by £67,842; passengers carried numbered 65,061,878, an increase of 6,260,008; car-miles run, 5,513,441, giving an average consumption of 1·99 units per car-mile; total units used, 11,008,348. Total length of line worked was nearly 76 miles, and approximately 14½ miles of permanent way was relaid during the year.

TELEGRAPH AND TELEPHONE NOTES.

Automatic Telephony.—During the past five years as many new installations of automatic telephone equipment have been made as were made in the 20 preceding years. In America the invasion of the automatic has been slow, but substantial. In the West particularly the automatic has been favourably received. The most remarkable development, however, has been in the adoption of the private automatic exchange. During the first five months of 1918 over four times as much apparatus has been ordered by manufacturing plants and industrial offices as was ordered during the same period in 1917. In 1917, 150 per cent. more such installations were made than in 1916.—*T. and T. Age.*

Sweden.—The Swedish Telegraph Administration has made representations to the Government with regard to the reorganisation of the radiotelegraph service, especially in the matter of installations on mercantile ships. Hitherto the shipowners have been compelled to apply to the international company—the Société Anonyme de Télégraphie sans Fil, of Brussels—which is said to be the owner of the working rights for Sweden of both the Telefunken and the Marconi systems. The Telegraph Administration considers that the letting-out on hire of ship installations should be taken over by the Administration, and after negotiations with the Elektriska Aktie-Bolaget A.E.G., of Stokholm, which represents the licensee company mentioned, has entered into an agreement for the delivery of 0·5-kw. installations on the Telefunken system for which Swedish shipowners will be invited to subscribe in the same manner as in the case of telephone exchanges. Stations for ocean-going vessels, with plants of from 1 to 2 kw., will be dealt with later.

United States.—According to the *Telegraph and Telephone Age*, the Postmaster-General has prohibited the installation of new telephones and the extension of old services, except where they are imperatively necessary; surveys are being made for a

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consolidation of mail and telegraph services, with a view to the cheapening and improvement of the service for the benefit of the public, conflicting private or corporate interests being ignored. A scheme is under preparation for combining Western Union and Postal Telegraph offices, and placing them in Post Office buildings. There is no intention of cheapening or reducing either the mail or the wire service. A Special Committee has been appointed to investigate contracts with railroads and telegraph and telephone companies; an Inter-State Commerce Commission, which commenced inquiries more than a year ago, on August 30th declared that the charges made for private telegraph wire service to bankers, brokers, and industrial concerns were unreasonably low, but the leased wires of railroads and the Press were not affected by the ruling, the Commission holding that these were quasi public services, and not to be classed with strictly commercial business.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Queensland. November 29th. Electric lifts for the Department of Public Works, Brisbane.—*Industrial Australian and Mining Standard.*

Bedford.—November 13th. Two water-tube boilers, mechanical stokers, and induced-draught plant for the Corporation. See "Official Notices" October 4th.

Dublin.—November 7th. Gt. Northern Railway Co. of Ireland. Six or 12 months' supply of stores, including various electrical items. See "Official Notices" to-day.

Glynneath.—October 22nd. Wiring and fitting Bethel Baptist Chapel and Vestry. Mr. W. Harrett, Central Buildings.

London.—October 25th. H.M. Office of Works. Electric cable. See "Official Notices" to-day.

South Africa.—Johannesburg.—November 27th. Municipal Council. 2,000 copper ribbon bonds, and 2,000 copper solid bonds (Contract No. 424). A copy of the specification can be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence), London.

Warrington.—October 22nd. Water-tube boiler, for the Electricity Department. See "Official Notices" October 4th.

CLOSED.

Australia.—P.M.G.'s Department, Queensland:—

990 yd. paper-insulated rubber-covered conductor cable, 104 pairs, £692; 880 yd. lead-covered paper-insulated conductor cable, £373.—W. T. Henley's Telegraph Works Co., Ltd.

Victorian Railways Department:—

Porcelain insulators, 5½d. each.—Firebrick Insulator & Pottery Co., Pty., Ltd.

Metropolitan Board of Water Supply & Sewerage, Sydney:—

One 75-h.p. electric motor, for use in the plant at Folley Point, for the manufacture of chloride of lime from sea water, £420.—Crompton and Co., Ltd.

—*Tenders.*

Barnsley.—Owing to war conditions the T.C. has allowed Messrs. Babcock & Wilcox, Ltd., to increase their tender for an induced-draught fan for the new boiler, from £294 to £304.

Barnes.—U.D.C. Provisionally accepted:—

British Thomson-Houston Co., Ltd.—500-k.v.a. rotary converter, complete with switchgear and transformers, £3,685.

Bolton.—Tramways Committee. Hadfields, Ltd., points and crossings.

Electricity Committee. Robert Foster, three months' supply of conduit and fittings.

Malvern.—U.D.C. Coal for the electricity works, 600 tons of boiler slack. South Wales & Cannock Chase Coal Co.

Southend.—T.C.—

Edison Accumulators, Ltd.—Two-ton tip wagon for tramway department, £1,942.

W. Ward & Co.—Pump and starter for tramway department, £27.

B. I. & Helsby Cables, Ltd.—One mile 600 yd. trolley wire, 1s. 5½d. per lb.

Stretford.—A paragraph in our last issue was headed "Stratford" instead of *Stretford*.

Wolverhampton.—T.C. Electricity Department:—

Staveley Coal & Iron Co.—Standard straight length water piping, £17 10s. per ton; special piping £27 10s. per ton.

J. Hopkinson & Co., Ltd.—Steam and water valves, £179.

Gibbons Bros., £367, plus 10 per cent. for contingencies.—Traversing conveyor for unloading coal at the G.W.R. siding.

The E.C. has sold a 300-kw. reciprocating set at the destructor works to Mr. F. Gilman, of Birmingham, for £1,150.

FORTHCOMING EVENTS.

Industrial Reconstruction Council.—Tuesday, October 22nd. At 6 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "Women in Industry," to be introduced by Miss Lilian Dawson, Secretary of the Fabian Society (Women's Group), and a member of the National Union of Women Workers.

Manchester Association of Engineers.—Saturday, October 26th. At 6.30 p.m. At the Grand Hotel. Paper on "Fuel Oil and its Application," by Mr. J. Butterworth.

NOTES.

The Red Cross Appeal.—We desire to remind all our readers of the great City effort, referred to at some length in our last issue, on behalf of the funds of the British Red Cross Society. The business community is being appealed to for one million pounds, and over three hundred thousand pounds was subscribed down to Monday afternoon last.

The increasing desire inside Germany to bring the war to an end must not be permitted to interfere with the flow of generosity on behalf of our wounded and our men who are prisoners. Indeed, the prevailing situation—bringing Peace in sight, and, perhaps, within our early grasp—ought to promote a desire to place at the disposal of this excellent organisation all the funds needed both now and for a period of 12 months after the war to assist the men who have suffered in order that the Victory might be won. Subscriptions should be sent to Sir Robert Hudson, 83, Pall Mall, S.W. 1, or to Major Lionel M. Rothschild, M.P., who is acting as hon. treasurer of the City appeal.

Volunteer Notes.—Royal Engineers (Vols.), London Army Troops Companies.—Headquarters: Balderton Street, Oxford Street, W. 1.

Corps Orders No. 43, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Captain of the Week.—Capt. E. G. Fleming.

Next for Duty.—Capt. W. Hynam.

Sunday, October 20th.—Annual musketry course at Pirbright. Parade Waterloo Station, 8.45 a.m. Drill order, with rifles. Mid-day and tea rations to be carried.

Monday, October 21st to Saturday, October 26th.—Drills as usual.

Sunday, October 27th.—Commandant's Parade, at Waterloo Station, 8.45 a.m., for work at Esher. Drill order. Mid-day and tea rations to be carried.

C. Higgins, *Capt.* R.E., *Adjutant.*

A smoking concert will be held on Saturday evening, October 26th, at the Regent Street Polytechnic, at 7.30 p.m., Lieut.-Col. C. B. Clay, V.D., in the chair.

Foreign Trade.—The September Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

Imports.	*September*, 1918. £	*Inc. or dec.* £	9 *months*, 1918. *Inc. or dec.* £
Electrical goods ...	83,348	− 11,195	− 218,926
Machinery	900,318	+ 94,526	+ 1,977,572
Exports.			
Electrical goods ...	190,080	+ 3,081	− 746,409
Machinery	1,183,895	−290,771	− 3,007,558

Economic Proportion of Hydro-Electric and Steam Power.—A paper by F. G. Baum, in the *Journal* of the A.I.E.E. (Vol. 38, No. 9) describes a new method of determining for any power system what proportion of generation should be hydro-electric, and what steam, from the standpoint of economics. A method is outlined for obtaining a curve showing "total cost per kw.-year for hydro-electric and steam power" for any percentage combination of generation. With system load curve, fixed charges on steam and hydro-electric plants, cost of fuel, and other steam energy charges all known quantities, this curve can be readily calculated, and one can see at a glance the limiting economical percentage of steam power for the given conditions.

The King's Fund for the Disabled.—The King's Fund for Disabled Officers and Men of the Navy, Army, and Air Force, opened by his Majesty with a gift of £78,000, is designed by the Minister of Pensions, the Right Hon. John Hodge, to raise a minimum of £3,000,000 to re-establish in civil life those gallant Britons who have fought and suffered for their country and for civilisation. This Fund is wholly apart from any State aid, and is a voluntary monument of the nation's gratitude to our heroes who, disabled as fighters, have now to be re-established in civil occupations. The loss of limbs and other physical disabilities make the battle of life difficult for them, and the King's Fund, which is dealing with some 600 cases a week, provides grants of various sums to enable those who have given so much for us again to start life as contented, self-supporting citizens. Donations will be received gratefully by the Minister of Pensions, Westminster House, London, S.W. 1.

Liftwomen's Wages Award.—At a meeting in the Caxton Hall last week of women lift attendants and electricians in Government offices, it was announced that an award had been issued under which the women lift attendants were to receive the same rate of pay as the men—8d. per hour—and, in addition, the women's war advance of 11s., making a total wage of 43s. for a 48-hour week, as against the present wage of 28s. The award is to be retrospective as from September 1st.—*The Times.*

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Shaft and Bearing Currents.—It is well known that under certain conditions local currents may be set up in the shafts and bearings of electrical machinery. These currents may cause pitting of the bearing linings, and if the currents are sufficiently heavy the journals may suffer as well.

In the case of alternating-current machines the actual amount of current may be measured with a good degree of accuracy. A method adopted by the General Electric Co., of Schenectady, N.Y., and explained by Mr. F. Ashton in the *Mechanical World*, involves the use of a current transformer with a core built up of rectangular laminated plates. The core should be provided with two separate windings, as shown in fig. 1, the winding to which the ammeter is connected being the secondary. The ammeter should, of course, be suitable for alternating current. In circuit with the lower winding marked "primary" (having a known number of turns) another alternating-current ammeter should be connected, and this latter winding should be energised from some external current supply, having the same frequency as that for which the machine is designed. This second winding is simply for calibrating purposes, and when the shaft current is being measured, by means of the ammeter in circuit with the other winding, the calibrating or primary winding should be disconnected from the supply, the shaft of the machine then becoming the primary. The rotor should be removed

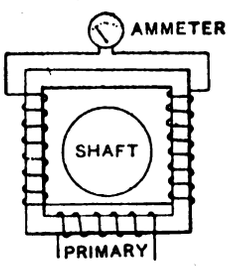

Fig. 1.

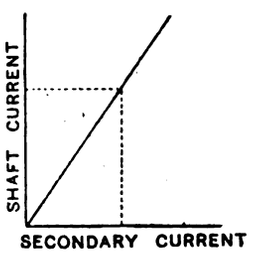

Fig. 2.

from the machine and the transformer threaded over the shaft so that when the rotor is replaced the transformer is situated between the rotor and one of the bearings. By impressing various voltages upon the primary or calibrating coil various currents will be made to circulate in this coil, and if the number of turns on the coil is known, the exciting ampere turns can be calculated by multiplying the current by the number of turns. The exciting values so obtained should be noted together with the corresponding current in the secondary circuit to which the ammeter shown in fig. 1 is connected. Having obtained these values, the primary or calibrating coil should be disconnected from the source of supply, and the shaft of the machine then becomes the primary of the transformer. This primary is obviously composed of only one turn, so that the primary current and primary ampere turns are identical. If a curve be plotted between the readings obtained in the manner described (ampere turns and secondary amperes), it will be possible, if the curve assumes a straight line, to arrive at an average multiplying factor which links the primary ampere turns and secondary amperes, and this factor will, of course, be the ratio of the transformer. But when the alternator is running, the shaft becomes the primary, and by noting the current in the secondary of the transformer the actual shaft current can be arrived at either by multiplying the secondary current by the transformer ratio or by reading it off directly from the curve as shown in fig. 2.

There is no objection to a shaft current, provided that it is confined to the shaft and does not pass into the bearings; hence if brushes are placed at both ends of the shaft, and are either connected to the bearing pedestals or are connected together by a low-resistance copper conductor, bearing troubles will be eliminated. Another and better method of overcoming the difficulty is to completely insulate one or both of the bearing pedestals from the bedplate. This may be done by removing metal shims from under the bearing pedestals and replacing them with thin sheets of fibre. All holding-down bolts must, of course, also be insulated with fibre tubes and fibre washers.

Electric Thermal Storage Heaters.—A summary is given in the June *Bulletin* of the Schweizerischer Elektrotechnischer Verein of the report issued by a committee appointed by the Swiss Electrotechnical Union to deal with heating and cooking apparatus. This communication deals only with electrically heated thermal storage devices for heating individual rooms. The requirements are explained in detail and many data are given relating to the design of such heaters. Common faults in storage heaters now on the market are excessive surface temperature and inadequate storage capacity. The storage media considered are metal, stone, and sand. The committee is conducting certain researches, and expresses its willingness to criticise designs and aid in development work. It is suggested that if the heater imparts all its energy to the room, an input of 30 to 40 watts per cu. m. of room space is sufficient for ordinary winter conditions, and 40 to 60 watts per cu. m. for the coldest weather. It is stated that the complete report gives methods for determining all the characteristics of a thermal storage heater from simple temperature measurements. Most of the heaters built hitherto have been inadequate in dimensions and mass. The heating resistance should be near the centre of the storage material and in good thermal contact with the latter; an intermediate air film results in a steep temperature gradient. It is considered that there is best prospect of obtaining satisfactory results, without spending much time or money on research, by building either stone storage heaters with a core in intimate contact with a heater of chrome nickel or constantan; or heaters with sand as storage medium (in a suitable tile or metal casing), and nichrome or silundum heating elements. Easy replacement of heating element is an important factor.

The Whitley Report.—A correspondent sends us the following Open Letter to Mr. Lloyd George:—

"In view of the recent trouble with railway employés being led by committees in the various centres in direct opposition to the recognised heads of their Unions, may I suggest that whilst the Whitley Report is an excellent proposition it lacks finality?

It is well known that when a committee is appointed by a particular workshop, the ringleader or agitator is to the fore and undoubtedly secures a place on such committee! failing this his occupation is practically gone.

The recent railway trouble, as we all know, was due to the men not abiding by the agreement made by their Union leaders.

I venture to suggest that to the Whitley Report should be added provision for severe punishment by the Government to whoever is responsible for failure to carry out an agreement duly made between the recognised Trade Union officials and another. Such punishment to fall definitely on the Shop Stewards Committee. On that committee shall rest the onus of proving if the fault rests on others than themselves, and only by such proof shall the punishment be transferred from the committee to the actual ringleaders.

'Unless something of this kind is put into force industrial peace can never last long; further, it would deter the professional agitator from desiring to get on the Shop Stewards Committee for his own selfish ends, if he knew what awaited him."

"Industrial Peace."

Testing Electric Meters in Germany.—New Regulations have been issued, dated May 22nd, 1918, by the Physikalisch-Technische Reichsanstalt concerning the testing of electric meters, says the *E.T.Z.* of July 4th. A complete measuring device consists of transformers and one or more meters. During the testing of the instruments all auxiliary apparatus (power, current, voltage, indicators, relays, &c.) that are to be actuated by the transformer in practice must be connected into circuit, or replaced by substitute resistances and coils with the correct energy consumption and power-factor. If the secondary leads of a current transformer exceed 0.15 ohm, an equivalent resistance must be inserted during the test. Tests made according to this new regulation are indicated by affixing special name plates to the meters and transformers, the two devices bearing corresponding numbers.

Discharged Men not Strike-breakers.—From copies of correspondence with Mr. J. M. Hogge, M.P., President of the Discharged and Demobilised Soldiers' and Sailors' Federation, which have been forwarded to us by Mr. W. J. Webb, London District Secretary of the Electrical Trades Union, we learn that there is no truth in the assertion that the members of the Federation are to be allowed to act as strike-breakers.

The Purchase of Fraser & Chalmers, Ltd.—The General Electric Co., Ltd., have completed the purchase of the Erith Works and of the goodwill of the manufacturing business hitherto carried on by Messrs. Fraser & Chalmers, Ltd. Practically the whole of the *personnel* have transferred their services to the G.E.C., who will carry on the business as a going concern and under the title of Fraser & Chalmers Engineering Works—proprietors, the General Electric Co., Ltd.

Batti-Wallah Luncheon.—Mr. C. H. Wordingham, Director of Electrical Engineering, Admiralty, will be the guest of the Batti-Wallah Society at their next luncheon, on Monday, October 21st.

Appointments Vacant.—Shift engineer for the Barnsley Corporation electricity works; charge engineer for the Royal Engineers' Camp, Ripon; engineer in charge (£3 + 12½ per cent.), fitter-driver (35s. + 25s. + 12½ per cent.), wireman, linesman, and wireman linesman's mate (40s. and 25s. + 12½ per cent.) respectively for the R.E. Camp, Crowborough; telegraph storekeeper (£200) for the Post and Telegraph Department of the East African Protectorate; shift engineers (77s. 6d.) for the Eccles Corporation electricity works; shift engineer (65s. + 12½ per cent.) for the Radcliffe U.D.C. electricity department; shift engineer (74s. 6d.) for the Warrington Corporation electricity department. See our advertisement pages to-day.

Educational.—The Board of Education's Regulations for Technical Schools, &c., in England and Wales have been issued (Cd. 9,152, price 2d.), and include provisions for the increase of grants to meet the increased rates of fees paid to teachers, the increase being retrospective for the year 1917-18.

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Institution and Lecture Notes.—Institution of Electrical Engineers.—The first meeting of the session of the Western Centre was held at Bristol on Monday evening last. Prof. David Robertson, in the unavoidable absence of Mr. R. Howard Fletcher (the retiring chairman), presided over a fair attendance, and inducted Mr. H. I. Rogers to the chair.

Mr. Rogers prefaced his inaugural address by a short allusion to electric welding, and gave many interesting details. The address dealt mainly with the post-war conditions of the electrical industry from the manufacturer's point of view, and made a strong plea for standardisation, both in regard to the producer and the ultimate purchaser. He deprecated Government control of the industry, but welcomed its co-operation. A more efficient method of training apprentices was advocated, and he instanced what had been done in this direction by the Bristol engineering manufacturers with the Local Education Committee. The Institution should renew its endeavours to obtain the much-talked-of Royal Charter, in order that the status of the electrical engineer might be elevated to that enjoyed by the legal and medical professions. Intensity of output was another feature to be aimed at, and this could only be obtained by the manufacturer having at his command a cheap supply of power; the conclusions of the Coal Conservation Sub-Committee in this respect were worthy of the closest and most careful consideration. At the close of the address the chairman invited a discussion on the ways and means of extending their area and incidentally increasing their membership. Mr. C. T. Allan (joint hon. sec.) furnished some details comparable with other centres, and suggested that the western area should embrace Pembrokeshire, Cardiganshire, Brecknockshire, Radnorshire, Carmarthenshire, Herefordshire, and the towns of Gloucester and Cheltenham. Mr. A. C. A. Atchison advocated developing the social side of their meetings, and agreed with the suggestion contained in the chairman's address as to the formation of engineers' clubs. Mr. W. A. Chamen stated that, owing to the war, they had confined their meetings to Bristol and Cardiff, but it was the intention to hold their meetings at a variety of centres in the area when national conditions returned to normal. Mr. G. N. Langdon remarked that the holding of meetings at different centres would attract men who lived in the immediate vicinity of those centres.

Birmingham Electric Club.—On Saturday night Mr. H. F. Steventon read a paper on "Some Modern Applications of the Gyroscope."

Institution of Mechanical Engineers.—On October 4th, the Thomas Hawksley Lecture was delivered by Dr. W. C. Unwin, who dealt with the experimental study of the mechanical properties of materials. At the meeting to-day three papers on hardness tests will be read and discussed, the authors being Prof. C. A. Edwards and Mr. F. W. Willis, Mr. R. G. C. Batson, and Dr. Unwin. Later in the session a paper is to be read on "Electric Welding."

Belfast Association of Engineers.—Last night Mr. W. Walker delivered his presidential address. The following items are included in the programme for the session :—

November 21st.—"Ljungstrom Steam Turbine and Generator," by T. H. Hurst.
January 16th, 1919.—"Electric Welding," by K. Edwards.
February 6th, 1919.—"Ship Riveting," by A. J. Lewis.

Illuminating Engineering Society, U.S.A.—The annual Convention was to be held in the Engineering Societies' Building, New York City, on October 10th. The entire technical programme was confined to one day, instead of four days, as was the custom before the war. The evening of October 10th was given over to a dinner-meeting, at which speakers of national prominence discussed questions pertaining to the war and illumination.

The Proper Use of Coal.—Lecturing on this subject, at the Dewsbury Central Liberal Club, last Saturday, Mr. W. B. Woodhouse, general manager and engineer of the Yorkshire Electric Power Co., spoke of the inefficiency of the steam engine in regard to economy of fuel, not more than 25 per cent. of the heat value being utilised in power production. He said the gas engine was rather more efficient under steady load conditions, but was less efficient when the load varied. Though hopes were entertained of the possibility of a gas turbine, or some means of using some of the heat which both gas and steam engines wasted, efficiency in the meantime called for the production of power by large steam turbines generating electricity for distribution over wide areas. There was difference of opinion in regard to the recommendations of the Board of Trade Committee that a new body should take over all electricity generating stations, though no doubt generation at large stations would effect a big saving. Several municipalities in the West Riding considered that the work should be done in conjunction with neighbours, and working arrangements had already been made between Sheffield, Bradford, Rotherham, and the Yorkshire Power Co. The Reconstruction Committee had quoted the saving of 78 per cent. on the North-East Coast, and if a similar saving was made throughout the country, there would be a gain of 45,000,000 tons of coal per year in the factories alone. There was much waste of power at the mines, and there was a possibility of saving 40,000,000 to 60,000,000 tons of coal a year in the mines and factories by using electric power economically produced. Referring to the expected future economy in steel-making by the combination of coke ovens, blast furnaces, steel furnaces, and rolling mills with large plants, and a concentration of such works in suitable centres, the lecturer said electric power would, of course, be used, and if steel works capable of a yearly production of 300,000 tons were established, the use of motors of 15,000 H.P. each would be involved. As to domestic uses, he said there was such a loss of heat in producing gas and electricity that, despite its poor efficiency, the open coal fire was the cheapest method by which fuel could be consumed to-day, except that a coal fire had to burn itself out, whereas electricity and gas could be turned off at will. A carbonised solid fuel, produced by methods giving the best yield of by-products, would probably be the cheapest for general house heating, gas and electricity being used for cooking and occasional heating.

Institution of Post Office Electrical Engineers.—On Monday last the 1918-19 session of the South Wales Centre opened with a lantern lecture upon "Telephony Fundamentals," given by Mr. A. L. Stanton, A.M.I.E.E., at the South Wales Engineers' Institute, Cardiff. Mr. McIlroy, Superintending Engineer for South Wales, occupied the chair, and a discussion, opened by Mr. J. H. M. Wakefield, followed.

Inquiry.—Makers of the "Aldis" electric lamp, used in hospitals, are asked for.

Theft of Copper.—At Loughborough Petty Sessions, on 9th inst., Alfred Williams, electrical engineer, of Fulham, was sentenced to three months' imprisonment, with hard labour, and William Whittaker, erector, Romford, and Frank Turley, fitter, Birmingham, were fined £10 each, including costs, for stealing 296 lb. of copper, value £14 16s., the property of the Loughborough Corporation, on July 25th. It was explained that for some months past extensive alterations had been in progress at the electrical station, the defendants being employed by the contractors.

Salt in Leclanché Cells.—A correspondent who recently had occasion to write to the Ministry of Munitions of War, Explosives Department, for a licence to purchase salammoniac, received a reply, from which we extract the following paragraph :—

"I recommend that you should make good the deficiency in your requirements by the substitution of a corresponding proportion of common salt in your battery charges. It is found that up to 40 per cent. of this material can be substituted without serious effect on the life of the batteries."

We should be interested to learn whether any of our readers have had any experience in this connection.

Measures for the Conservation of Metals.—The attention of scale and weighing-machine manufacturers is drawn to the concession which has been granted to the trade by the Priority Department of the Ministry of Munitions for the supply of metals required by the whole trade of the United Kingdom of manufacturers and repairers of scales and weighing machines for industrial purposes for home trade. The metals may be used for repairs and maintenance of weighing apparatus of all capacities, but, for new machines to replace those beyond repair, only those which do not exceed a capacity of 5¼ cwt., or a total weight (material) of 4¾ cwt., can be supplied. Under this new rationing scheme no new weighing instrument may be manufactured, supplied, or sold having a capacity of more than 5¼ cwt., total weight 4¾ cwt., or exceeding the following values :—56-lb. capacity, maximum value £20; 5½-cwt. capacity, maximum value £50; without a special permit granted by the Priority Department of the Ministry of Munitions. Messrs. Price, Waterhouse & Co., chartered accountants, of 3, Frederick Place, Old Jewry, E.C. 2, have been appointed the Rationing Authority, and will deal with applications for the release of material, and apportion to each manufacturer the quantities allocated to him. In the event of manufacturers requiring material during the three months commencing November 1st next, it will be necessary for them to complete a schedule and declaration of information required by the Priority Department, and forward them to Messrs. Price, Waterhouse & Co. The Ministry of Munitions wishes to impress upon all manufacturers the absolute necessity of limiting, as far as possible, the estimates of their requirements. In the first place, the conservation of metals is a matter of the greatest national importance, and, in the second, a strict economy on the part of manufacturers will have considerable influence in their favour on the issue of further permits. Full particulars, with the schedule, &c., can be obtained from the Secretary to the National Advisory Committee, 97, Cannon Street, London, E.C. 4.

Kaiserism in England.—A correspondent sends us the following letter which, he says, was picked up in a railway train, having apparently been dropped by someone unknown :—

"Potsdam.

"My Dear Brother.—While reading the Electrical Review, I came upon your magnificent letter. Impossible for any man to work without your permission! Superb! I had not thought that in your traitorous country was one of such spirit. My heart warms to you, and when my shining armour has been polished up and my mailed fist repaired, I have decided to transfer my glorious powers to the ennobling of your land. I have written it and shall indeed do it. I will be your Commander and you shall be my Chief of Staff. None shall breathe without our permission.

"I kiss you on both cheeks. "Wilhelm."

Unlighted Tramcar.—At Halifax, on Friday last, Norman Brook, Corporation driver, was fined 10s., including costs, for having his car unlighted in Godley Road, at 8.45 p.m., on September 25th. He had lost the trolley wheel, and did not possess a hand lamp. He should have had two lamps, but stated there was a shortage. When the trolley came off, it got fast in the overhead guard wires, which were brought down, and it was necessary to cut the current off a section to avoid accidents. Defendant was some distance from the nearest houses, and could not leave the car to try and borrow candles or lamps. It was agreed by the Bench that the Tramways Committee should not be exonerated from blame, but the case must be dealt with in the ordinary way.

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Electric Vehicle Progress.—The railways are going ahead in their adoption of the electric vehicle. The latest news is that the Lancashire and Yorkshire Co. has put into service a new five-ton vehicle supplied by the General Vehicle Co. The first five-tonner acquired by the company has been in constant use for the last two and a-half years. The new vehicle is arranged to take a detachable platform or skip upon which the goods are loaded, the skip being placed on or removed from the chassis by means of special lifting tackle. While the vehicle is taking one loaded skip out for delivery, another skip is being loaded up ready to place on the vehicle when it returns, the maximum amount of work being thus obtained from the vehicle.

The following municipalities have either decided to obtain electric vehicles or have actually placed orders:—Kettering, a wagon (£1,200) for the borough surveyor's department; Southampton, an additional wagon for the tramway department; Bolton, a vehicle for the electricity supply department; Leyton, two tip wagons; Swansea, two tip wagons; Chester, a tip wagon at £1,439; South Shields, a tip wagon; Aberdeen, a five-ton tip wagon at £1,600; Worthing, four tip wagons; Inverness, two tip wagons at £1,229 each; Cardiff, the city engineer advises the Corporation to adopt electric vehicles for refuse collection; Mansfield, the Corporation has recently put into service for refuse collection a two-ton tipping wagon supplied by the General Vehicle Co.

A borough surveyor, in recommending his Council to adopt electric vehicles, estimates that their employment will reduce the cost of collecting refuse by 1s. per ton after payment of wages, repairs, interest and sinking fund, electrical energy, and all other charges. The Adelaide Corporation, N.S.W., has in use an electric sweeper which is fitted with an Ironclad-Exide battery of 48 cells. During the year ended September 30th, 1917, this machine covered 2,730 miles, the units of electricity used per mile averaging 2·08, and the total cost of operation, excluding wages, 5·4d. per mile.

Operating Costs.—One firm in the United States—the Ward Bakery Co.—employs no fewer than 600 electric vehicles in bread delivery. That such vehicles are extremely economical in power cost is shown by the following record of a 750-lb. electric van used in ordinary city delivery service, furnished by the Electric Vehicle Section of the National Electric Light Association of America—

Days in use	30
Miles covered	1,140½
Average load carried	1,000 lb.
Number of miles run on 1 unit of electricity	3·57
Average miles run per day	38·01
Average units of electricity consumed per day	10·65
Power cost per mile at 1½d. per unit ...	0·42d.

—*Electric Vehicle.*

The Kettering U.D.C. electricity department put into service in the early part of last summer a 3½-ton tipping wagon supplied by the General Vehicle Co. It is employed for the cartage of coal and clinkers, and we gather from the *Electric Vehicle* that the results attending the first nine months' use have been very satisfactory. The saving in cost over the previously-employed system of horse-haulage works out at the rate of £146 per annum. The vehicle has fully lived up to the reputation of electrics for reliability; during the whole nine months it has not been out of commission a single day. The tipping body made by Messrs. Ruston, Proctor & Co., of Lincoln, is hand-operated, and a full load can be emptied in two minutes. We quote the following figures:—

Total mileage covered...	3,500
Total coal and clinker carted, tons	6,494
Cost of electrical energy used, 5,840 units at 1d. ...	£24
Drivers' and other wages, maintenance, licences, insurance	£238
Interest and sinking fund	£155
Average total cost per ton carted	1s. 3d.
„ units per vehicle-mile	1·67
„ „ „ ton carted	0·9

Wireless on German Aeroplanes.—The Halberstadt two-seater biplane, according to the *Engineer*, is wired internally to increase its capacity for wireless. Accommodation for the aerial and its spool is provided in the observer's cockpit. The dynamo also provides energy for heating the pilot's and observer's clothing. It is driven direct from a pulley on the engine, and is carried on a bracket fixed to the left-hand engine bearer. The dynamo when fitted—it is not fitted unless actually required—projects outside the fuselage, and is enclosed in a bulbous stream-line fairing. The bracket carrying the dynamo is hinged at its upper edge, and is provided with a clamping device at its lower edge; by this means the tension of the driving belt can be adjusted.

The Decimal Association.—The Royal Commission on Decimal Coinage, of which Mr. T. McKenna, chairman of the Executive Committee of the Decimal Association, is a member, held a preliminary sitting on October 16th.

Fatalities.—John Barratt (59), labourer, of Hove Edge, near Halifax, was killed instantaneously last week, on accidentally touching an electric switch at the chemical works where he was employed.

A stoker named Woodman, employed at the Great Western and Metropolitan Dairies, Weston, Staffs., died, on Wednesday last week, from injuries received from a blow from an electric fan which kept the chamber cool. The supposition was that he was struck whilst looking through the gap in the wall in which the fan was running. The Government Inspector said the fan was reasonably safe, but, in view of the accident, he would require it to be further protected. A verdict of "Accidental death" was returned.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Swindon T.C. has fixed the salary of the acting electrical engineer, Mr. F. Newey, at £275 a year.

The salary of Mr. A. B. Slater, manager of the Burton-on-Trent tramways, has been increased by £50 per annum and war bonus.

Mr. W. P. Hooper, charge engineer, Dewsbury Corporation electricity Works, has resigned, having obtained a post under the Rawtenstall Corporation.

Mr. R. H. Wilkinson, tramways manager to the Huddersfield Corporation, has been appointed tramways manager of Bradford, in succession to Mr. C. J. Spencer, who joins the London Underground system. Mr. Wilkinson is 44 years of age, and has been in charge of the Huddersfield undertaking for 14 years, previous to which he was manager for four years at Oldham. The commencing salary is £800 a year.

Mr. W. B. Smith, chief assistant of the Greenock Corporation electricity department, has been appointed manager of Paisley Corporation electricity department. There were 150 applicants. The salary is £600. Mr. Smith entered the service of the Greenock Corporation in 1907, and became chief assistant engineer four years ago. He has been lecturer and demonstrator in electrical engineering in Greenock Technical School evening classes for 12 years.

Rotherham E.C. recommends the Establishment Committee to increase the salaries of the technical staff at the Power station (Messrs. Lilleker, Redmayne, Rodgers, and Jessop) to £400 per annum.

Mr. J. C. Connell, who has been for ten years on the staff of the Blackburn Corporation electricity department, has been appointed charge engineer at the Accrington electricity works.

The Loughborough Corporation has advanced the salary of Mr. R. B. Leach, the borough electrical engineer and manager, by £50 per annum. Mr. Leach has also been appointed Fuel Overseer of the borough.

Mr. A. E. Pott, M.Inst.C.E., M.I.E.E., has resigned the managership of the Metropolitan Electric and London United Tramways, Ltd., in order to take up a position under the Tramways (Board of Trade) Committee. The two tramway companies have, however, retained Mr. Pott's services in a consultative capacity. Mr. C. J. Spencer, at present manager of the Bradford Corporation Tramways, has been appointed to fill the vacancy created by Mr. Pott's resignation.

General.—Mr. Thomas McLeod has purchased the controlling interest in the Power Plant Co. We are informed that the management is now entirely British. The new managing director is Mr. R. J. McLeod, and the assistant general manager Mr. W. H. Sykes, the technical staff remaining as before.

Roll of Honour.—Mr. H. G. Burnett, who was in civil life a draughtsman in the Rugby works of the B.T.H. Co., has been killed in action.

Private L. Walmsley, Liverpool Regt., who has died of wounds, was prior to the war on the electrical engineering staff at the Neepsend power station, Sheffield.

Second Lieutenant A. V. Bradshaw, Royal Berks Regt., who has been awarded the Military Cross for gaining a position over a stream and maintaining it, was on the Grantham staff of the Urban Electric Supply Co.

The Military Medal has been awarded to Sergeant F. Critchley, R.E., who enlisted in September, 1914, from the electrical engineering staff of Siemens Bros., Stafford.

Private J. G. Nelson, Lincolnshire Regt., recently reported missing, now stated to be a prisoner of war in Germany, was employed by Messrs. Dick, Kerr & Co., Preston.

Private A. Goderidge, formerly on the staff at Siemens Bros. Dynamo Works, Stafford, has fallen in action.

Second-Lieutenant G. M. Barnett, 39, West Riding Regt., killed in action, was, prior to the war, chief cashier of the Huddersfield tramways department.

Private I. Creighton, West Yorkshire Regt., killed in action, was employed by Messrs. Dixon & Sons, electricians, Leeds.

Lance-Corporal B. Nadin, Northumberland Fusiliers, who has been killed in action, was employed in the engineer's office of the electrical department, Midland Coal, Coke, and Iron Co., Apedale.

Corporal W. F. Dale, Grenadier Guards, an employé on the Birmingham electric tramways, has been awarded the Croix de Guerre for bravery in a gas attack.

Private C. Price, Lancashire Fusiliers, wounded, was formerly employed by Messrs. Ferranti, Ltd., Hollinwood.

C.Q.M.S. H. Stanway, Loyal North Lancashire Regt., who has died from wounds received in action, was employed by Messrs. W. T. Glover & Co., Ltd., Trafford Park.

According to the *Times*, Major L. P. Aizlewood, M.C., R.A.F., who was accidentally killed while flying over the sea on September 29th, studied mechanical and electrical engineering at Sheffield University and Parkgate Iron and Steel Works. He had received the Military Cross in 1916 for engaging five enemy aeroplanes, one of which he brought down. Subsequently he was wounded in France, and after

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that did valuable work at home in establishing and conducting aerodromes and in training men for the R.A.F.

Gunner H. Tilley, previously employed in the controller's department at the British Thomson-Houston Works, has been killed in action.

Obituary.—Mr. T. R. Taltavall.—We regret to record the death of our confrère, Mr. Thomas R. Taltavall, editor of the *Telegraph and Telephone Age* since 1911, and formerly associate editor of the *Electrical World*. He began life as a telegraphist, in which capacity he excelled; while the pages of the *Age* under his direction have always been full of interest and information. Mr. Taltavall was a native of North Shields, and was 63 years old when he died. He went to America at the age of 12 years, and rose from the post of messenger in the Atlantic & Pacific Telegraph Co.'s service to the position of superintendent of telegraphs of the Associated Press. In 1890 he became editor of the *Electrical Age*, and from 1894 to 1911 he was associate editor of the *Electrical World*. He made improvements in the typewriter, invented a useful quadruplex repeater, and was well known as an author.

Mr. J. K. Symonds.—The death occurred on October 3rd, at the age of 66 years, of Mr. J. K. Symonds, a director of the Braunton (Devon) Electric Light & Power Co., Ltd.

Mr. Thomas Preece.—Mr. T. Preece, electrical and mechanical engineer, and the local agent of the Westinghouse Co., Manchester, and the Westinghouse Brake Co., London, died very suddenly on Saturday last at Bradford, at the age of 57 years. Formerly his firm was known as Andrews and Preece, but latterly he practised under his own name only.

Mr. Henry Howgrave-Graham.—Mr. H. Howgrave-Graham (a cousin of Mr. W. J. Tennant) passed away at St. Leonards on October 10th, at the age of 80 years. He was articled as an engineer, and subsequently acted as resident engineer for certain public works. After holding several responsible secretarial positions he was, in the early eighties of last century, appointed secretary of the Institute of Patent Agents (which office he held for nearly 36 years, missing during that period only two or three meetings). Under the Patents Act of 1888 he was also appointed Registrar of Patent Agents.

Wills.—The late Mr. J. Allen Baker, M.P., chairman of Joseph Baker & Sons, Ltd., for many years a member of the L.C.C. and interested in its tramway matters, left £22,411.

NEW COMPANIES REGISTERED.

Aabada Dry Batteries, Ltd. (151,596).—Private company. Registered October 5th. Capital, £3,000 in £1 shares. To enter into an agreement with George Nikolayevitch Autonoff for a licence to use a certain invention relating to improvements in dry cells in electrical batteries, &c. The subscribers (each with one share) are:—W. Blount, 80, Gracechurch Street, E.C. 3, insurance broker; W. J. Chivers, 24, Byton Road, Mitcham, S.W. 17, clerk. C. W. Grimwade signs as a director. Registered office: 61, St. James's Street, S.W. 1.

Metrodes, Ltd. (151,642).—Private company. Registered October 10th. Capital, £5,000 in £1 shares. To carry on the business of electrical and mechanical engineers, founders, smelters, smiths, manufacturers of chemicals, steel manufacturers, general merchants and agents, metallurgists, contractors for coal, coke, iron or ironwork, steel, bricks, tiles, &c. The subscribers (each with 50 shares) are:—W. Christie, 105, St. Vincent Street, Glasgow, manufacturing agent; J. Henderson, 6, East Parade, Sheffield, chartered accountant. The first directors are not named. Registered office: Town Hall Chambers, 87, Furgate, Sheffield.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Mann, Egerton & Co., Ltd.—Mortgage dated September 18th, 1918, charged on freehold premises at Ipswich, to secure £4,500. Holders: F. P. Bugg, A. J. Leighton, and F. E. Leighton, Ipswich.

E. G. S. Co., Ltd.—Particulars of £6,000 debentures created September 18th, 1918, filed, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Weaverham Electricity Supply Co., Ltd.—A notice of the appointment of H. L. Dale, of 133, Chester Road, Northwich, as receiver on October 3rd, 1918, under powers contained in trust deed dated 1916, filed pursuant to Section 94 of the Companies (Consolidation) Act, 1908.

Watford Electric & Manufacturing Co., Ltd.—Mortgage deed, dated October 2nd, 1918, to secure £3,400 and further advances charged on freehold hereditaments and premises at Whippendell Road, and Sydney Road, Watford. Holder: R. A. Lister & Co., Ltd., Dursley, Glos.

CITY NOTES.

Victoria Falls and Transvaal Power Co., Ltd.

The Marquess of Winchester, addressing the annual meeting on October 11th, said that the further improvement of over £36,000 in revenue, under circumstances which increased the cost of everything, was a source of great satisfaction. After going through the financial details in the accounts and referring to a law court case bearing upon the question of relief of colonial income-tax, he said that the position of the low-grade mines had been a source of anxiety. The one commodity which was of first-rate importance to the gold mining industry was the price of power, and that, having been fixed by statute, remained the same. Gold mining and the supply of power to the mines were the two industries in which profiteering was impossible. The only way in which they could meet wage and stores advances was by economy of production. They could not maintain regularity of supply if they failed in maintaining their plant at the highest point of efficiency. Skimping their upkeep would not assist them; therefore the only way was to study economy of production. After referring to the employés who had rendered service with the Forces, the speaker mentioned that in conjunction with the Johannesburg Juvenile Advisory Committee the management in South Africa had submitted a scheme to give technical instruction to a certain number of young men who had lost the years between 18 and 23 in fighting, and who had therefore passed the usual age of apprenticeship, to enter themselves on their return, and the scheme embraced the payment of a sufficient wage to enable the individual to be independent of family assistance. The period of indenture would be for four years on a rising scale of remuneration. Their chief engineer, Mr. Bernard Price, had been appointed chairman of the committee appointed by the Union Government for the scientific and technical encouragement of the development of South African industries and resources. The appointment would not interfere with his duties to the company, whilst his presence on the committee might eventuate to the company's benefit. The general working of the stations had been maintained at the highest point of efficiency in spite of the difficulty in obtaining spare parts. No additions had been made to the generating plant. Rains had been plentiful, and the water supplies were ample. The monthly returns of profit promised a report as satisfactory as that now before them, but those results could not be indefinitely improved upon unless the demand for power increased. The chairman expressed sympathy with the head engineer in the electrical branch (Mr. Bryden) on the loss of his wife and child through the dastardly sinking of the *Galway Castle* by the enemy.

Eastern Extension, Australasia, and China Telegraph Co., Ltd.

The report for 1917 states that the revenue was £1,508,440, while the ordinary expenses were £351,261, and £220,886 was expended upon maintenance of cables, maintenance ships' reserve fund, payments to staff, and other war expenses, &c., leaving £956,294. After providing £427,057 for income-tax and excess profits duty payable in England, and £30,096 for debenture interest, £499,141 remains, plus £63,121 brought forward. £250,000 has been placed to general reserve fund. The total distribution for the year was 8 per cent., free of tax, leaving £72,261 to carry forward. The cost of the diversion and partial renewal of the New Zealand cables (£28,280) has been debited to general reserve, together with £25,000 as a further provision on account of investment fluctuations, and £6,546 representing the loss on sale of investments during the year. The concession granted to the company by the Spanish Government in 1897 for providing and maintaining under a subsidy arrangement cable communication between Manila and the Islands of Hoilo and Cebu (Visayas), having expired in November last, the company's stations in those islands have been closed, and the cables picked up for utilisation elsewhere. Their estimated value will be credited to the general reserve fund this year.

Barcelona Traction, Light & Power Co.—The committee representing the holders of the 7 per cent. prior lien "B" bonds, the 5 per cent. first mortgage 50-year bonds, and the 5 per cent. ten-year notes of the Barcelona Traction, Light and Power Co. have drawn up a plan, of which the approval of the bondholders is asked, which, while involving further sacrifice on the part of the latter, will, the committee believes, place the company upon a solid financial foundation.—*Financial Times.*

West African Telegraph Co., Ltd.—Revenue for 1917, £59,041, less £18,020 ordinary expenses and £31,181 expended upon maintenance of cables, differences in exchange, income-tax, pension fund, &c., leaving £9,840. Total distribution for the year 4 per cent., free of tax, carrying forward £50.

Electric Supply Corporation, Ltd.—For the past year £2,668 is put to repairs and renewals, £2,500 to reserve, 10 per cent., less tax, dividend is paid, and £393 carried forward.

Oriental Telephone & Electric Co., Ltd.—Interim dividend of 3 per cent. on the 6 per cent. cumulative preference shares for the current year, less income-tax, and one of 4 per cent. on the ordinary shares, free of income-tax.

National Telewriter Co., Ltd.—For the year ended June 30th there was a loss of £206, against £240 for the previous year.

Indo-European Telegraph Co., Ltd.—Interim dividend for the June half-year at the rate of 5 per cent. per annum, free of income tax.

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Anglo-American Telegraph Co., Ltd.—Interim dividend for September quarter 15s. per cent. on the ordinary stock, less tax.

United River Plate Telephone Co., Ltd.—Interim dividend 3 per cent. (3s. per share) on the ordinary share capital, free of income-tax, for the half-year.

Lima Light, Power & Tramways Co.—Dividend 1½ per cent.

Shanghai Electric Construction Co., Ltd.—Interim dividend at the rate of 5 per cent. actual, less tax.

STOCKS AND SHARES.

Tuesday Evening.

Markets throughout the Stock Exchange show notable strength. The German appeal for an armistice is regarded more in the nature of an admission that the enemy knows the game is up, than a step which is likely to lead to immediate peace. At any rate, it is a step, and one in the right direction. Markets are by no means unduly elated. There is intense satisfaction, but no indication of the mafficking spirit. President Wilson's reply is held to be admirable. Satisfactory progress with the War Bonds campaign has had little effect in denuding markets of money for investment. One of the features this week is a further rise in the prices of cable securities.

Peace prospects are having a marked influence upon electric lighting shares—upon all illumination issues as a matter of fact, for gas stocks have been advancing sharply, and instances have come under our notice of investors who have been buying both gas and electric light shares during the past few days, on the assumption that the companies will do well after the war. The principal change in the home electricity list is a rise of 10s. in City of London ordinary to 12½, closely followed by another 7s. 6d. in Westminsters, while St. James are 5s. up, and Charing Cross ordinary 2s. 6d. Besides these actual changes, the tone of the market is very different from what it was a month ago, and now it is just as difficult to get the offer of shares at reasonable figures as it was then to get an offer for them at prices satisfactory to the holder. Dividends are less of a factor to-day than are the prospects of business after the war, although, of course, the electricity companies afford good returns on the current quotations, as reference to our lists will show, although it must be repeated that there is a chance of the next batch of dividends suffering reduction.

Allotment letters of the new ordinary shares of the Newcastle-on-Tyne Electric Co. are out this week, and the price is 9d. to 1s. 6d. premium on the issue price of 20s. 6d.

The cable market is sustained by a batch of excellent reports which have appeared within the past few days. The Eastern Extension is a good example. The company earned £50,000 short of a million pounds net, an advance of £165,000 over the previous year's figures. As, however, the income-tax and excess profits duty took £180,000 more than in the previous twelvemonth, the actual result is to leave things much as they were, in spite of an increase in the gross receipts of £208,000. Appropriations are again treated on a liberal scale, and the reserve receives £250,000, making it £1,680,000, of which nearly 70 per cent. is invested in War Bonds. The price of the shares has risen to 16 ex dividend. Eastern Telegraph ordinary has recovered a point in addition to the 30s. deducted for the dividend last week. Westerns have gone up 12s. 6d. allowing for the dividend, and Cuba Submarine ordinary at 10½ ex 5s. are the same price as they were last week cum dividend. Anglo-American preferred has at last risen to par. Globes hold their improvement, and the only shares in the market to show a decline are West India and Panama ordinary, which slipped back to 36s. 3d.

Marconis have come to the fore again, recovering to 4⅛. There seems to be some little doubt in the minds of investors as to whether Marconi shares fall into the "peace" or the "war" category, and after falling to 4 7/16 on peace prospects, the same reason was used as a lever for rallying the price as already mentioned. Marconi Marines at 3½ and American Marconis at 32s. 6d. are both above the lowest levels recently reached, but it is not at all surprising that sellers should have come in, considering the somewhat breathless advance that has taken place since the beginning of September.

Mexicans have been again forging ahead materially. Mexico Tramway 5 per cent. Bonds, which stood at 50 at the beginning of the month, are now 60, and gains ranging from 1 to 3½ points have been secured by most of the issues in utility companies with which we deal. Monterey debentures has gained 2 at 47½. There is no stock about, and, as indicated here when prices were very much lower than they are now, quite a little demand sufficed to bring about a radical change in the market, and to lift prices by leaps and bounds. Brazilian Tractions have again been rising, showing a gain of 2 points at 58, supporters of the company claiming that it should not be long before a dividend on the common shares comes into sight. The last payment made to holders of these was in January, 1917. Anglo-Argentine Tramways are good, the 5 per cent. debenture advancing 3 to 74, and the second preference at £3 being ⅛ up. British Columbia issues are unchanged, save for a gain of 1 in the deferred. Kalgoorlie Electrics at 1s. 6d. have trebled in price.

The manufacturing group holds its own with firmness, though here, again, the market has made some rough attempt to divide the stocks and shares into peace and war categories. Because of this, British Westinghouse Preference are ⅛ down at 2½, and Babcock & Wilcox have eased off to 3⅛. India-Rubber shares, on the other hand, are 5s. up at 17½. Telegraph Constructions have risen to 49, in sympathy with the strength of cable shares. Callender's gave way another 5s. by reason of the impending new issue, while the preference at 5¼ are the fraction higher in consequence of the proposed raising of the dividend. Some are asking whether Henleys will follow suit in regard to the preference shares, the dividend on which is 4½ per cent., allowing a yield, at £4 per share, of 5⅝ per cent. on the money. Edison-Swans stand out with a rise of 1s. 3d. to 17s. 6d., brisk business taking place in the shares. Victoria Falls preference strengthened to 25s., and the ordinary are holding the improvement which they secured upon account of the recent report. The second debentures changed hands pretty frequently on the basis of 106½.

Rubber shares have recovered further, and are now a less disappointing market. The suggestion that the Ministry of Munitions should fix a maximum price for the produce is a perplexing factor in the situation. Armament shares are inclined to give way. Railway stocks are steady. Underground Incomes rose a point, the market being short of stock. London and Suburban Tractions are dull, the ordinary at 3s. 3d., and the preference at 8s. 3d. Indian Electric debentures at 90 are 5 points higher.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Oct. 15, 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6⅝	—	£7 17 0
Charing Cross Ordinary	5	4	3½	+ ⅛	6 3 0
do. do. do. 4½ Pref.	4½	4½	8¼	—	6 18 6
Chelsea	3	5	8⅛	—	7 16 10
City of London	8	8	12½	+ ½	6 10 7
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	10	—	7 0 0
do. do. 6 per cent. Pref.	6	6	9⅜	—	6 3 1
Kensington Ordinary	6	7	5⅞	—	6 17 7
London Electric	Nil	Nil	1⅜	—	Nil
do. do. 6 per cent. Pref.	4	5	3¼	—	7 2 10
Metropolitan	3	4	8⅛	—	6 10 7
do. 4½ per cent. Pref.	4½	4½	8¼	—	6 18 6
St. James' and Pall Mall	8	9	6⅜	+ ¼	6 13 4
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	6½	+ ⅜	6 18 6
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	100	+ ½	6 0 0
do. Def.	1½	1½	23¼	—	6 9 0
Chile Telephone	8	8	7⅞	—	5 6 8
Cuba Sub. Ord.	7	7	10¾xd	+ ¼	*6 13 4
Eastern Extension	8	8	16xd	+ ⅛	*5 0 0
Eastern Tel. Ord.	8	8	161¼	+2½	*4 19 1
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 5
do. do. Pref.	6	6	10⅜	—	5 17 1
Great Northern Tel.	24	22	35	—	6 5 8
Indo-European	13	13	58¾	+1	5 12 0
Marconi	15	20	4⅛	+ ⅛	4 6 6
Oriental Telephone Ord.	10	10	3⅞xd	+ 1/16	2 19 4
United R. Plate Tel.	8	8	7⅞	—	*5 3 3
West India and Panama	6d.	1/8	1⅛	— 1/16	*8 8 8
Western Telegraph	8	8	17⅛xd	+ ⅛	*4 13 5
Home Rails.					
Central London Ord. Assented	4	4	62½	—	6 8 0
Metropolitan		1	26	—	3 17 0
do. District	Nil	Nil	25	—	Nil
Underground Electric Ordinary	Nil	Nil	2¼	—	Nil
do. do. "A"	Nil	Nil	7/6	—3d.	Nil
do. do. Income	6	4	87	+1½	*4 12 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅜	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	9⅜	—	—
do. do. 2nd Pref.	5½	—	3	+ ⅛	—
do. do. 5 Deb.	5	5	74	+3	6 15 2
Brazil Tractions	—	—	58	+2	—
Bombay Electric Pref.	6	6	10⅜	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	59½	—	8 8 0
do. do. Preferred	Nil	Nil	41¼	—	Nil
do. do. Deferred	Nil	Nil	38½	+1	Nil
do. do. Deb.	4½	4½	59½	—	7 2 10
Mexico Trams 5 per cent. Bonds	Nil	Nil	60	+5	Nil
do. 6 per cent. Bonds	Nil	Nil	45	+1	Nil
Mexican Light Common	Nil	Nil	34½	+2½	Nil
do. Pref.	Nil	Nil	48	+3½	Nil
do. 1st Bonds	Nil	Nil	67	+1	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅜	— ⅛	4 2 8
British Aluminium Ord.	10	10	1¾	—	5 6 8
British Insulated Ord.	20	20	2⅜	—	4 4 2
British Westinghouse Pref.	7½	7½	2½	— ⅛	6 0 0
Callenders	20	25	10½	— ½	6 2 0
do. 5 Pref.	5	5	5¼	+ ¼	—
Castner-Kellner	22	20	3⅛	—	5 8 4
Edison-Swan, "A"	—	—	¼	+ 1/16	Nil
do. do. 4 per cent. Deb.	4	4	75¼	—	5 6 0
Electric Construction	7½	10	1⅜	—	7 5 6
Gen. Elec. Pref.	6	6	10⅜	—	6 2 4
do. Ord.	10	10	18½	— ½	*5 8 1
Henley	25	25	2½	—	5 11 1
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	+ ½	*5 14 3
Telegraph Con.	20	20	49½	+ ½	*4 18 6

*Dividends paid free of Income Tax.

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BUSINESS CONDITIONS AFTER THE WAR.

We print below from the *Yorkshire Observer* an account of a speech delivered by Mr. Stanley Baldwin, M.P., Parliamentary Secretary to the Treasury, at the autumn congress of the Textile Institute last week. We do so because we regard it as important that such a warning should receive whatever publicity we can give it when so many minds seem to be intent on spending millions of money on all sorts of schemes of amelioration in times when the nation will require to watch its expenditure very conservatively.

Mr. Baldwin said there was nothing of greater importance to the country than the way in which the English business world was going to face what might lie before it at the conclusion of peace. First of all, he would ask them to consider the main feature of the financial position of this country as we saw it after four years of war. He thought one thing stood out before all others, and that was the immense creation of credits with the enormous purchasing power appertaining to them and the consequent rise in prices which had gone on in this country beyond anything that could have been anticipated. We had seen bank deposits very nearly doubled during the last four years We had seen also—what we had never expected to see—a practically unlimited issue of currency. He did not mean unlimited in any wild-cat manner; but only without limit so far as the creation of credits might be without limit. They must all recognise that these processes must come to an end.

It was quite impossible for anyone to indulge in prophecy as to what would happen after the war in the domain of trade and finance, and for this reason, that so many of the factors that must enter into the equation were, and must remain, unknown. There was an idea in men's minds, founded on their experiences of the past, that the period immediately succeeding a great war—as had happened in Europe after the Franco-Prussion war—must be a time of booming trade. Many men would in consequence have their speculative instincts aroused. There would be an enormous amount of short-dated bills—he meant Treasury bills—to be redeemed, and these would mean a vast amount of fresh purchasing power. A great amount of fresh credit could be opened by the employment of them, and he looked upon their existence as one of the danger points, for those who were the holders of them might seek immediately to employ their funds in speculative rather than in sound business transactions.

One more very fruitful source of expenditure that might become very dangerous was rash and ill-considered expenditure on large schemes of social amelioration, the argument being put forward—as it was on some platforms—that if the country could afford to spend seven millions a day on war it could afford to spend a great deal on improving the condition of the country. He did not wish to say anything on any schemes that might be proposed, but only to remind them—what many who used the argument did not know—that it was not possible to go on much longer, it would not be wise to go on a day longer raising money for any purpose in the way in which we had been raising it.

Owing to the German submarine, we had not been able to export gold. When the danger of the submarine was gone, however, then the danger would become immediately present to us of any movement in the exchanges which would deplete this country of its gold resources to a greater extent than it had already suffered. They had got to remember as business men that a great deal of the apparent prosperity of the business world of to-day was built on a foundation of sand, and was more of the nature of a house of cards than a house of stone. Their object should be to convert it into a house of stone on a foundation of rock.

To his mind the great danger to-day, the great danger of a period of inflation, lay in the political situation. Inflation was not a subject that was understood by the masses of the people, nor was it a subject that could easily be discussed on a popular platform, and when the inevitable panics ensued, which must and would ensue, with all the countries of the world suffering from inflation in different degrees, they must remember that they had to deal with a world where the power had passed into the hands of an enormous number of new voters to whom the whole subject would be incomprehensible. He believed there would be no surer road to ruin than for a country of this kind to pass from a well-ordered constitutional Government into a condition akin to that of revolution. There would be no surer road to ruin than a period of prolonged inflation, enormously high prices, with the consequent wage disturbances that must ensue, and the inevitable panic that would come at the end of it. In his view, then, it was of the very greatest importance that at the earliest possible moment the borrowings of the Government beyond what might be found to be absolutely necessary should be stopped. As a necessary corollary to that the Government should try to live within its income. Then it should begin to make provision, on however small a scale that might be possible, for the repayment of the debt.

As we emerged from the period of the creation of bank credits to which we had become so accustomed, we had got to realise that the only sound foundation for the creation of capital was the way in which our forefathers created it, and that was by saving. It was not popular to talk about saving, but he was immensely impressed by the necessity for it. We had got to check the export of gold, we had got to import nothing that was not absolutely necessary, and we had got to stimulate to the utmost extent our export trade. Then, treading the parts of sound finance, we wanted to reduce, as we were able, the amount of currency notes, and help to check inflation in that way. Above all, business men must produce, and produce as far as possible only useful articles, and not waste money and energy and ingenuity in speculative trades. In useful trades he would say produce, produce, and produce everything they could.

With regard to the adjustment of wages, Mr. Baldwin said that to-day there was a very pronounced movement in favour of securing a living wage rate, and putting the price of the article on the top of that. They all knew the difficulty of that in international trade, but he believed the movement in favour of it would not be confined to this country, and they might find it possible in the business of the future to help the working classes to progress on those lines in a way that had hitherto been impossible in international trade.

As to the future, Mr. Baldwin declared that the great thing would be the spirit of the people. He thought we had got to realise that there were ugly things that had got to be rooted out. We had seen a great deal of the spirit of self-sacrifice and the spirit of heroism during the war. At the same time there was a spirit of selfishness and greed that boded no good. The word profiteering which was given to it was an ugly word which had a reality behind it. Now he felt very strongly that one of these spirits—that of self-sacrifice or that of profiteering—was going to be the master of the whole of our future. Our future depended upon which gained the upper hand. If the spirit of profiteering gained the upper hand after the war, then we should head for an inevitable disaster financially, and build up no civilisation that was worth having. But if we followed the other path, and if we put our whole endeavour into the task of conducting the businesses of this country on sound and honest lines, if we threw our whole might into that, and determined on so doing our duty as to elevate with us so far as we were able and in a spirit of self-sacrifice the classes that were brought into contact with us, we need have no fear for the future, and we should know that the civilisation that we should build up after the war would be one built upon a rock, and one that would last.

EXTENSIONS AT LEEDS.

The official opening of the new works at Whitehall Road of the City of Leeds electricity department was performed by the Lord Mayor of Leeds (Mr. Frank Gott) on Friday, October 11th.

The new works consist of the first instalment of buildings designed ultimately to contain some 42,000 kw. of generating machinery, and comprise three main blocks, namely, boiler house, pump house, and engine room and switchgear house.

Of the boiler house the extension now opened consists of half the ultimate building, and eight water-tube boilers, each capable of evaporating 30,000 to 35,000 lb. of water per hour, with all accessories, can be housed in it. It consists of three stories, the basement being devoted to the handling of the ashes, the ground floor accommodating the actual boiler plant, and the first floor the economisers and coal bunkers. In the basement are situated the hoppers into which the ashes from each boiler are discharged. These ashes are passed through electrically operated crushers into pipes and conveyed by air current into a large bunker situated outside the building, and fixed at such a height that it can be readily emptied into motor wagons, tramway trucks or canal barges without the ashes being handled by hand. The heating surface of the boilers, which were manufactured by Messrs. Babcock & Wilcox, Ltd., is 7,719 sq. ft., with superheaters of 1,815 sq. ft., and chain grate stokers of 182 sq. ft. area, capable of burning 4,000 lb. of coal per hour.

Each boiler is provided with its own economiser, and every pair of boilers discharge gases into a single chimney through a large induced draught fan which is driven by a three-phase motor. The manufacturers of the economisers are Messrs. E. Green & Sons, Wakefield, the induced draught fans, Messrs. Hattersley Pickard & Co., Leeds, and the motors, the Hinchcliffe Green Manufacturing Co., Leeds.

The coal bunkers situated above the boiler house have a capacity of approximately 1,250 tons, and the coal handling plant was manufactured by Messrs. Babcock & Wilcox. The coal is brought to the works by barges or motor wagons, and is efficiently discharged by mechanical appliances into bunkers situated on the wharf adjoining the works. From these bunkers it is conveyed by a gravity bucket conveyor up the end of the boiler house and over the coal bunkers and discharged at any desired point. The capacity of the single conveyor is 40 tons per hour. The bunkers themselves communicate with the hoppers fixed over the automatic stokers by long steel shutes, so that the coal passes direct from the barges to the fire grate without being handled.

For convenience of access and repair a 2-ton Waywood lift is provided, communicating with all floors in the boiler house.

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The pump house is one-third constructed, and contains one unit of the machinery ultimately to be installed. This unit consists of a high-speed triple-expansion engine manufactured by Messrs. Belliss & Morcom, and directly coupled to a centrifugal pump manufactured by Messrs. Rees Roturbo Co., Wolverhampton. This pump is designed to discharge 3½ million gallons of water per hour against a head of 35 ft., and is specially fitted up internally for dealing with water from the River Aire. The engine exhausts directly into a condensing plant manufactured by Messrs. Isaac Storey, Ltd., Manchester.

To enable repairs to be promptly carried out a 15-ton overhead electrically operated travelling crane is provided.

The main engine room is a lofty building provided with an electrically operated travelling crane manufactured by Messrs. Isles, Ltd., Stanningley, capable of lifting 60 tons. It contains at the present time two generating sets, one 6,000-KW. turbo-alternator manufactured by the British Thomson-Houston Co., Ltd., Rugby, exhausting into a jet condensing plant manufactured by Messrs. Cole, Marchent & Morley, of Bradford, the auxiliary plant being supplied by Messrs. Rees Roturbo Co., Wolverhampton; and one 12,000-KW. turbo-alternator supplied by Messrs. Siemens Bros. Dynamo Works, Ltd., Stafford, exhausting into a surface condensing plant manufactured by Messrs. Mirrlees Watson Co., Ltd., Glasgow. Both the main sets run at a speed of 1,500 R.P.M., and generate three-phase alternating current at a pressure of 6,600 volts. They are each provided with the necessary instruments and measuring appliances to permit of their economical operation being at all times carefully checked. In the basement of the engine room are situated the large water pipes necessary to convey the condensing water, various hot-well tanks and also a large capacity motor-driven boiler-feed pump which automatically provides the supply of water for the boilers. A duplicate of this pump is provided in the auxiliary plant for the 12,000-KW. machine, and in that case the pump, together with other machinery to which it is connected, is driven by a 200-H.P. steam turbine manufactured by the British Thomson-Houston Co.

The switch-house consists of six floors; the lowest floor forms the pipe basement referred to above; the next floor contains stores for sub-station equipment and also accommodates the main generator cables. The third floor accommodates incoming feeder cables, reactance gear and bus-bar transformer gear; the fourth floor the main switches, works sub-station, and machine rheostats; the fifth floor contains the control board for operating the switches, main bus-bars, battery room and motor generating plant; and the top floor forms the meter store and testing department.

In addition convenient rooms are provided for accommodating the staff. To provide adequate safety for the attendants operating the switchgear, this is of the remotely controlled solenoid-operated type, no high-pressure current being in contact with any portion of the operating board, and the main switches are designed to break loads considerably in excess of the capacity of the generating plant to be ultimately installed. The switchgear was manufactured by the British Westinghouse Electric & Manufacturing Co., Ltd., Manchester. The generating plant and outgoing feeders are all protected with devices to automatically operate when faults occur on the system, and the regularity of pressure is maintained by apparatus manufactured by Messrs. Cox-Walker, Darlington.

The contractors for the buildings were Messrs. William Airey & Sons, Leeds, the architect being Mr. G. W. Atkinson, Leeds, and the engineering details were designed and arranged by Mr. C. Nelson Hefford, the Corporation electrical engineer.

The new works are electrically connected with the older ones through a large sub-station containing 12,000 KW. of Scott connected two-to-three-phase transformers, so that the works always operate in parallel, either being able to make up any deficiency experienced by the other.

Further extensions in both old and new works are now being carried out, and when the present extension is completed the contents of the two works will be:—

Old Works.—Two 3,000-KW. sets; two 6,000-KW. sets; two 7,500-KW. sets.

New Works.—One 6,000-KW. set; one 12,000-KW. set.

Total for both works: 51,000 KW., including spare machinery.

The second half of the new boiler house is to be completed, and a further section added to the pump house and switch house. It is further anticipated that a second 12,000-KW. set will be ordered and installed in the new works as soon as the Ministry of Munitions is prepared to issue the required sanction, and the subsequent installation of a third set of similar capacity will complete the new works and make the capacity of the combined stations 75,000 KW.

The chairman of the Corporation Electricity Committee (Councillor Hugh Lupton) expressed the gratification of the committee at meeting such a large attendance of visitors at the works. As one might learn from one's enemies, so one might learn from one's friends, and the new engine house owed something of its inspiration to the large engine houses which had been visited on the Rhine, and also owed a good deal to the large engine house visited in Paris. The committee had no prejudice in favour of any particular type of turbine, but chose what it considered the best to meet the needs of the time. In going through the boiler house the visitors would notice that the coal was handled entirely automatically, from the moment it came alongside the wharf to the time the ash was discharged by the shoots into carts for carrying away. It was never touched by hand at all. The ash cellar in the new house was, he considered, the last word in perfection. This was a matter of great satisfaction because it contributed not only to greater efficiency of working, but also to the better health and comfort of the men. He considered they had approached very nearly the limit of possibility in the way of economy with steam plant. When he considered the growth of the Leeds station during the past ten years, and the cost of generating a unit of electricity in that station, he could not think that any reconstruction of the kind proposed by Government Committees could be of the slightest advantage to Leeds. But it might be said that they must not be selfish; there were smaller areas which would benefit by such a change. That was granted, but he would suggest that the larger towns, in conjunction with the Yorkshire E.P. Co., which already covered the greater part of that area, should unite their forces and help each other and any of the smaller districts which required cheap power.

The Lord Mayor, in declaring the works open, said it was a pleasure to congratulate the committee on what it had been able to carry through during a period of great difficulty. He urged that where it could be shown that a city had a well-arranged and progressive station, such as that at Leeds, which had never cost the ratepayers a penny, and had made profits in relief of rates, the Government should hesitate before transferring the undertaking to some other body which might not understand the needs of the citizens as their own electrical representatives would do. He would suggest that in a district such as that, where the larger cities and the Yorkshire E.P. Co. practically covered the ground, surely some mutual arrangement could be arrived at, which, whilst not including smaller urban districts, should safeguard the city's own interests and authority. One did not object to the five national commissioners proposed by the Williamson Committee, who merely took the place of the Board of Trade, but he maintained that the Corporation ought to be allowed to retain complete ownership of the municipal generation and supply, with obligations to smaller places at proper rates, and there would be no difficulty in arranging mutually satisfactory terms. It would be impossible to show that such a proposal as the Commissioners contemplated could generate and deliver energy in Leeds more cheaply than the Corporation could ever deliver.

Mr. Alec Campbell, on behalf of a group of works, said the demand of those factories had come suddenly on the electrical undertaking, but they had never been let down for power. The consumption for the past year had been over nine million units, and it was expected to be materially greater during the coming year. The demands they had made on the department had been readily met in the past, and he did not doubt they would be equally well met in the future.

Mr. C. Nelson Hefford, the electrical engineer, thanked the speakers for the kind things which had been said of his working colleagues, his staff, and himself. It was gratifying to know that their labours had met with success, and to feel that their work was appreciated. He also took the opportunity to thank the chairman and the committee for the consideration and care with which they had looked into many suggestions which he had, from time to time, had to put before them. On many occasions they had given him valuable guidance. He thanked those firms whose support in the early days had helped to build up the present extensive undertaking.

The Lord Mayor then started the 6,000-KW. set, and the visitors afterwards inspected the whole plant and buildings.

OUR TRADE WITH CANADA.

His Majesty's Trade Commissioner's Office at Montreal has issued a report on the trade of Canada and Newfoundland for the year 1917, and this has been printed recently by the Department of Overseas Trade (Cd. 9,159, price 3d.). It can be obtained from His Majesty's Stationery Office, or through the usual agents.

It will be of interest to electrical manufacturers and allied traders in this country, not so much perhaps from the point of view of immediate openings for the sale of their goods, as with a view to keeping in touch with manufacturing developments in Canada and with such opportunities for the sale of non-competitive goods as may arise after the war.

American Competition.—The most important fact bearing upon the economic situation of Canada during the year 1917 was the entry of the United States into the war. Before that event, it seemed as though the United Kingdom, engrossed in manufacturing supplies of war for her own needs and for her Allies, would be compelled gradually to withdraw from the export trade to Canada. Naturally, in such case, Canada, both on account of proximity to the United States, and of the ever-increasing means of communication between the two countries, would seek to obtain from the neighbouring republic that part of her requirements previously obtained

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from the United Kingdom, with which the latter was not in a position to supply her.

The entry of the United States into the war in April, 1917, changed the situation, but, while the pressure has thus been relieved to some extent, the United Kingdom manufacturers have not been in a position to resume their former activities and to supply the demands from overseas.

United Kingdom manufacturers, when the war ceases, and labour is once more available for peaceful purposes, should have no fear that they will not be able to regain the businesses they have been compelled to relinquish during the war, provided they maintain their system of supplying goods above reproach at reasonable prices.

Canada's Appreciation of the United Kingdom Market.—The value to Canada of the United Kingdom market has probably been appreciated more widely and more fully in the Dominion since the war commenced than at any time previously.

This has been strongly impressed in many ways upon the citizens of Ontario and Canada generally. For example, the national advertising campaign undertaken in connection with the flotation of the Victory War Loan in November and December last, persistently emphasised the fact that the United Kingdom had always been Canada's best customer, is so now, and will be in the future. This cannot have other than a beneficial effect upon United Kingdom trade with Canada. The point is being impressed upon the people at large who ultimately make up the purchasing power of the country, and many of whom may have overlooked the fact that the United Kingdom is Canada's best market.

While the United States remained neutral, it was able to supply Canada with many lines previously purchased from the United Kingdom.

United Kingdom trade with Canada naturally suffered as a result of war conditions which prevented the exportation of certain goods to the Dominion. The trade of the United States with Canada benefited to some extent because of that fact. This position was somewhat changed in 1917, as it has become increasingly difficult for Canada to obtain various goods from the United States. In short, many of the disadvantages which the United Kingdom shouldered in regard to trade with Canada, because of war, are now shared by the United States. This, perhaps, may be considered an advantage to British trade in relation to the return of normal trade conditions.

Sentiment in favour of the United Kingdom is still strong in Ontario, and augurs well for British trade after the war. The advertising there of many varieties of United Kingdom goods, with emphasis upon the patriotism of buying goods made in the United Kingdom or in the British Empire, has had a good general effect, in addition to the results attained by individual firms. The desirability of United Kingdom firms not allowing the Canadian market to forget their brands, even in war time, when deliveries are difficult or impossible, cannot be too strongly emphasised.

The competition of the United States in Canada is likely to be just as vigorous, if not more so, after the war as before it.

How to Obtain Trade in the Dominion.—In the course of gathering information for this report, merchants in the various lines of trade were asked how, in their opinion, the British manufacturer could secure a greater portion of the trade offering. The answer, in almost every instance, was that British manufacturers and exporters should have representatives calling on the trade, and, where their lines permitted, showing samples, and—more important—studying the requirements of the local market.

One large firm, whose buyers cover the European and American markets several times a year, made the following remarks: "British manufacturers have not to any great degree investigated New Brunswick or Canadian requirements or conditions. They have been indifferent to the designs and styles demanded by our people. They have been slow to adopt suggestions touching improvements. . . . The neglect of these vital things has hindered the development of British trade in Canada, and compelled us to buy largely in the United States market."

"Remedies suggested would be that the manufacturers send representatives who are progressive and possess initiative, and who would collect samples of shapes and patterns suitable for the Canadian trade, and take them to their principals, who should take some action instead of shelving the samples, and declining to produce the goods because they are something different from what they have been making. The Japanese commenced collecting samples in the autumn of 1914; the result is that large shipments made from these samples have been coming into Canada during 1916-17, and are giving satisfaction, being copied from the medium-class goods, hitherto supplied by Germany and Austria."

The buying capacity of the Maritime Provinces is arpidly increasing, and local merchants have no hesitation in saying that they will give the British manufacturers the preference of their trade if they will take advantage of their opportunity.

Increased Dominion Production.—As an indication of the competition which United Kingdom manufacturers have to face as against local industries, it may be noted that the census of manufactures taken in Canada during 1915 showed that as regards iron and steel products 851 establishments were in existence with a capital approaching 196 million dollars, using materials of aggregate cost of 59 million dollars, and with a total value of production amounting nearly to 120¼ million dollars. There were 1,173 establishments producing metals and metal products other than steel, the value of their output being nearly 91 million dollars. Another noteworthy item refers to vehicles for land transportation, which were being turned out by 464 establishments to the value of nearly 74 million dollars.

AN AMERICAN REVIEW OF FOREIGN ELECTRICAL TRADE PREPARATIONS.

The New York *Electrical World* (September 28th) publishes the following review of the preparations that are being made by various electrical manufacturing nations for after-the-war trade throughout the world:—

Each week brings fresh evidence of the preparation that is being made by every industrial nation to enter the markets of the world in competition for the foreign trade that is expected on the conclusion of the war. Of German plans little information has reached the outside peoples. There has been, however, sufficient proof of Germany's intention to regain as much as possible of the foreign trade that she once held. German capital is finding its way into Scandinavian countries. Only recently a large German electrical corporation was started in Sweden. It was plainly evident that this company would provide a market for certain German goods that when fabricated could enter Russian and other Eastern markets without the stigma of "Made in Germany" attached to them.

In the international trade in electrical merchandise Germany stood number one, with England running second, and the United States third. France and Belgium also shipped considerable quantities of electrical goods to other countries. When war broke out, however, the foreign trade of the world in electrical goods fell off considerably. That of Germany and Belgium fell to nothing, with France not much better. England has only partly regained that which dropped off. For the first three months of the current year the exports of English electrical goods were but slightly more than $3,000,000, which is less than one month's figures for the United States have been for many months.

Exports of electrical goods from the United States have increased by almost 100 per cent. over the 1913 total in value, although the increase in volume is evidently considerably smaller.

The facts are, therefore, that a considerable volume of trade remains unsatisfied. For this trade and for those markets that have arisen as a result of the war's devastation manufacturers are beginning to make active preparations.

England and Japan are unusually active in so far as electrical goods are concerned. In the past four years the output of electrical goods in Japan has increased enormously. To some extent, of course, the Japanese output has been augmented by American electrical factories in Japan. The factories are under American guidance, but use Japanese labour. Large factories are springing up all over Japan, and with efficient production methods and very cheap labour, these goods will be able to reach foreign markets at a price which will be difficult for other countries to meet.

English manufacturers have apparently learned the advantage in foreign trade held by the German cartel. They are now forming groups, studying conditions and laying plans. Particularly is this true of the wire and cable manufacturers. One thing is evident, and that is that the English manufacturers are going to make every effort to monopolise colonial markets. For economic reasons, however, it is doubtful if much headway will be made in the Dominion of Canada.

Italian electrical manufacturers are organising for foreign trade. The latest evidence is the formation of a trade association for this purpose by the wire manufacturers. Sweden and Norway are understood to be making similar preparations.

In the United States electrical manufacturers are very quietly making their plans. Some large corporations have been formed by the larger manufacturers for foreign trade, and agencies are being quickly established in the principal open markets. Smaller manufacturers are making connections with export houses.

Far more significant than the above, however, is the fact that the American electrical manufacturer is at last beginning to realise that goods meant for domestic consumption are not as a rule suited to foreign trade. In the past year a large number of wiring products and other kinds of electrical goods have been developed solely for use in foreign trade. Almost without exception these goods have been designed to meet low-price competition.

The Fixation of Nitrogen in Japan.—According to a Bill passed by the last Diet, the Government of Japan has decided to establish a laboratory for the study of the fixation of atmospheric nitrogen. The demand for ammonia for fertiliser amounts to nearly 20,000,000 yen each year, and up to now this has been supplied solely by importation. It is hoped to make this a local industry in the near future.—*Journal of Electricity.*

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NEW BRITISH AND KEY INDUSTRIES EXHIBITION.

On Monday, October 7th, as stated here last week, a new industrial exhibition was opened in the Central Hall, Westminster, just a month after the close of the British Scientific Products Exhibition. The initiative and organisation in this instance are due to the Tariff Reform League.* The name chosen for the exhibition, New British and "Key" Industries Exhibition, is rather ambitious, as indicated by the singling out of tungsten as a key metal, as is done in the handbook.

The exhibition is compact; many firms have large and impressive stands, and atttention is drawn to the pleasing display. Nearly half the 145 exhibitors were represented at the recent exhibition at King's College; in many cases, however, the exhibits are differently arranged or of different kinds. The handbook is conveniently arranged, but does not contain much detailed information besides the general articles on the chief industries. The expense involved in such an undertaking, especially at the present time, is very heavy, and has to be met by voluntary contributions. No charge is made to the public, nor has any charge been made to exhibitors for space. The exhibition will be kept open every day from 11 to 8, till October 24th, when it will be transferred to Manchester and other centres; the hours and date might have been mentioned in the handbook.

Messrs. Hadfield's, Ltd., Hecla and East Hecla Works, Sheffield, have excellently arranged exhibits which face the visitor on entering; most of these will be familiar to visitors from the King's College exhibition. The variety of the alloys of iron with many metals, including tantalum, zirconium, and sodium, of copper, cobalt, aluminium, &c., is very great, and further, a model of the United Engineers' Society building, of New York, 254 ft. high, is shown, to which Sir Robert Hadfield has frequently referred in discussions on the organisation of scientific bodies and publications.

Sir W. G. Armstrong, Whitworth & Co., Ltd., exhibit samples of materials used in manufacture of high-speed tool steels, special alloy steels, &c. The millionth-measuring machine, produced by Sir Joseph Whitworth in 1855, is also on view. This machine will show a difference of one-millionth part of an inch; it works with a gravity piece, which drops when one of the centres is slightly receded.

Messrs. Firth & Sons, Ltd., Norfolk Works, Sheffield, show samples of bullet-proof manganese steel and of non-magnetic manganese steels; further, tungsten (18 per cent.) steel, and magnetos (in conjunction with the British L. M. Ericsson & Manufacturing Co., Ltd., Beeston, Notts.), illustrating the use of ferro-tungsten magnet steel; nickel and nickel alloys, including the Firth-Brearley stainless knife steels.

Messrs. Vickers, Ltd., Vickers House, Westminster, S.W., utilise their central stand for demonstrating the testing of their magnetos under actual test conditions. Magnetos with a 6-mm. gap for six- and eight-cylinder engines are sparking continuously, and an engine, run for demonstration at 2,000 revolutions, sends a rapid succession of sparks up a slightly diverging spark gap of 10 mm., arranged like a lightning arrester of the horn type. The various other exhibits of the firm are similar to those shown at King's College, and will be remembered by visitors.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, E.C. 4.—Aluminium is well represented by this company, which exhibits the ores, intermediaries, and by-products. Ingot, sheet, rod, bar, sections, tube, wire, powder, &c., are exhibited, as are also alloys containing aluminium. Articles illustrating the use of aluminium in aeronautical, automobile, electrical, and other industries are on view, together with articles showing the domestic uses of aluminium.

We were interested in noticing among these exhibits a small aluminium commutator, field coils wound with aluminium wire, and an aluminium trolley head.

(To be concluded.)

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

15,836. "Reactance coils." J. R. Beard & Electrical Improvements, Ltd. September 30th.

15,853. "Selective devices for wireless telegraph receiving-apparatus." W. M. Mather. September 30th.

15,868. "Electric incandescent lamps." British Thomson-Houston Co. (General Electric Co.). September 30th.

15,869. "Electrical welding-apparatus." British Thomson-Houston Co. (General Electric Co.). September 30th.

15,945. "Manufacture of incandescent electric lamps." British Thomson-Houston Co. (General Electric Co.). October 1st.

15,953. "Dynamo-electric machines." W. A. Price. October 1st.

15,957. "Driving-mechanism for ignition apparatus of internal-combustion engines." H. H. Saddington. October 1st.

16,035. "Electric clocks, &c." W. Youlten. October 2nd.

16,044. "Receiving and repeating systems for telegraphy." J. S. Withers (K. C. Cox). October 2nd.

16,046. "Methods for detecting variable electric currents in the sea." F. B. Young. October 2nd.

16,054/5. "Electric switches." J. A. Crabtree & J. B. Tucker. October 3rd.

16,136. "Electric vacuous bulb-thermonic devices." J. Erskine-Murray. October 4th.

16,137. "Detection of conducting-bodies submerged in electrolyte." A. G. Ionides, W. Jevons & F. B. Young. October 4th.

16,138. "Wireless-signalling systems." British Thomson-Houston Co. (General Electric Co.). October 4th.

16,142. "Electro-plating and electro-cleaning apparatus. A. Ness. October 4th.

16,179. "Electric heat-regulating switches." A. A. Buck. October 5th (Switzerland, March 11th.)

16,193. "Torsion dynamometers." H. Bolas & Parnall & Sons. October 5th.

16,203. "Protective devices for alternating current electric systems." A. E. McColl. October 5th.

16,217. "Electrical operation of recording, &c., instruments." L. Williams. October 5th.

* Elec. Rev., October 11th, 1918.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

10,163. Call distributing systems for telephone exchanges. Western Electric Co. & L. Polinkowsky. July 13th, 1917. (118,864.)

12,857. Electrical resistances. F. A. Ross. September 7th, 1917. (118,878.)

12,959. Dynamo-electric machines. Hon. Sir C. A. Parsons & A. H. Law. September 10th, 1917. (118,880.)

13,139. Brush and terminal contact mechanism of dynamo-electric machines. J. Stone & Co. & A. H. Darker. September 13th, 1917. (118,886.)

13,192. Automatic telephone sub-station mechanism. A. E. Stevens. September 14th, 1917. (118,889.)

13,541. Telephone exchange systems. Western Electric Co. September 22nd, 1916. (109,815.)

13,559. Current motors. A. L. Munn. September 20th, 1917. (118,899.)

13,681. Detective and protective devices for electric cables. C. J. Beaver, A. F. W. Richards & E. A. Claremont. September 22nd, 1917. (118,902.)

15,210. Electrically-heated soldering iron. E. Caretti. October 19th, 1917. (118,928.)

15,232. Change-speed gears. O. von Zweigbergk. October 19th, 1917. (118,929.)

17,095. Alloys. British Thomson-Houston Co. (General Electric Co.). November 20th, 1917. (118,947.)

17,377. Electric storage batteries. R. L. Smith. May 17th, 1917. (116,256.)

18,860. Rotary field magnets. Aktiebolaget Ljungstroms Angturbin. December 19th, 1916. (112,441.)

1918.

3,106. Electrical relays. E. Fawssett & H. Parry. February 21st, 1918. (118,984.)

3,418. High-voltage distributors for electric-ignition apparatus. Akt.-Ges. Brown, Boveri et Cie. March 14th, 1917. (114,825.)

4,000. Internal-combustion engines having electric ignition. R. W. Maudslay & Standard Motor Co. March 7th, 1918. (118,801.)

4,613. Apparatus for therapeutic treatment by means of electric and other forms of radiant energy. W. J. Smyth. March 15th, 1918. (118,992.)

4,640. Electric motor controllers. Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). March 15th, 1918. (118,994.)

4,749. Signalling-apparatus for automatic telephone system. A. E. Stevens. September 14th, 1917. (Divided Application on 13,191/17.) (118,805.)

6,466. Electricity meters. Landis & Gyr Akt.-Ges. April 19th, 1917. (115,627.)

7,667. Electrolytical production of zinc. G. H. Clevenger. May 7th, 1917. (115,847.)

7,750. Governing means for fluid-pressure turbines. Brush Electrical Engineering Co. (Aktiebolaget Ljungstroms Angturbian.) May 8th, 1918. (118,821.)

9,074. Means for controlling electric circuits. British Thomson-Houston Co. (General Electric Co.). June 1st, 1918. (119,016.)

9,082. Interlocking plug switches for electric circuits. H. Stokes. June 1st, 1918. (119,017.)

9,285. Manufacture of carbon electrodes. B. E. D. Kilburn (Norske Aktieselskab for Elektrokemisk Industri, Norsk Industri-Hypotekbank). January 9th, 1918. (Divided application on 551/18.) (119,018.)

10,306. Electric signalling systems, more particularly for use in mines. Automatic Telephone Manufacturing Co., and Remington Co. February 22nd, 1918. (Divided application on 12,199/17.) (118,828.)

Electroscope Cautions.—When a delicate gold-leaf electroscope is used, considerable care should be taken to prevent damage to the gold leaves. Only a very small charge must be given to such an instrument. If it is desired to experiment with larger charges, make up a rough electroscope with Dutch-metal leaves, which are not nearly so easily damaged, and far more readily repaired. It is necessary to keep the cap of the instrument free from dust, but care should be exercised in dusting. Too vigorous application of the silk may excite the cap sufficiently to drive the leaves too far apart, and strain them at the point where they are attached. The electroscope should be put right away in a cupboard when an influence machine is to be used. A correspondent states that he once spent several hours making a particularly delicate electroscope and then absent-mindedly left it on the table about six feet from a Wimshurst machine, with the result that the leaves were torn off by the induced charge, and driven to opposite sides of the glass case.

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THE

ELECTRICAL REVIEW.

VOL. LXXXIII. OCTOBER 25, 1918. No. 2,135.

ELECTRICAL REVIEW.

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THE UTILISATION OF SURPLUS ENERGY.

THE question how best to utilise the surplus energy available from a hydro-electric installation during light-load periods is one of great interest and importance. Obviously, if a load factor of 100 per cent. can be secured, the cost of the kilowatt-hour will be greatly reduced, owing to the distribution of the fixed charges over a greater output; even with the most diversified industrial and domestic demands, it would be unduly optimistic to hope for a load factor much above 50 per cent., so that in general, by raising the load factor to 100 per cent., it should be possible to reduce the fixed charges per unit by about one-half. The running charges being small, the resulting total cost per unit would be extremely low. In the case of a steam-driven station the advantage would not be so great, owing to the proportionately increased cost of fuel and labour; but subject to this qualification, the gain is very important. It is often suggested that one of the best methods of thus filling up the valleys in the load curve is to install electrochemical or electrometallurgical plant, working on processes which can be regulated according to requirements without affecting the value of the product; a correspondent of the *Revue Générale de l'Electricité* has suggested an ingenious system for the utilisation of surplus energy, or, more generally, we would say surplus plant capacity. He proposes to produce oxygen and hydrogen by the electrolysis of water, and, as the market for hydrogen gas is restricted, to utilise it for the extraction of nitrogen from the air by the simple process of combustion, the nitrogen being afterwards employed in the manufacture of calcium cyanamide and synthetic ammonia, from which nitric acid can be readily obtained. The nitrogen and oxygen can also be used for the production of nitric acid by means of the electric arc, and the manufacture of nitrate of ammonia provides another outlet for the products of the works. In times of peace there is a continual demand for cyanamide and ammonium nitrate as fertilisers, a demand which, under the new conditions of intensive agriculture that will obtain in the future, is certain to increase; at the same time, while we hope there will never be another great war, it is impossible to exclude that eventuality from consideration, and the possession within our own borders of sources from which high explosives can be obtained, a precaution so strongly advocated by Mr. E. K. Scott both before and during the war, will constitute a valuable safeguard. We do not suggest that the process above referred to is the only one applicable to the purpose in view—the utilisation of surplus plant capacity—or even the best one; but its simplicity and elasticity render it worthy of consideration, and when we proceed to the erection of big central power stations it will be a matter of the first importance to provide them with ancillary factories suitable for the purpose of maintaining the demand upon the costly generating plant at a load factor approaching 100 per cent.

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Belgian and Swedish Railways.

Events are moving rapidly in connection with the war, and in regard to the indirect results which have been produced in neutral countries through the condition of hostilities. The watchword everywhere now is independence of external resources as far as any country's internal conditions will permit. In the case of Sweden, whose native coal supplies are practically insignificant, the comparative scarcity of imports of coal during the war has brought about circumstances in that country which it is hoped will not recur at any future period. The railways there, despite the alteration of many locomotive furnaces so as to permit of the use of wood fuel, have keenly felt the shortage of coal, which has become accentuated as the weary war months have passed away. Recognising the gravity of the situation, the Swedish Government as far back as December, 1915, instructed the State Railway authorities to investigate the question of the conversion of the State Railways to electric traction, and the end of September this year has witnessed the conclusion in its main features of the protracted inquiry. The preliminary report states that it is necessary to introduce electric locomotion partly on the ground of the enormous increase in the prices of coal—that from German sources is threatened with a further advance due to an export tax after the war—and partly owing to the necessity for extending the railway system. It is considered by the railway authorities that the work of transformation could be completed in a term of 10 years, and for this purpose there are available the water powers of the Lagan, Gota River, Motala River, Dal River, Indals River, the Ume River, and power plant on the Lule River. The requisite waterfalls are in Government ownership, and several great power stations are already in operation. It is calculated that the power available would allow of the laying of mains also for the supply of light and power, particularly for the use of agriculturists, and it is stated that the apprehension that the plant might be damaged during war-time has been overcome.

The situation of Belgium is not precisely the same as that of Sweden. When the whole of Belgium has been cleared of the enemy, it is thought that many of the railways will be found to have been destroyed, and the work of reconstruction will, consequently, have to be commenced. Before the war the railway system of Belgium was the greatest throughout the world in proportion to the country's superficial area. Some time ago the Belgian Government, among the various Commissions appointed to prepare schemes for the restoration of the country on the termination of hostilities, nominated a Railway Commission to draw up a report on the position, and this Commission has reached the conclusion that it will be more advantageous to adopt electric than steam locomotion on the whole of the railway network. This decision has not been prompted by any scarcity of coal, although the coal production in pre-war days was only able to satisfy the domestic requirements, seeing that exports and imports were approximately equal. It is considered, however, that the near future will present a favourable opportunity for proceeding with a gigantic change for the improvement of the means of communication, which would scarcely have been undertaken, as far as can be seen, but for the war.

The New Hydro-Electric Works in France.

A problem of considerable interest has arisen in France which also has indirect application to other of the Allied countries. It relates to the hydro-electric works which have been erected for the execution of war contracts during the course of hostilities, on land or riparian property requisitioned by the military authorities for this purpose. What France has accomplished in this direction, partly owing to the scarcity of coal, will only be known definitely after the conclusion of the war. Many manufacturers in the early period of the war were encouraged, if not compelled, by the Ministry for Armaments to establish new installations very promptly, the first result being the presentation by some speculators of such extortionate demands for the transfer of their rights as to threaten to bring about the failure of the schemes. Under the existing law the projected works could not be declared of public utility, as it was impossible to do so if the waterfall was not intended for the supply of energy to the public. In order to overcome this difficulty the Government requisitioned the properties in question, and it was then possible to begin operations. This step merely served to postpone the problem, as the effects of the requisition will cease with the discontinuance of the war, when the owners of the lands will be able to demand the payment of a considerable sum, or the return of their property. The manufacturer will then either have to submit, and become financially burdened with a dead load on his undertaking, or he will prefer to abandon the works, with the result that a source of power will incur the risk of being no longer utilised.

It is considered that this eventuality is all the more regrettable, inasmuch as a general Bill awaiting consideration—the Hydro-Electric Works Bill—provides that works for the utilisation of falls exceeding a yield of 500 kw. shall form the subject of a concession, whatever be their object, and be capable of benefiting by the right of expropriation of the land or property concerned. On the other hand, the Bill further provides that the owners of existing installations can elect to place themselves under the proposed new *régime* or remain subject to the present laws, but on condition that the undertakings revert to the State on the expiration of a period of 75 years. Such arrangements, in the opinion of M. G. Tochon, as published in *L'Information* of October 1st, would compromise the fate of the falls brought into use during the war, and cause serious prejudice to the national economy. The Government, however, has desired to obviate this by causing undertakings representing a capacity of over 500 kw. to benefit by the first clause of the Bill relating to the definite continuance of public works carried out during the war. This Bill—the War Works Bill—relates chiefly to railways, roads, works at seaports and inland navigation improvements, aviation camps, and hydro-electric works which have been executed without the fulfilment of the legal formalities applicable to permanent works. Most of those works will be capable of being adapted for peace purposes, and will have to be continued, and it will, therefore, be necessary on the cessation of hostilities to decide which shall be maintained and which shall be discontinued. As a consequence, it will be essential to preserve those works which have been erected on requisitioned property from losing their position immediately on the return of peace. Under these circumstances, the first clause of the War Works Bill provides that until the expiration of two years from the year of the termination of hostilities, no action can be taken by landed property-owners for the return of lands occupied by military requisition, and serving for public purposes, without the legal formalities appertaining to peace times being fulfilled.

If, on the arrival of the appropriate time, it be decided to continue the war-time established works, a decree will be issued by the Council of State equivalent to a declaration of public utility. This will have the effect of exempting the Government from the observance of the formalities under the old law of 1841, in so far as inquiries are to be made, and then the expropriation will be proceeded with and the compensation settled, as provided for under that law. As, however, there could be no question in the present state of legislation, as already previously explained, of submitting hydro-electric works established during the war for military purposes to the procedure applicable to public works, the War Works Bill stipulates that these particular works shall benefit by the period of two years, during which the right of action shall not lie in regard to requisitioned lands, although the capacity of the undertakings concerned must exceed 500 kw. The limitation to works of over this power is due to the fact that a concession is provided for in the Hydro-Electric Works Bill before the Chamber of Deputies only in the case of works of this size, whilst the other installations of lower powers will remain subject to the authorisation under which they were created, and will consequently escape reversion to the State. The period of two years has been fixed because the Government hopes that in the meantime the general Bill relating to hydro-electric works will be adopted by Parliament.

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ELECTRIC TRACTION ON THE CENTRAL ARGENTINE RAILWAY.

(*Continued from page* 365.)

The high- and low-pressure portions of the turbines are in separate cylinders, the high-pressure cylinder being of cast-steel; this was steamed with superheated steam for 24 hours both before and after blading. The rotor shafts and drums are forged solid of steel with a tensile strength of 35 to 40 tons and an elongation of 20 per cent. The blades are of brass. Between the turbine and the hand- or electrically-operated main exhaust valve is an atmospheric release valve. The speed between no load and maximum load can be varied 5 per cent. up or down while the turbine is running, and can be controlled from the switchboard by electrical means.

The condensing water is taken from a pump house on the River Lujan through two 27-in. diameter pipes about 500 yards long, and is discharged into a small creek somewhat nearer the power station.

The condenser shells are cast-iron, and the tube plates are of rolled brass $1\frac{1}{8}$ in. thick. The tubes are of $\frac{3}{4}$ in. external diameter, and are of solid drawn copper of No. 18 S.W.G. Aluminium blocks are fixed in the water chambers in metallic contact with the tube plates.

The circulating water pump bodies are of cast-iron and the impellers are of gun metal. The motors are housed in a steel-framed, corrugated-sheet-iron house erected on a wooden jetty; one side of the jetty consists of two screens of expanded metal, arranged so that one screen at a time can be raised for cleaning.

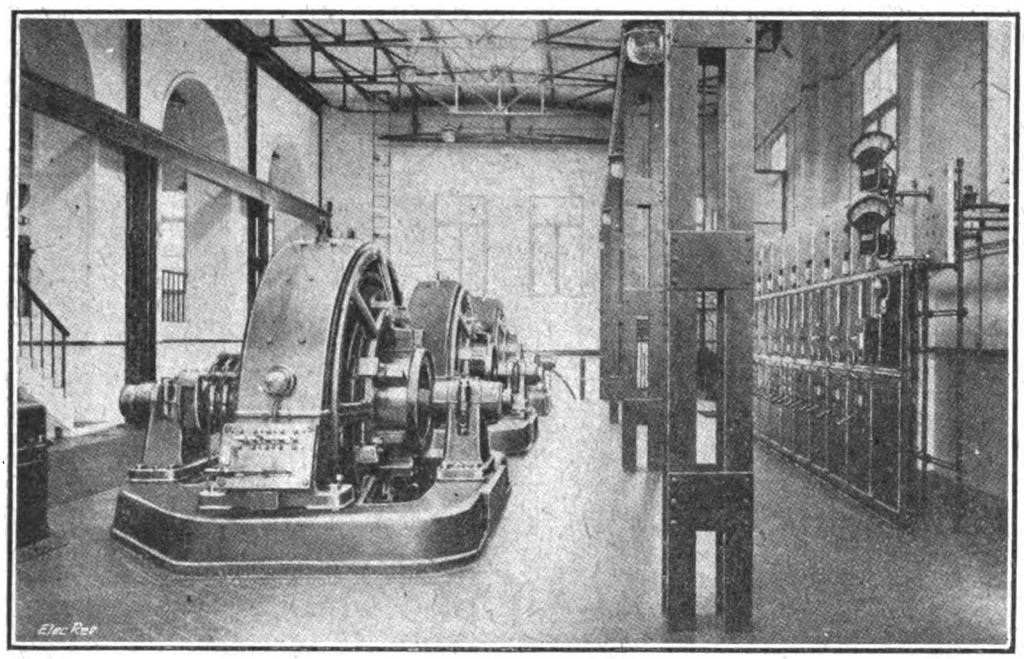

Fig. 7.—Interior of Sub-station.

In addition to the main circulating-pump motors, the jetty carries a centrifugal pump capable of delivering 300 gallons per minute against a head of either 20 or 95 ft. This supplies water through a 6-in. diameter pipe either to the purified water reservoir or direct to the storage tanks in the pump house. Two motor-driven air exhausters are also located in the pump house, each capable of producing in three minutes a vacuum of 20 in. in any one of the main pumps, including its suction pipe and discharge pipe up to the discharge valve.

The main pump motors are started by means of oil-immersed auto-starters, consisting of two separate single-phase transformers and the starting switch. Each motor is connected by a separate cable to one of the unit distribution boards in the power house.

Owing to the swampy nature of the ground between the river and the station, it was not possible to lay the circulating-water pipes direct in a trench. Instead they were erected on cross bearers carried by pairs of wooden piles driven down to the tosca. The cables are carried on angle irons supported from the cross timbers. The pipes, which are of steel, are lapped with tarred Hessian tape.

The alternators are totally enclosed, and ventilated by fans on the rotor which draw air from the basement through a dry air filter and discharge it outside the engine room. The combination of an alternator and a step-up transformer as one generating unit permitted the actual alternator voltage to be selected so as to give the most simple and robust stator winding; the stator slots, which are completely closed, each contain only one conductor. The rotors are of the built-up plate construction, with a distributed winding in slots, and are fitted with mild steel slip-rings.

The step-up and unit transformers belonging to each generating set are housed in a separate chamber in the basement, with hatchways in the engine-room floor through which they can be handled by the crane. The chambers are ventilated by fans which draw air from the basement, and provision is made for running off the oil from the transformers to the outside of the building in case of fire. Each step-up transformer has its own oil cooler, through which the oil is circulated by a rotary pump driven by a 10-h.p., 440-volt, three-phase, squirrel-cage motor. The unit transformers are air-cooled. The station transformers are situated in separate chambers at the ends of the engine room basement, and are air-cooled.

The main step-up transformers are of British Westinghouse make, of the three-phase shell type, oil-immersed, with mesh-star connections, and are rated at 4,860 k.v.a.; the unit transformers, of similar type, are of 250-k.v.a. capacity, and the station transformers of 1,250-k.v.a. capacity. The lighting motor-generators, made by the British Thomson-Houston Co., Ltd., comprise each a 55-kw., d.c., generator driven by an induction motor, with a 10-kw. battery-charging booster.

All main switching is carried out at 20,000 volts. The main switchgear is located in a bay on the side of the engine room opposite to the pump house and boiler house, the operating gallery being raised about four feet above the engine-room floor, so that the operator has a good view of all the machines. The generator panels, which are in the middle of the gallery, are set round a recess, so that all the instruments and gear can be seen from one position (fig. 4). The station transformer and feeder panels stand on either side of the generator panels, parallel to the axis of the engine room.

Each operating panel consists of two cast-iron plates built into a wall of moulded concrete, 11 ft. high, faced with glazed titles; this wall is set forward 3 ft. from the main panels, and at the back carries the auxiliary wiring, which is run as vulcanised india-rubber-covered cable on porcelain racks. In the case of the generator panels, the instruments (of the edgewise pattern, and comprising an ammeter, voltmeter, power-factor meter, and indicating wattmeter) are mounted on the wall above the upper cast-iron plate. Below them are the red and green indicating lamps which show whether the oil switch is closed or open. The upper cast-iron plate carries the oil-switch operating handle, and, interlocked with it, the handles controlling the cable and bus-bar isolating switches. Below the oil-switch lever are the automatic trip coils, and above it

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the time-limit fuses. The voltage regulator is mounted on the wall to the left of the plate. The bottom plate carries the integrating wattmeter, the exciter field switch, the governor control switch, and the change-over switches for the voltage regulator and the ammeter.

In front of each generator panel is a pedestal carrying the exciter ammeter and voltmeter, and the handwheel which operates the exciter field rheostat, mounted on an intermediate floor in the basement. A second pedestal carries the transmitter of an electrically-operated telegraph by means of which the switchboard attendant can communicate with the driver when synchronising. Similar instruments mounted at the front of the gallery give communication to the boiler house.

The main panels are formed of moulded concrete cubicles 5 ft. wide; the main wall is 9 in. thick, and the sides of the cells are 4 in. thick. Intermediate floors, 4 in. thick, separate each cubicle into five storeys, which (starting from the bottom) are occupied as follows:—

(*a*) Potential transformers (fig. 5); (*b*) cable isolating switches and current transformers; (*c*) oil switch (fig. 6); (*d*) bus-bar isolating switches; (*e*) bus-bars. The different compartments are protected by screens of expanded metal interlocked with the main switch, so that they can be opened only when the switch is open. The whole structure was moulded in position, the holes for the apparatus being cored out so that no cutting of the work was required. Porcelain only is used for insulation, and in general, connections are made with bare copper, a minimum spacing of 15 in. between phases and to earth being adopted; where there is risk of conducting fumes causing short circuits, the leads are covered with porcelain tubes. Small wiring in the cells is kept down to a minimum, and is run as rubber-covered cable on porcelain cleats.

The three phases of each high-pressure switch are contained in one tank, which is built up of wrought-iron plates with special stiffening channels to take care of the maximum pressure generated in the tank when the switch opens on a fault. A vent pipe leads from the top of the tank to the outside of the switch cubicle, to carry off any gases that may form. The leads to the switch terminals are introduced into the tank through cast-iron "U" bends filled up solid with compound. Provision has had to be made for the expansion of this compound in hot weather, otherwise the bends or porcelains are liable to crack.

The current transformers are compound filled and iron-clad. They are of two types, one suitable for mounting against a wall, the other passing through the floors between the compartments of the panels. The use of the latter saves floor insulators and economises space. On the generator panels current transformers are provided for the instruments, the protective devices, and the voltage regulators.

The potential transformers are oil-immersed and self-cooled. Isolating switches and fuses are installed between them and the cable terminals, so that a faulty transformer can be isolated from the rest of the switchgear.

The unit distribution boards are built up of enamelled slate panels, and have the bus-bars mounted in front; porcelain handle fuses connect the bus-bars to studs which pass through the slate to the motor leads at the back. The oil switch controlling the feeder cable from the unit transformer is mounted at the back of the panel, along with the current transformers for the trip coils and instruments. Bus-bar isolating switches are mounted on the front of the incoming feeder panel.

The main motor distribution board is of slate panels similar to the unit distribution board. It is surrounded with expanded metal to prevent articles from falling on it from the engine room floor above.

Feeders are run from the station distribution board to the station auxiliaries, and also to the unit distribution boards, so that the latter can be made alive when a supply is not available from the unit transformers, *e.g.*, when starting up or shutting down a generator. In order to avoid any risk of paralleling a generator out of phase through its unit transformer, the switches on the two feeders to each unit distribution board (viz., from the unit transformer and the station distribution board) are interlocked, so that only one can be closed at once. They are also so arranged that the change-over from one supply to the other can be so quickly effected while the auxiliary plant is running, so that there is no appreciable drop in the speed of the motors.

At each end of the switchboard gallery is installed a 110-volt, D.C. board to control the supply from the lighting motor-generators to the lighting circuits and the batteries. Two 250-ampere-hour Tudor batteries provide current for the indicating lamps on the main switchboard, the trip coils of feeders, electric telegraphs, and a stand-by to the lighting system. The end cells of each battery are cut in or out of circuit by a solenoid-operated, remote-controlled regulating switch.

The line at present electrified is served by three traction sub-stations. The buildings are all steel-framed structures, walled with brick covered with armoured cement plaster. The floors and roof are of concrete reinforced with Clinton fabric, the roofs being flashed with ¾ in. of rock asphalt. Provision is made at the sub-stations for housing the attendants.

Each building is divided into three main aisles, the centre one containing the rotary converters and transformers and the side ones containing the high-pressure and direct-current switchgear respectively (fig. 7). There is a loading bay at one end, into which a siding runs, so that railway trucks can be brought under the overhead crane which traverses the whole building. Provision is made for extension of the building at the end away from the loading bay, when it is necessary to install further converter sets. The basement contains the main transformers, the potential and current transformers, the high and low-pressure feeders, rotary field rheostats, and battery. On the first floor are situated the rotaries, the 800-volt switchgear, a motor-generator, and, on a raised gallery, the high-pressure operating gear.

The high-pressure gear is similar to that in the power station; the bus-bars are sectioned and interconnected by an oil sectioning switch, the two halves of the bars being fed by different cables.

The direct-current switchboard is built up of panels supported on a pipe framework. A single-pole circuit-breaker with overload and reverse current tripping coils, and a knife switch which isolates the circuit-breaker from the bus-bars, are mounted on a marble panel at a height of about 8 ft. from the floor. Marble partitions between adjacent panels form separate cubicles, and prevent the arc from a breaker which opens on a fault from travelling to adjoining switches. The switches are operated through wooden rods and porcelain insulators by handles which project through cast-iron panels mounted about 14 in. in front of the marble slab. In this way, all live metal in front of the board is placed out of reach of a person standing on the floor. The generator panels carry hand-wheels for operating the rotary field rheostats, which are mounted in the basement directly below the board. Differential relays are provided to prevent a circuit-breaker from being closed when the polarity of its rotary is reversed. These operate in conjunction with indicating lamps which light up in such circumstances.

At present there are three 1,000-KW. rotary converters in each sub-station, made by the British Thomson-Houston Co., Ltd.; they are compound-wound, with commutating poles, of the six-phase type, diametrically connected. The normal output is 1,000 KW. at 800 volts, and they can give 1,500 KW. for two hours, 2,000 KW. for 10 minutes, and 3,000 KW. momentarily. The converter transformers, made by the British Westinghouse Co., Ltd., are single-phase, rated at 375 K.V.A., oil immersed, and naturally cooled. The station and lighting transformers are of the same make and type, the former (three in number) being rated at 20 K.V.A., 20,000/440 volts, and the latter, a single unit, at 10 K.V.A., 440/110 volts. A B.T.H. motor-generator of 5 KW. gives D.C. at 110 volts, and a Tudor storage battery of 50 A.H. is provided. An air compressor, made by Messrs. Alley & McLellan, and Blackman ventilating fans, have been installed.

The rotary converters (fig. 7) are self-synchronising, and are started from tappings on the low-pressure side of the transformers by an oil-immered controller. Provision is made for coupling negative boosters to the ends of the shafts when the traffic increases to such an extent that the drop in the track rails becomes higher than desirable.

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Special precautions have been taken to reduce to a minimum the flashing-over which is liable to be caused by heavy short circuits on the track. With this object the commutator cones have been covered with projecting fibre sleeves, and all earthed metal near the commutators has been painted with a composition made up of half gold size and half linseed oil. In addition, screens are fixed between the brush-holders to prevent flashing round the commutator. By these and other means, the number of flash-overs was reduced from an average of six per month during the first six months of operation to an average of two per month for succeeding months.

The transformers are mesh-connected on the high-pressure side, with tappings on the high-pressure side to compensate for variations in the supply voltage and on the low-pressure side for starting. The tanks are ¾-in. boiler plate, with external tubes to give increased cooling surface. They are mounted on rollers, so that when the core has been lifted by the overhead crane the tanks can be run out of the chamber and the core set down on a drip tray for examination. The chambers are ventilated by ducts carried up to the roof to Barrol ventilators; cooling air is drawn from outside the station by motor-driven fans, and passed round the foundations of the converters into the transformer chambers through an expanded metal opening in the door.

The auxiliary equipment of each sub-station includes a bank of three single-phase transformers, which gives a supply to the motor-generator, air compressor used for cleaning purposes, ventilating fans, and the lighting transformer. The motor-generator gives a direct-current supply at 110 volts for charging the battery used for the tripping and indicating circuits and emergency lighting.

(To be continued.)

AN ELECTRIC WORLD GIRDLE.

By Edward Raymond-Barker.

In the article published in the *Times Trade Supplement* for September entitled "An Imperial Cable," Mr. Llewellyn Preece, M.Inst.C.E., M.I.E.E., discusses the practicability of installing and working profitably what he considers "the most economical Imperial telegraph system"—viz., "one long electric girdle round the globe"—consisting of 27,000 miles of submarine cable and 3,000 miles of landline across Canada, with an additional separate cable between India and Mauritius. This system, following an *all-red* route, Mr. Preece says, "could only be installed by the joint Governments" of the British Empire.

In reply to your kind invitation, the writer is pleased to offer the following remarks under the clear understanding that they apply solely to what he considers to be the much too superficially considered scheme as described by Mr. Preece, and not to any other well thought-out, practicable, and safeguarded project, which also does not ignore the reasonable rights and interests of the pioneer cable companies to whom the British Empire owes a debt which can never be adequately paid.

Among the reasons given by Mr. Preece for undertaking such a comprehensive and extensive system is that "the maintenance of this league will be possible only if all the principal countries are linked together on one special system of submarine cables, so that each can be in touch with all the others at all times," and that "far more personal interchange of information is requisite, and the Governments of all these countries must have at their disposal a system of telegraphic communication so reasonable in cost that all their messages shall be rapidly transmitted and immediately answered, and all occasions of misunderstanding avoided."

As to whether such a system could be installed and worked profitably at a rate of ½d. or 1d. per word for Press news, and at a flat rate of 2d. or 3d. per word for Government and private messages, Mr. Preece is of opinion that it would, because "if it were possible to supply each country daily with ample news from all the other countries the cable system would be filled with traffic throughout the 24 hours."

The capital outlay for a complete new ring should, Mr. Preece thinks, not exceed £7,000,000. "But as there is no apparent reason why the Pacific cable should not form a section of the ring, the actual expenditure should not exceed £5,000,000."

As to its proving profitable at the rates above mentioned, Mr. Preece says, "the total revenue could thus be £800,000 and the expenditure £750,000."

Now, Sirs, the object in view, viz., facilitating, cheapening, and expediting communication between Great Britain and the Dominions, is one with which every one, and more especially the mercantile fraternity of all these countries, will cordially sympathise, as, indeed, with any sound scheme which promises uninterrupted and Government-protected telegraphic service. The scheme in question is, however, so vast, and the risks of interruption so considerable, that before even seriously entertaining the idea, or advocating such a project, its practicability must, of course, be considered in all its bearings—electrical, hydrographical and

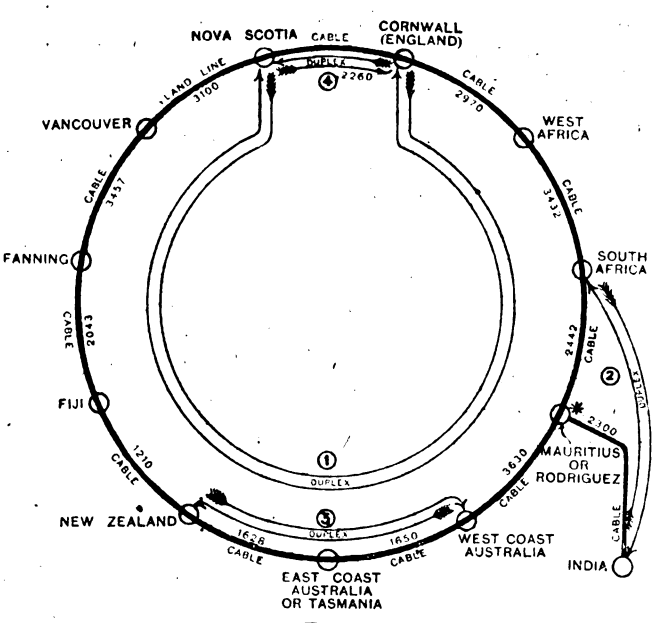

Fig. 1.

financial, by a Committee of Experts—the financial question, including traffic receipts at the suggested very low rates as against the high expenses connected with a numerous and unusually highly trained and reliable working staff, being thoroughly gone into by an expert cable company accountant.

As put forward by Mr. Preece, it will probably appear to those readers of the *Times Trade Supplement* who have no special knowledge of the subject as a thoroughly practical proposition, and, therefore, the writer would like, as a telegraphist and electrician who has for many years been occupied in the working, laying, and repairing of long submarine cables—to direct attention to certain important difficulties which, in his opinion, would prevent the success of the scheme in question being realised as fully as Mr. Preece anticipates.

As several of the criticisms refer to the practicability of the system, the writer has given the proposed cable girdle scheme in the form of a *graph* (fig. 1), which enables one to appreciate at a glance the cable circuits and working routines, the details of which, without it, it is difficult to keep in the mind's eye.

"It would consist of a submarine cable starting from Nova Scotia, touching at Cornwall, West Africa, South Africa, Mauritius or Rodriguez, Western Australia, the East Coast of Australia or Tasmania, New Zealand, Fiji, Fanning Island and Vancouver. A separate cable would connect India and Mauritius, and a land-line across Canada would complete the ring from Vancouver to Nova Scotia."

As the landing points of the cables in the several countries

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Press News.—Six countries. Duplex working, 50 w.p.m. each way.

Routine.	Through girdle.	Intervening relays.	Terminal stations send words.		Working duplex words.	
(1)	*England—Canada ...	8	10,000 in $3\frac{1}{2}$	=	20,000 in $3\frac{1}{2}$	hours
(2)	†S. Africa—India	10	10,000 „	=	20,000 in $3\frac{1}{2}$	„
(3)	*Australia—N. Zealand ...	8	10,000 „	=	20,000 in $3\frac{1}{2}$	„
					60,000 in $10\frac{1}{2}$	„

Routines (1) (2) (3) are worked in succession for $3\frac{1}{2}$ hours each.

Each country of the ring receives 50,000 in $10\frac{1}{2}$ „

Government and Private Messages.—Six countries, duplex working, 50 w.p.m. each way.

Routine.	Direct circuit between	Relays.	Each end of circuit sends.		Working duplex, words.		
(4)	England and Canada	1	10,000 in $3\frac{1}{2}$	=	20,000 in $3\frac{1}{2}$	hours	This Routine (4) is worked concurrently with Routines (1) (2) (3).
	†S. Africa „ India	1	10,000 in $3\frac{1}{2}$	=	20,000 in $3\frac{1}{2}$	„	
	Australia „ N. Zealand	1	10,000 in $3\frac{1}{2}$	=	20,000 in $3\frac{1}{2}$	„	
				=	60,000	$10\frac{1}{2}$ „	
						$1\frac{1}{2}$ „	allowed for corrections, delays, and for daily testing.
						12 „	

Government and Private Messages.—Six countries.

Routine.	Circuits.	Relays.	Words.	
(5)	Canada sends to England	1	12,000 in 2	hours
	England „ S. Africa	1	12,000 in 2	„
	†S. Africa „ India	1	12,000 in 2	„
	†India „ Australia	1	12,000 in 2	„
	Australia „ N. Zealand	1	12,000 in 2	„
	N. Zealand „ Canada	2	12,000 in 2	„
			72,000 in 2	„

All six circuits working simultaneously.

Government and Private Messages.—First three countries, working duplex, 50 w.p.m.

Routine.		Relays in circuit.	Each country sends.	Hours.		Words.	
(6)	§England—India ...	3	12,000	in 2	=	24,000 in 2	hours
	§India—N. Zealand...	3	12,000	in 2	=	24,000 in 2	„
	N. Zealand—England	4	12,000	in 2	=	24,000 in 2	„
				Total	=	72,000 in 2	„

These three circuits worked simultaneously.

Second three countries, working duplex, 50 w.p.m.

			Hours.		Words.	Hours.	
(7)	Canada—S. Africa ...	3	12,000 in 2	=	24,000 in 2	„	These three circuits worked simultaneously.
	‖S. Africa—Australia...	1	12,000 in 2	=	24,000 in 2	„	
	Australia—Canada ...	4	12,000 in 2	=	24,000 in 2	„	
				Total =	72,000 in 2	„	

Government and Private Messages.—Six countries working: Two routes available.

		Relays in circuit.	Route 1.		Route 2.			
(8)	¶ England—Australia...	6 : 3	12,000	+	12,000	=	24,000 in 2	hours
(9)	** Canada—India ...	5 : 6	12,000	+	12,000	=	24,000 in 2	„
(10)	¶ N. Zealand—S. Africa	6 : 3	12,000	+	12,000	=	24,000 in 2	„
			36,000	+	36,000	=	72,000 in 6	„

Routines (8) (9) (10) are worked in succession for two hours each.

		Words.	
Government and private messages	sent through the cable girdle in 12 hours	60,000	276,000 words.
		72,000	69,000, *i.e.*, 25 %
		72,000	
		72,000	207,000
Press words	„ „ in $10\frac{1}{2}$ „ = 60,000; and 50,000 received by each station.		

* As the single cable to India does not form part of the ring, it apparently can only be worked as a T-piece; so how is India to participate in the Press words coming from both end stations of the girdle at the same time?

† Mauritius can put India through to W. Australia and free end of cable to S. Africa, so that India can send Press messages through the ring; but India cannot work at the same time directly with S. Africa, as required by Routine (4).

How is the single India cable to communicate private messages (duplex)?

‡ With S. Africa and at the same time with Australia?

§ With England and at the same time with N. Zealand?

‖ Apparently the India cable must be detached at Mauritius:

¶ { England can work with Australia *via* New Zealand, / New Zealand can work with S. Africa *via* Canada, } but the India cable should be detached at Mauritius to render working by the reverse route practicable.

** Apparently India and Canada are expected to communicate through both routes using only a single cable between India and Mauritius.

are not stated, the lengths given on the graph by the writer are in most cases the direct cable plus 10 per cent. for slack; and as they together very closely approximate the 27,000 miles of cable mentioned, they will enable the reader to appreciate the lengths to be worked through.

(To be continued.)

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TRADE OF AUSTRALIA.

The Department of Overseas Trade has issued a report (Cd. 9,160—Price 3d.) on the Trade of Australia, prepared by H.M. Trade Commissioner in the Commonwealth. The following extracts will be of interest to the electrical and allied trades:—

Hydro-Electric Developments.—The Hydro-Electric Department of the Tasmanian Government continues to develop its undertaking, and in addition to supplying the municipal tramways at Hobart, as well as light and a certain amount of power to other users, power is being supplied to a company engaged in the extraction of metallic zinc from concentrates by the electrolytic process, as well as to a concern manufacturing carbide of calcium. Projected developments include the supply of power to a woollen mill, and to certain industries near Launceston. The demand for power appears to be in excess of the supply, owing to the difficulty experienced in getting delivery of the necessary plant. The Hydro-Electric Department has in view the development of further sources of power in the Island State, in conjunction with an irrigation scheme for intense cultivation, and one may safely predict that the activities of the Department will have a far-reaching effect on its future.

Development of Brown Coal Deposits.—In Victoria the Government has been investigating the possibility of developing the immense deposits of brown coal situated at Morwell, and other places in this State, while a local group is endeavouring to obtain from the Government a lease of certain water powers. In the Report of the Advisory Committee appointed by the Victorian Government to investigate the possibilities of brown coal, it is stated that the power generated in the Metropolitan power houses in 1908 amounted to 14,000,000 units, and that by the year 1917 this total had grown to 72,000,000 units, the average increase per annum being 20 per cent. The report adds that, assuming this rate of increase to be maintained, and allowing for the conversion to electrical traction of the cable tramways in Melbourne, it is estimated that the requirements in the year 1921 will amount to 163,000,000 units, with a maximum demand for 46,580 kw., and in the year 1925 to 341,500,000 units, with a maximum demand of 97,500 kw.

Changes in Import Trade.—A review of the figures relative to the imports of machinery suggests that, when all the circumstances are had in view, the trade has been well maintained during 1916-17. As is, perhaps, natural, there has been complaint as to delay in delivery of plant for public works and factories, with the consequent postponement of completion of the work, but, generally speaking, the position is recognised and accepted as inevitable in the circumstances. There has been a marked decline in the import of steam plant generally, particularly in that of locomotives. The practice of the Railway Commissioners in the various States is either to place orders, if possible, for locomotives with one of the several firms of local builders, or to build them in their own shops. At present, boiler plates, wheels and axles, and many other items entering into the construction of a locomotive are imported, but it seems likely that, in a future not distant, many of these parts will be made in Australia. There has also been a considerable falling-off in the imports of gas and oil engines. Many of the latter, particularly of the smaller kerosene type used on farms, are manufactured in Australia, in some cases by quite small firms. As a result, the absence of standardisation is apparent.

The market for electrical machinery and equipment of every kind is important, and certain to grow rapidly. Various schemes for the production and transmission of electrical energy are under consideration at present, but are held up owing to the war. As has been pointed out in previous reports, the United Kingdom's chief competitor in this trade is the United States, although Italy and Sweden also contribute. As regards appliances, other than machinery, Japan has made rapid progress. Recently, a Japanese firm introduced a wire-covered cable with a label attached to the coil bearing the letters "C.M.A.," the obvious inference by the uninitiated being that the firm is a member of the Cable Makers' Association. As the result of representations made by H.M. Trade Commissioner to the Department of Customs, it has been decided to regard the letters "C.M.A." or the word "Association," when unqualified, as indicating that the manufacturer of the goods is associated with the British Cable Makers' Association, and that the goods have been manufactured in accordance with the specification of that Association. It has also been decided that statements such as "Guaranteed equal in all respects to C.M.A. product of similar grade" may be used on wires and cables manufactured by non-members of the Cable Makers' Association provided that the goods are thereby correctly described. The latter part of this somewhat important decision appears to throw on the Customs Department the obligation of seeing that the goods are correctly described.

The decline in the imports of mining machinery is explained to some extent by the conditions of the industry, and by the fact that much of the mining equipment throughout the country, other than electrical, is manufactured locally. The winding engines and pumping plant on some of the mines are of local manufacture, while at Broken Hill, jigs, concentrating tables embodying the features of well-known tables of overseas origin, and tube mills, formerly made by Krupp, of Essen, are all made locally. Roll shells used in the reduction of zinc-lead ores, formerly imported from the United Kingdom and Germany, are now also made at Melbourne and Sydney. American manufacturers retain their supremacy in rock drills and coal-cutting machinery, and such competition as there is from the United Kingdom is not pronounced. Mine managers at Broken Hill state that, so far as they are aware, there is no British-made drill sharpening machine on the market.

Considerable quantities of machinery will be required almost immediately by the Electrolytic Zinc Co. of Australia, Ltd. (Risdon, near Hobart), as it is known that its successful treatment of zinciferous ores will bring in its train quite a number of subsidiary industries. The Mount Lyell Mining & Railway Co., Ltd., is also completing large works on the West Coast of Tasmania for the electrolytic treatment of its ores, and will be a large buyer of machinery for use in these directions. Similar operations also are contemplated by the Refractory Ores, Ltd., Hobart.

Local Industries.—With regard to the progress of the steel industry at Newcastle, N.S.W., which is being developed under the direction of the Broken Hill Proprietary Co., Ltd., until recently the output of these important works was largely confined to steel rails and structural material, but merchant bars are now being turned out, while a continuous rod mill imported from the United States has been erected for rolling wire rods, from which fencing and other wires will be drawn. An additional blast furnace, which will double the output of the works, has been installed, as well as a steel foundry where all the heavy castings for the new plant can be made. The equipment for producing plate for shipbuilding has been completed, and, in the opinion of the directors of the company, it should now be possible to build steamers in Australia constructed entirely of material manufactured in the Commonwealth.

At Lithgow, N.S.W., there is another firm turning out pig-iron, merchant bars, railway material, as well as pipes and tubes. A Newcastle engineering firm has recently designed and constructed an electrically-driven three-high mill for rolling merchant bars, and it is stated that the mill is running satisfactorily. The Australian Electric Steel Co., Ltd., too, is installing its second electric furnace at its works at Alexandria, near Sydney, and in view of the demand for its products, contemplates a similar installation in Western Australia in order to supply material for the mining industry. It is also proposed to erect an electric furnace in Melbourne. A firm at Castlemaine, Victoria, has taken up the manufacture of semi-Diesel crude-oil engines of the Skandia type, while oil-driven tractors for agricultural work are being manufactured by two Melbourne firms. Further, the Castlemaine firm recently completed an order for the Public Works Department of Victoria for four sets of triple-expansion marine engines and auxiliaries, with a total capacity of 1,200 i.h.p. The same firm is manufacturing electric motors up to 50 h.p.

A company, with which copper-producing interests are identified, is installing plant at Port Kembla, New South Wales, for the manufacture of copper sheet and wire.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

A few weeks ago the final tests on the great Quebec bridge were made; heavily loaded trains, weighing in all 7,000 tons, were run on to the centre of the bridge, which stood the test satisfactorily, so that at last this great structure can now be turned over to the Government as a completed work.

A United States Government report says that the present shortage of power at Niagara Falls amounts (presumably on the American side only) to about 200,000 h.p., which could be taken up at once by existing industries if it were available. The great steam-driven plant of the Buffalo General Electric Co. is to be enlarged, and, together with additional plant being installed by another company, 62,000 h.p. more will, it is expected, be available towards the end of the year. Increases in the generating capacity of some of the hydro-electric plants at Niagara Falls will provide about 160,000 h.p. more.

An American paper, *Engineering and Contracting*, has recently suggested that electric, gas and water meters might all be read at the same time by one meter reader, and the bills for all three services posted together in one envelope. An estimated saving over present methods of $5,000,000 is believed by this paper to be a conservative one as applied to the United States.

In England, where the Corporation of a town frequently owns all three undertakings, such an arrangement should not be difficult to make.

Reference was recently made in these notes to the application of the St. Lawrence River Power Co., before the International Joint Waterways Commission, for permission to build a submerged ice weir in that channel of the St. Lawrence River which lies south of Long Sault Island. The Canadian Government opposed the scheme, and sent two representatives to Washington to see if arrangements could

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not be made whereby the Governments of Canada and the United States should build the weir, and allow the company to have the use of it under licence; the deputation was unsuccessful, and the company has been given permission to build the weir, and use it for a period of five years, or the duration of the war, after which the matter must again be brought before the Commission referred to. The deciding factor in this case was the need for urgency on account of war requirements, as the company claimed that by having the weir they could generate more power during the winter months than is possible at present owing to the ice troubles which they experience, and that this would enable the Aluminium Co. of America to produce from six to seven million pounds more of aluminium per annum than they can under existing conditions.

The *Toronto Globe* argued a few days ago that the extra 10,000 or 15,000 H.P. said to be required could be furnished several times over by the Laurentide Co., or the Cedars Rapids Co., both of which are affiliated with the St. Lawrence River Power Co. This paper also publishes the following views of an hydraulic expert regarding the matter:—

"The St. Lawrence River Power Co.'s engineer stated that the dam and appurtenant works would cost $350,000. Assuming that the penstocks, turbines, and dynamos for the 114,000 H.P. made available by these works cost $1,500,000, the total cost would be $1,850,000, or a capital cost of about $16 per H.P., as compared with upwards of $75 per H.P. at that specifically favoured power site, Niagara Falls. It is a fair assumption that power is as valuable to the Aluminium Co. at Massena (New York) as at Niagara. If this be correct, and if the St. Lawrence River Co. is permitted to keep its dam at the South Sault, it has been presented with a free gift of about $6,750,000, plus whatever 114,000 H.P. is worth at Niagara. It is not an unfair assumption that the St. Lawrence Co. will make a profit of 5 cents per lb. on its aluminium. On this assumption, the product from this 114,000 H.P. will yield a profit of over $2,500,000 per annum."

The tunnel of the Canadian Railway Co. through Mount Royal at Montreal was opened a few days ago; trains are run through the tunnel by electric locomotives. Tenders are being called for by the Hydro-Electric Power Commission of Ontario on four water turbines with generators. These turbines are to be of the enormous size of 52,500 H.P. each, to be operated under a net effective head of 305 ft. at a speed of 187.5 R.P.M.; the best efficiency is to be available at 47,000 H.P., as it is expected that the turbines will normally be working at about that load. Each generator will be three-phase, 25-cycle, 12,000 volts, 43,900 K.V.A., 85 per cent. power factor; they must be capable of operating in parallel.

These huge units are intended as the first instalment of plant for the Commission's development of 300,000 H.P. at Niagara Falls. The generating station will be on the Canadian side of the Niagara River, about a mile below Queenston, but the water will be brought from beyond the Falls along the Chippewa Canal, about 13 miles in length, which is now under construction. It is unfortunate that British engineers cannot gain the necessary experience in the manufacture and operation of great hydraulic units such as those referred to, to enable them to tender for anything of that kind.

The Hydro-Electric Power Commission is also constructing a 13½-ft. pipe line in Queen Victoria Park to supply additional water to the generating plant of the Ontario Power Co.; by this means it will be possible to obtain 50,000 additional H.P. The work was only started this summer, and has been rushed as much as possible; it is expected that it will be ready about October 23rd, and, if so, it will be a great boon to South-Western Ontario, as there is a serious shortage of power in that region.

It appears that the Fuel Controller has made a demand on the City of Montreal that it should save 30,000 tons of coal this winter, and in order that this may be done the question of driving half the municipal waterworks pumping plant by electricity is being looked into.

Toronto, London, and other centres are having electric power shut off from various districts for an hour or two every day, particularly in residential parts, so that munitions factories may be kept running; all the sign and window lighting which was cut off last winter still remains off, and about half the street lights have been cut off also.

There will be a serious coal shortage in Canada this year; the supplies from the United States have been cut down appreciably by the U.S. Fuel Controller, and owing to difficulties of transportation, reduced output from the mines, and other causes, even the quantity that has been allowed is not coming in as it should. What this means in a country like this, where the temperature, even in a large city like Toronto, which is nearly as far south as Rome, can drop, as it did last winter, to 25 deg. below zero Fahrenheit, can hardly be imagined by people at home in England, who have never tried it. In many places there are hundreds, and in some cases thousands, of homes which have no coal in at all yet, and have no idea when they will get any. Under these circumstances it is not surprising that the firms manufacturing electric heaters are—well, busy, is a very mild word. Though a 1,000 or 1,500-watt heater, even in a small room, is not much use during a Canadian winter, it must be better than nothing, and may at least help to eke out a meagre coal supply.

NEW BRITISH AND KEY INDUSTRIES EXHIBITION.

(*Concluded from page* 384.)

All who are concerned with the development and improvements which have been effected by British makers in the manufacture of magnetos, and in the success which has been attained in establishing the magneto industry in Great Britain, will have been interested in seeing the display that was arranged by the British Ignition Apparatus Association. The exhibit included a complete range of magnetos for every purpose made by the British L. M. Ericsson Co., Ltd., Beeston, the British Thomson-Houston Co., Ltd., Coventry; E.I.C. Magnetos, Ltd., Birmingham; the M-L Magneto Syndicate, Ltd., Coventry; North & Sons, Ltd., Watford; Thomson-Bennett Magnetos, Ltd., Birmingham; and C. A. Vandervell & Co., Ltd., Acton. In addition, there were interesting groups of components furnished by the B.T.H. Co. and Messrs. North, as well as a set of vulcanite mouldings in various processes of manufacture by the latter firm. There was also a display of mica used in the manufacture of magnetos, and on other stands were displays of ferro-tungsten steel used for magnetos, insulating materials, &c. Messrs. Jas. Neill & Co. and Messrs. J. J. Saville & Co., Ltd., both of Sheffield, were showing specimens of permanent magnets of special interest to makers of magnetos.

The London Electric Wire Co. & Smiths, Ltd., Playhouse Yard, Golden Lane, E.C., had on view primary and secondary, H.C. copper, enamelled wire for magnetos and aircraft engines. The samples shown were of 0.08, 0.10, 0.11, 0.12, and 0.7 mm. diameter.

Messrs. Cookson & Co., Ltd., Newcastle-on-Tyne and London, were the only firm exhibiting lead and antimony. The lead was either pure and soft, for manufacturing sheet lead, lead pipes, and lead oxides, or hard, containing up to 15 per cent. of antimony for the manufacture of bullets and of accumulator grids; of course, the lead peroxide electrodes require pure lead. The antimony has a purity of 99 per cent.; the exhibits included antimony ores, oxides, and compounds. A fine display of lead oxides (red and orange) was made at King's College by this firm.

Messrs. Cuthbert Andrews, 47, Red Lion Street, High Holborn, W.C., exhibited X-ray apparatus showing the use of tungsten in target tubes. Various types of British-made X-ray tubes were shown, including a water-cooled model for use in any position, together with protective appliances such as rubber gloves, goggles, and masks.

The General Electric Co., Ltd., 67, Queen Victoria Street, E.C.—This firm's exhibits included many types, shapes, and sizes of incandescent electric lamps and parts. An "Osram Atmos" lamp filled with argon gas was also shown. Vacuum jacketed flasks, specimens of ebonite and carbons for searchlights, arc lamps, magazine flame lamps, &c., were also to be seen, and photographs of the works showing the processes of manufacture.

The British Ebonite Co., Ltd., 16, Victoria Street, S.W., was showing samples of raw rubber and sulphur, of which ebonite is composed. Samples were on view showing the use of ebonite in accumulator cases, electrical fittings, medical bottles, and in various other ways.

The British Thomson-Houston Co., Ltd., Rugby, and 83, Cannon Street, E.C.—This firm's show-case contained a Coolidge X-ray tube and a large variety of the firm's well-known types of incandescent electric lamps, with tungsten filaments. Types of magnetos for multi-cylinder engines were also shown, and a magneto distributor with the material of which it is made, showing the evolution of a distributor made of moulded insulating materials. Photographs illustrating the assembling of magnetos were also exhibited.

The Morgan Crucible Co., Ltd., Battersea Works, Church Road, S.W.—Amongst these exhibits were crucibles for melting steel, brass, bronze, and metal alloys, as well as foundry facings, a selection of carbon brushes, and lubricants. A chart showing the various uses to which graphite is applied was also shown. Some of the graphite crucibles of various shapes and sizes up to nearly 5 ft. on view are for direct electric heating, the crucible serving both as container and resistor. The one shown is of vase shape, and is provided with suitable extension pieces both at the top and bottom; these pieces are encircled by the ring electrodes through which the cooling water circulates. A small crucible of the form shown would take 150 lb. of metal, but crucibles for charges up to 1,000 lb. have been made. In the tubular crucibles the ring electrodes are placed round the thickened extremities of the tube; such crucibles are used also for the reduction of oxides and gas reactions.

An important application of tungsten is for the production of tungsten steel employed in the construction of magnets for aeroplane magnetos and high-speed tools. A less known, but equally important, application illustrated at the exhibition was as a substitute for platinum and its alloys. In wireless telegraph instruments, magnetos, and various electrical appliances, tungsten parts are used, it is stated, at one-tenth the cost of platinum with even better technical results. Combined with sodium, tungsten compounds are largely employed for impregnating fibres to render them fireproof, and as a mordant in dyeing. Messrs. Duram, Ltd., Thanet House,

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231, Strand, W.C., were one of several firms exhibiting specimens of tungsten ore and molybdenum ore, with specimens of finished and partly finished products of these metals, showing the various stages through which they pass.

The exhibition was due to close on October 22nd, but at the request of the Board of Trade it remained open until yesterday, to enable the Greek Minister of Agriculture and the influential party representing Greek commercial interests, which is now touring the leading industrial centres of the United Kingdom, to pay it a visit.

On Wednesday afternoon, last week, Mr. W. M. Hughes, Prime Minister of Australia, delivered an address, in which he said the exhibition should bring home to the people of this country how near we had been to handing over the possession of the raw materials of the Empire to the enemy. He advocated no economic war, but with our friends we would be friends, and enemies with our enemies till they had paid the full penalty for their crimes.

The exhibition was well patronised by the public, the daily attendance averaging about 5,000 visitors.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Technical Publicity.

Mr. Birkett's homilectical remarks in the article appearing last week are very pertinent, and deserve, if not to be "read, learnt, and inwardly digested," at least to be duly cogitated upon.

Mr. Birkett's remarks ought certainly to carry weight, as he is specially qualified to speak on this matter of advertising, as he has viewed it all round in rote, as buyer, seller, manufacturer, and sympathetic onlooker, and, too, with artistic qualifications, though these, as becomes an engineer, he discreetly submerges.

But the point in his article I should like to support is his suggestion as to the newer publicity taking the form of distributing the latest information. It certainly seems regrettable that so little is at present to be gained in turning over the pages of usual technical advertisements. Mr. Birkett's suggestion that "information" should be conveyed through the advertisement columns of the trade journals, would, if adopted, relieve the aridity of these pages, and in some measure at least, stimulate an interest in the firm, thus relieving the monotony, a first step, even if a small one (according to advertising psychology), towards the conversion of the reader into a buyer.

T. W. Cole.

London, S.W., *October 16th*, 1918.

I have read with pleasure the interesting articles and correspondence published in the last three issues of the ELECTRICAL REVIEW, and hope you will kindly insert the following remarks with regard to advertising in foreign countries:—

It is evident that if a business man is interested at all in foreign markets, he cannot afford to entrust his translations to persons whose knowledge of the required language is at best general, and who have to hunt up the technicalities in dictionaries. Dictionaries, like explosives, must be handled with judgment. A word may be rendered in different ways, and if the translator is ignorant of the subject, the expression that *seems* correct to him may be quite misleading to others. Hundreds of translators are every day writing "voltage," "ohm," "dynamo," "booster," "balancer," &c., who would be quite nonplussed if they were asked to tell, for instance, the difference between "ohm" and "volt." They are in bondage to the dictionary. Men under such bondage cannot depart one comma from the text. They cannot frame successful appeals.

It is well to remember that psychology also counts. It is wrong to assume that even a verbally correct translation constitutes a good piece of advertising. Take, for instance, the Latin-American buyer. He is a rapid, nervous type of man. "He thinks in flashes." He hates detail. Illustrations followed by terse explanations of salient features will be sure to interest and please him.

If any of my readers has a Latin-American friend, let him watch him while he is buying. Perhaps it is a new tie. The style and colour appeal to him. He does not want to hear the salesman expatiate upon the beauty and choiceness of his wares. Neither does he want to haggle over the price. He wants to pay, and perhaps wear his tie on the spot! Englishmen are less impulsive buyers. They take time to "think it over." They are interested in the details, and like as much information as they can possibly secure. They are of a more "philosophical" type.

Thus, successful translation involves adaptation of what appeals to one type of buyer so that it may appeal with equal force to a different type of buyer.

Maximiliano Attias.

London, W.C. 2, *October 18th*, 1918.

The Coal Crisis.

It is now universally realised among business men that only the most rigid economy on the part of all users of coal will stave off a perhaps serious shortage, which shortage, of course, would affect public utility undertakings.

The section which least realises the importance of economy is perhaps the public, and the Coal Controller is doing all he can to drive the truth home. In order to assist in this endeavour, my committee is asking its member companies to help in the distribution of a circular on coal economy, got out by the Coal Controller. They would enclose this with their correspondence, accounts, &c., and the batch of circulars would be delivered post free to the undertakings.

As every little helps, I put forward as a suggestion that other sections of the supply industry might perhaps offer similar assistance.

T. W. Cole,
Secretary,
The Provincial Electric Supply Committee of the United Kingdom.

London, E.C., *October 22nd*, 1918.

Commercial Bribery.

You state that German firms were most strict in regard to bribery at home, though they never hesitated to employ corruption to any extent outside the Fatherland.

This is borne out by the fact that influential Germans, as usual quick to copy others, formed an anti-bribery association on the lines of this League—we had a conference in Berlin in 1912!—and in a short space of time this had a huge membership, and instituted a large number of prosecutions.

The Secretary,
Bribery and Secret Commissions Prevention League, Inc.

London, E.C. 4, *October 16th*, 1918.

Foreign Competition.

A great public service was rendered by the secretary of the C.M.A. by publishing in the REVIEW of September 13th the cutting from another paper, of an article with reference to Falk, Stadelmann & Co., headed, "How to Become British."

From Mr. Asquith's statement recently, affirming still his adherence to Free Trade, we appear to have little hope of Government assistance in protecting our vital industry from after-war foreign competition, and few trades have suffered more in the past, as you know, than ours.

Cannot you, Sir, supplement this letter by publishing in the REVIEW a complete list of all electrical firms supported by foreign capital still in existence in this country? In view of the prospects of an early peace, such information would be of the greatest value to hundreds of your readers, and presumably it would be difficult, if not impossible, to publish such a statement after peace is declared.

J. Farr.
(*J. Farr & Co., Ltd.*)

Nottingham, *October 20th*, 1918.

[A printed official list of enemy businesses ordered to be wound up is obtainable from H.M. Stationery Office. Inquiries respecting businesses concerning which correspondents are in doubt should be addressed to the Department of the Board of Trade dealing with the matter. The policy of the Board has been settled by Acts of Parliament, and it is for the Board to decide whether or not a business may be continued. As already stated, we cannot undertake a detailed investigation and analysis of all the firms connected with the industry, nor is the trustworthy information at our command sufficient for such a purpose. We would suggest that our correspondent, and others who have made similar proposals, should avail themselves of the information which their trade associations have facilities for collecting.—EDS. ELEC. REV.].

The Electrical Power Engineers' Association.

While I feel that the columns of your journal need not have been used by Mr. Vincent to communicate with me, I will answer briefly the queries of his letter in your last issue, and will be glad to reply to him further if he will communicate with me, as under:—

1. Yes.

2. By the staff engineers engaged in the generation and distribution of electricity throughout the United Kingdom.

3 and 4. As a protective association to safeguard the interests of staff engineers in this section of the electrical industry.

While we regret its misgivings, we venture to disagree with the Marylebone branch of the Union of which Mr. Vincent is secretary.

Staff engineers cannot admit that their interests would be adequately protected by his Union, or his rival unions, in the same way that a medical man would feel averse to leaving his professional concerns to the chemist or to the competent man who drives his car.

W. Arthur Jones,
Hon. Sec., E.P.E.A.

37, Wallwood Road, Leytonstone, E. 11.
October 21st, 1918.

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The Bonus System as Applied to Sub-Stations.

We hear from time to time of the bonus system being successfully applied to large power stations, but very little has been said as to the possibility of applying it to sub-stations, although in most large power stations every unit which they generate has to pass through a sub before it is finally distributed.

The bonus system applied to car driving has just resulted in the drivers and conductors on the L.C.C. tramways receiving their first allocation.

At first sight, it would appear that there was very little scope for the saving of power in a sub, but on further reflection, one comes to the conclusion that those in charge of a sub can materially affect the efficiency in the ratio of their success in the manipulation of the plant.

The efficiency may be raised either by reducing the "machine hours," or by reducing the "station hours," the latter reduction being obtained by interlinking with other stations, at light loads.

To reduce the machine hours, a careful watch of the load is necessary, so that machines can be started up or switched out to meet the varying demands.

The type and capacity of the machines have a certain influence on the result. For instance, where it be possible a rotary converter should be run, instead of a motor-generator of similar capacity, when the load is a light one. A careless operator may leave a machine running much longer than necessary, through having his attention diverted to something other than his recognised duties.

If two curves were plotted, one giving the capacity of the running machines, and the other the units generated as registered on the integrating wattmeter, say, every quarter of an hour, one would at once see where it would be possible to economise. For the basis of calculation, the combined mean efficiency of all the sub-stations over a certain equivalent period could be used.

During these times, when it is so important to save every ounce of coal, the application of the bonus system to sub-stations is worthy of consideration, and would result in a substantial gain to the employé, employer, and country.

F. W. T.

October 19th, 1918.

"Fraternity"—or Tyranny?

I have been a constant reader of the Electrical Review now for more years than I care to remember, but certainly think the current week's issue the best number that up to date has seen the light. But it is putting a great strain upon your readers to have to search from page to page for the fun and jokes, and would respectfully suggest you have a separate page on the same lines as all first-class journals and periodicals—The Women's Page, by Dolly Daydream; The Cosy Corner, by Lady Cornelius Vere de Vere; Knotty Brain Waves, by Professor Horatio Bottomley, &c., &c., and place same under the directorship of Mr. J. Shaw. A page with the following articles would draw the crowd: "Why an ardent Trade Unionist employs Non-Unionists," by J. "Gilbertian" Shaw; "Causes and Leaders" (lost and otherwise), by the Editor; "How they got into the Wrong Room," by Sir G. Gibb; "The Mutterings, Utterings and Writings of the Kaiser," by Wilhelm; "How we Wound up the A.E.S.E.," by W. J. Ebben; "Amalgamation, Past, Present, and Future," by W. Arthur Jones; "How we got Something for Nothing," by Members of the E.P.E.A.; "Advice," by C. H. Wordingham.

Paper may be very scarce and also dear, but for goodness sake, Mr. Editor, please put in all that Mr. Shaw sends you. Good laughs these times are worth anything.

Mr. Shaw's letter I certainly shall not attempt to answer (not believing in painting the lily), except to sincerely trust he will not carry out his threat of reporting me to *John Bull;* if he does that, I am for ever damned.

Your leaderette, Mr. Editor, deserves a few remarks, however. The feeling that exists between the Electrical Trades Union and the E.P.E.A. will, I am afraid, continue to exist as long as the objects of the E.P.E.A. are as stated by Mr. Atkinson before Sir George Gibb. He said, "We came here on the invitation of certain representatives of *this side* (the employers' side), to contest the claim of the Electrical Trades Union to represent the staff engineers." My only remark is, that is the sort of statement one would expect to be made by the representative of a "trade union" such as the E.P.E.A.

One paragraph of your leaderette reads as follows: "The threat of the E.T.U. secretary, therefore, is utterly indefensible and unworthy of a free man, and will do far more harm to his own cause than to that of the E.P.E.A." But I though, Mr. Editor, the causes of all trade unions were the same, at any rate the cause of the Electrical Trade Union is the uplifting and bettering the material conditions of the workers in the electrical industry, and we are doing it fairly successfully. For confirmation, ask any member of the E.P.E.A. what the cause is, and why the cause for the E.P.E.A., should be stated by a member of that body; personally fear the law of libel.

Feel sure, Mr. Editor, that now you have drawn the attention of the members of the E.T.U. to their poor leader, I shall be getting the sack, and shall have to apply for employment to Mr. Shaw.

Whether the letter I sent one of our renegades was justified is a matter of opinion, whether the purport of it will be carried out is—well, wait and see.

W. J. Webb.

London, E.C. 1, *October 21st*, 1918.

[We think that Mr. Webb's objection to the remark attributed to Mr. Atkinson is well taken; but we do not agree that he is right in adopting that one remark as a criterion of the objects of the E.P.E.A., which have been fully set forth in our pages (see June 7th, 1918, p. 544), and which do not contain a single feature to which the E.T.U. could take exception, so far as we can see.

As regards our own remarks, Mr. Webb begs the question; we said his threat was "utterly indefensible and unworthy of a free man," and that is true; we are not concerned to argue about the causes of trade unions or any other red herring that he may drag across the track—to deprive, or endeavour to deprive, a fellow-citizen of his means of livelihood, on any pretext whatever, is a criminal act.—Eds. Elec. Rev.]

I think the enclosed letter is a sufficient answer to W. A. Jones, General Secretary, E.P.E.A., on "Fraternity"—or Tyranny? in your issue of October 11th.

R. Wadman,
Fulham Branch E.T.U.

London, S.W. 6, *October 16th*, 1918.

From the *Electrical Trades Journal*, September, 1918:—

The following is a copy of a most illuminating letter and throws considerable light on the means that are being adopted in certain quarters to discredit the E.T.U.:—

[COPY.]

Beechgrove, Ridgeway Road,
Redhill, Surrey,
June 24th, 1918.

John Whitehead, Esq.,
Admiralty Hostel,
63, Hamilton Square, Birkenhead.

My Dear Sir,—The secretary has handed me your letter of the 22nd inst., but, unfortunately, it has come into my hands too late for my reply to reach you by the time you named. I would reply to your questions as follows:—

1. On no account whatever join the E.T.U. By doing so you declare yourself to be a workman instead of an engineer.
2. You are under no obligation to join the E.T.U., though I suppose individual employers have a right to say they will only employ union men.
3. Joining the E.T.U. will not affect your membership of the Institution, though it is most undesirable that members should so lower their status.
4. A member of the I.E.E. *can* be a member of the E.T.U.

Under existing conditions it is most desirable for every worker to belong to a protective organisation, and the I.E.E. is at present busily engaged in seeing to it that such an organisation suited to the standing of its members is available. At the present moment I should strongly advise you at once to join the Electrical Power Engineers' Association, if they consider you eligible; if not, they will hand you over to a similar organisation dealing with manufacturers' staffs. Either of these associations you can join without loss of status and be as well protected and recognised as an organised worker as if you were in the E.T.U. If I can assist you with any further advice do not hesitate to let me know.

Yours truly,
(Signed) C. H. Wordingham,
President, Institution of Electrical Engineers.

WAR ITEMS.

Exports to China.—A further list of those in China to whom exports may be consigned appears in the *London Gazette* for October 18th.

Trading with the Enemy.—The "London Gazette" for October 18th contains further lists of persons and bodies in the following countries with whom trading is prohibited:—Cuba, Netherlands, Netherlands East Indies, Fernando Po, Spain, Sweden, and Venezuela.

The £5 Minimum Claim.—The award of the Committee on Production on the demand for a minimum rate of £5 a week for shipwrights in the Clyde, Barrow, Aberdeen, Dundee, and Leith districts has been issued, and the men's claim is not conceded. It appears to the committee that any award made at the present juncture would be to the prejudice of an independent and impartial hearing of the case with respect to the whole shipbuilding trade by the committee, which was fixed for October 24th.

Tramway Workers' Wages, &c.—According to the Manchester *Daily Dispatch*, the tramway workers throughout the country have put in still another application for an increase of pay. This is for the bonus of the men to be extended from 25s. to 35s., and that for women from 18s. to 35s. Half the bonus is asked for on behalf of boys and girls under 18. The agitation is part of the scheme for obtaining equal pay for women as for men where the same work is performed.

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When the War Ends: Munitions Contracts.—In the House of Commons last week, according to the *Times*, Mr. G. Terrell asked whether, in view of the possibility of an early peace, any committee had been appointed with authority to wind up contracts for the manufacture of munitions of war and to award compensation, and what arrangements had been made to find employment for workpeople now engaged on war work in munition factories. In reply Mr. Bonar Law said that these matters had been long under the consideration of the Government, but it was not possible at present to make a statement about them.

National Industrial Unity after the War.—Writing in the Manchester *Daily Dispatch* on "Affluence or Poverty After the War," Mr. H. Dubery, General Secretary of the Federation of Post Office Supervising Engineers, urges that for the few years following the war every means should be taken to create the best relationship between the progressive and broad-minded employer and the constructive and evolutionary trade unionist. "They must co-operate for the reconstruction of the social system on broad and sane lines. While retaining the weapons of the strike and the lock-out, they must be chary of using them. It is not enough to offer to the industrial world a machine such as Whitley Committees; nor will it improve matters if such machinery is put under the control, advice, or benevolent patronage of the bureaucrats of a Government department. This may be good as far as it goes, but the real need is a satisfactory atmosphere in which employers and workmen who put principle before profit, and national well-being in front of personal aggrandisement, can work together against all disruptive and enervating forces, whether they arise through a soulless bureaucracy, extremist agitation, or a brutal economic system. It is the duty of right-minded men and women in every walk of life to strive to attain in the near future this spirit of national unity."

The Demand for Manufactures after the War.—In the course of an article on "Munition Shops After the War," in the Manchester *Sunday Chronicle*, "Observer" predicts for this country an era of prosperity for at least twenty years, unknown in previous history. The writer gives the following reasons for his optimism:—

"All the world is starving for manufactured articles of all descriptions to be used in peaceful avocations. During the last four years the sole industry of the world, and particularly of this country, for instance, has been war. Coal, iron, steel, cotton, wool, chemicals, the basic materials of all industry—yea, even the land itself—have been used solely for the making of instruments of destruction, and every minute used, every ounce of energy expended, and every penny spent has been so much capital lost to the world. It will have to be made up, and made up by increased energy and production. Take as an example the electrical trade. Before the war Germany exported £15,000,000 worth of electrical plant and apparatus annually, England £5,000,000 (apart from telegraph material), America £5,000,000, Sweden £5,000,000, and Switzerland roughly £5,000,000, a total of £30,000,000. For four years these exports have ceased. This means that, without allowing for the increased demand for electrical plant, there is £120,000,000 worth of leeway to make up, not taking anything into account for the depreciation of the machinery already in existence, which has been working at full pressure the whole time. Not a single firm that is now making electrical stuff for the war will have to close down. On the contrary, if anything they will have considerably to extend their premises and engage more hands. No industry has been so much pushed along by the war as the electrical industry. We can as a result (and shall continue to) beat Germany. Those works now making electrical engines of all kinds for aeroplanes, motors, submarines, and cruisers will be able to make water turbines, steam turbines, generating plant, magnetos, motors, cables, and heating and cooking appliances. We can now make magnetos as good as the Germans, which we could not do before the war. I make bold to say, too, that every ordinary engineering shop in this country has sufficient orders on its books to provide work for at least 10 years."

The writer of the article considers that the standard of living of the working classes will not go down, but will indeed go higher and higher, and that wages instead of decreasing will increase!

Exemption Applications.—A tramcar conductor, in the employ of the Burnley Corporation, aged 43, was given exemption to the end of January.

At Kidderminster, on the appeal of the Tramway Co., exemption until March 31st was granted to E. Turner (38, Grade 1), foreman; J. Whitmore (31, Grade 2), motor man; and S. Edwards (24, Grade 3), general clerk.

The Bexley Heath Tribunal has granted six months' exemption to R. Dennett (35), motor man on the U.D.C. tramways.

At Oxford, Messrs. J. E. Elliott & Co., electrical engineers, appealed for their manager, C. J. Manley (50, Grade 1), and it was stated that all the three men were either employed by the Government or were in the Army. Three months were conceded.

At Broadstairs, the Isle of Thanet Tramway Co. appealed for a truck fitter, and it was stated that owing to business pressure he was putting in 80 hours per week. He was exempted and excused the Volunteer service.

St. Albans Tribunal has granted six months' exemption, subject to substitution, to J. W. Allen (45, Grade 2), electrical fitter with Messrs. Nicholson, Ltd.

LEGAL.

A.E.G. Electric Co., Ltd.

In the Chancery Division, on October 17th, Mr. Justice Younger made an order for the winding up, under the Trading with the Enemy (Amendment) Act, 1916, of A.E.G. Electric Co., Ltd., on a petition by the Board of Trade.

Mr. Austen-Cartmell said this was the last survivor of the group formed by the A.E.G., Berlin. There had been complicated arbitration proceedings with the Rio Tinto Co., and when the matter was before his Lordship last sittings it was thought by the company that an order for winding up might embarrass it in those proceedings. Now the points of fact had been dealt with by the Arbitrator and the points of law by the Official Referee, and their decisions had been given. So far as the arbitration was concerned, therefore, there could be no objection to the order he asked for.

His Lordship: Is there an appeal from that award?

Mr. Austen-Cartmell: Not yet. Counsel, continuing, said his Lordship on the former occasion was quite satisfied that the case was one in which a winding-up order should be made, and only allowed the matter to stand over on the application of the company's counsel, on the ground of possible embarrassment over the arbitration. The Board of Trade felt that, now that the decisions in the arbitration proceedings had been given, there would be no harm done to the company by a winding-up order. But he asked for two indulgences under the new Act—the appointment of the controller, who was seized of the whole matter, as liquidator, and to dispense with the meetings of creditors and contributories, and with the usual statement of affairs, under Sec. 152.

Mr. Stuart Bevan, who appeared for the Rio Tinto Co., said, apart from the question of the arbitration, the litigation between the company and his clients was not at an end. All that had to be found in these proceedings was what was the amount of damages to which the Rio Tinto Co. was entitled. But the Rio Tinto Co. was plaintiff in an action against the company, in which it was claiming a large sum of money.

Mr. Austen-Cartmell said it looked as though about £7,000 would eventually be found due to the Rio Tinto Co., and the winding-up order would not prejudice that. At the previous hearing, Mr. Conway was instructed by the company to express the view that a winding-up order before the award in the arbitration proceedings might conceivably embarrass it, and he (counsel) agreed.

His Lordship said he was not sure that the Rio Tinto would not be safer under a winding up.

Mr. Bateman, for the A.E.G. Electric Co., Ltd. said he had a list of salaries now being paid to employés of the company, at its request, and with the consent, of the Board of Trade. These would automatically cease upon the appointment of a liquidator. It was desired that these payments should be continued.

His Lordship said so long as the liquidator was satisfied that the funds in his hands were sufficient to meet all prior claims there would be no difficulty over that point.

Mr. Austen-Cartmell: There are large surplus assets in any case now, and there has been assent to this on the part of the German owners.

His Lordship said in the cases that had come before him there had been no reluctance on the part of the German owners to continue these payments under similar circumstances.

Eventually the Court made the order for the winding up of the A.E.G. Electric Co., Ltd., and gave the Rio Tinto Co. leave to continue its proceedings against the company.

In the King's Bench Divisional Court on October 22nd an application was made to extend the time for appeal in the matter of the arbitration proceedings between the A.E.G. Electric Co., Ltd., and the Rio Tinto Co., and the Court granted three weeks.

Elliston, Evans & Jackson, Ltd., *v.* Lynedocks Wood Turnery and Twisting Mills.

In the Shoreditch County Court, before his Honour Judge Cluer, plaintiffs, electrical and mechanical engineers, of 13, Cross Street, E.C., sued defendants, of Lynedock Street, Kingsland-road, wood sawyers and turners, to recover £16 for the supply of an electric motor for driving the machinery at the latter's saw mills. The defence was that the motor would not work, that the defendant had lost a considerable sum of money owing to his inability to use the machinery, and he did not consider he was called upon to pay for it. The plaintiffs said an electric motor was supplied costing £30, and the materials for fixing it £6. They had only received £20 on account.

Defendant: They tried to palm me off with a motor that will not go, putting me to a lot of expense.

Judge Cluer: That is no answer to the claim; you must counter-claim for any damage. Have you had the electric motor and do you owe for it, is all that is before the Court.

Defendant: Oh, yes, I had the motor, but I think I can prove that I have lost £25 in lost time, and thereby cannot pay for it.

Judge Cluer: That might or might not be the subject of a counter-claim, but it is no answer to this claim.

Defendant: It has taken me five months to put it right, and I have been losing money all the time.

Judge Cluer gave judgment for the plaintiffs for the amount claimed, and ordered it to be paid at £2 a month.

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BUSINESS NOTES.

Regulations Respecting Machine Tool Orders.—It is not generally understood that orders for machine tools for work, other than war work, may now be placed with manufacturers, merchants, and importers without submission to the Ministry of Munitions for approval. While the Ministry of Munitions has notified traders that they may place such orders on their books, they are not permitted to manufacture or supply until the present restrictions are withdrawn. For the time being, therefore, no machine tools may be manufactured except for the purpose of satisfying definite munitions orders approved by the Machine Tool Department of the Ministry of Munitions, or in accordance with manufacturing programmes also sanctioned by that Department.

The Minister of Munitions gives notice that all applications for a permit to purchase or enter into negotiations for the purchase of machine tools, power-driven wood-working machinery, or treadle lathes of 3-in. centres or over, suitable for use in cutting and working metal, or suitable for use in cutting, working, or operating on wood, under the above-mentioned orders, must be made to the Controller, Machine Tool Department (T.M.7), Ministry of Munitions, Charing Cross Buildings, Embankment, London, W.C. 2.

Australian Electrical Contracting.—We have received a copy of the annual report of the Electrical Traders' and Contractors' Association of Victoria. It shows that during the period ended April, 1918, the trade had been well maintained, in spite of the war. Restriction of imports from Great Britain, &c., caused serious misgivings early in the year, but the means for maintaining the industry had been, in a small measure, due to the large importations of electric wiring accessories from Japan. As a temporary source of relief this had been greatly appreciated, but it was to be hoped that, after Peace had been declared, the true British spirit would cause them to give every consideration to the Mother Country in the Commercial struggle. The war had strengthened and developed in Australia the manufacture of electrical apparatus and some lines of accessories. They hoped that this would not be a passing change, but would continue to be developed in the interests of those firms who had come forward to fill the gaps. The Association wished these new industries every success, and hoped that they would long continue to be a valuable asset to that part of the Empire financially. The Association has formed itself into two Sections—one dealing with trading matters and the other with wiring contracts and workshop work. The report states that satisfactory progress has been made with the standardisation of wiring rules. There is now throughout Australia only one set of wiring rules and regulations for the installation of electrical apparatus which is honoured by supply companies and fire insurance companies alike, and is in the care, as regards alterations and interpretations, of Standing Committees in New South Wales and Victoria. As the result of the proposed Municipal Trading Bill not having become law, members' interests were still conserved in what they considered their legitimate sphere, unassailed by competition from municipal bodies. The Council was in constant communication with the Electrical Contractors' Association in London in connection with any measure of that nature which might be brought before the British Parliament. The Association has dealt with the question of false trade descriptions (Japanese importations), and the Customs authorities have guaranteed the protection of British trade marks against such infringements. Mr. G. L. Just is president of the Association, and the address of the Secretaries is:—Fell, Rankin, Morrison & Co., 314, Collins Street, Melbourne.

Calcium Carbide in Japan.—According to the *Revue Générale de l'Electricité*, calcium carbide was first made on a small scale in Japan in 1901. As the demand increased, the manufacturing facilities were developed, and two of the factories are able to produce respectively 30,000 and 5,000 tons per annum of carbide, which is converted into cyanamide, and used for the manufacture of sulphate of ammonia. The increased production has enabled Japan to export carbide to Australia, the Philippines, Java, and India.

The Importance of Export Trade Development.—In the course of an address on "Present Aspects of Trade," Sir Albert Stanley, M.P., President of the Board of Trade, told the Bradford Textile Society that the demand of the workers for higher wages and better conditions could only be met by improved export trade.

Anglo-Italian Trade.—According to a daily paper, Mr. Victor Fisher has resigned the secretaryship of the British Workers' League, and is on his way to Italy on an "official mission" for promoting industrial and commercial unity between Great Britain and Italy.

The Importance of Advertising in War-time.—The American *Electrical Review* quotes the following statement recently issued by the Hon. W. B. Colver, chairman of the U.S. Federal Trade Commission, on the importance of maintaining trade advertising during the war:—

"Discontinuance or even sharp curtailment of advertising, because of temporary war conditions, would seem to imperil the most valuable asset that any business has—namely, its goodwill. No more faulty logic can be found than that which would impel a manufacturer to cease building for the future by means of advertising, simply because the output of his factory is, for the time being, restricted; or because diversion of his facilities to war-work has operated to withhold his goods from the accustomed markets. In modern business there can be no 'sufficient-unto-the-day' policy.

"In advertising, the business man has built up the intangible or spiritual side of his business, if such it may be designated, as distinct from the material side. It is the spiritual side as represented by the goodwill, that is slower of growth and that is the more seriously jeopardised by neglect—neglect which could take no more disastrous form than an interruption to advertising.

"Goodwill, in my estimation, is far more valuable than the physical property with which it is linked.

"The manufacturer who has converted his factory to war-work, and has, therefore, interrupted the production of his original line, does not tear down and discard his expensive machinery to save the insurance premiums or other similar expenses. It would be just as sensible for a manufacturer whose commercial integrity is founded upon advertising to abandon his advertising campaign in order to save the carrying-charge upon his greatest asset—goodwill.

"They told me when I was a youngster that even the Lord can't make a two-year-old calf in a minute. Big advertising spreads after the war will meet equally big spreads. Business will bid for public attention and interest on a bull market. The purpose will be to put a punch in goodwill which has gone flabby. The man who goes into that contest with a public attention and interest which he has never allowed to relax will go in with his goodwill trained to the minute.

"He will win."

Catalogues.—The New Switchgear Construction Co., Ltd., Wellesley Road, Sutton, Surrey.—Twenty-eight-page provisional catalogue and price list (No. 70), in English and French, containing fully illustrated description, tabulated prices, weights, &c., of the company's oil-break switches and switchgear.

The Industrial Situation in China.—It appears from a brief dispatch received from the *Times* correspondent at Peking, that while the educational needs of China are great, the industrial needs are greater. Engineering and industrial students returning from abroad are stated to be unable to find positions for which they are trained.

Neutral Trade Marks.—The *Daily Mail* learns that Germans are buying up well-known trade-marks in neutral countries, especially Sweden, Norway, and Denmark. "Certain established hardware specialities, now sold abroad as Scandinavian wares, are said already to have come under German control! The object of this manœuvre, of course, is to fool people into thinking that they are purchasing products of the countries in question, instead of goods actually manufactured by Germany. The same trick, it is reliably reported, is also being tried with regard to American trade-marks."

Book Notices.—*The Synchroscope.* September, 1918. A monthly publication by the Detroit Edison Co. in the interest of its employés. The number to hand contains an article by C. R. Cross on "The Connors Creek Power-Plant Piping," a list of Edison men in the war, and a number of interesting notes and notices.

Bureau of Standards, Circular No. 73, entitled "Copper," deals primarily with the physical properties of pure and commercial grades of copper. The best data and values are given for the various physical characteristics and constants, together with a bibliography of the sources from which these values were taken. The effect of impurities upon the properties of copper is discussed, as well as the influence of various factors in its manufacture. The circular contains over 100 pages, and is the most complete treatise on the subject that we have seen; it is freely illustrated with half-tones and graphs, and treats of every aspect of the subject more or less exhaustively, forming an invaluable store of information in a convenient form. Those interested may obtain a copy by addressing a request to the Bureau.

"*Proceedings* of the Physical Society of London." Vol. XXX, Part 5. August 15th, 1918. London: Fleetway Press, Ltd. Price 4s. net.

"*Journal* of the U.S. Artillery." Vol. XLIX, No. 3. May-August, 1918. Virginia: Coast Artillery School Press, Fort Monroe. Price $0·50.

"Post Office Electrical Engineers' Journal." Vol. II, Part 3. October, 1918. London: H. Alabaster, Gatehouse & Kempe. Price 1s. net.

Bankruptcy Proceedings.—E. C. Sparkes, electrical and manufacturer's agent, 118, Wardour Street, London.—Receiving order made October 17th, on a creditor's petition. First meeting, October 30th; public examination, December 3rd.

Australia.—A Conference of the engineers of the larger electric supply stations, which was convened by the Government, has agreed that power stations shall pool their requirements, so that orders in bulk may be sent to Great Britain, and delivery thereby facilitated.—*Australian Industrial and Mining Standard.*

Trade Announcement.—Messrs. Witton James, Ltd., have removed to the Hyde Electrical Works, Colindale Avenue, Hendon, N.W. 9. Telegrams: "Varishunt, Hyde, London." Telephone: Kingsbury, 280. New offices and commodious works premises have been taken, and the address of the registered office is as stated. The works are of ample proportion for immediate requirements, and the company has taken adjoining land for extensions. In future all its various specialities will be manufactured there.

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Patents and Alien Enemies.—Application has been made to the Board of Trade to avoid or suspend Patents No. 26,436/07, granted to Bosch for sparking plugs, by Messrs. Howard S. Cooke and Co., and No. 5,026/12, granted to Hubers (Pintsch A.-G.), by the Cosmos Lamp Works, Ltd. Applications have also been made for licences under applications vested in the Custodian in respect of Patents Nos. 16,620/14, and 109,298, applied for by the Pintsch A.-G., for metallic bodies, by the Cosmos Lamp Works, Ltd.

LIGHTING AND POWER NOTES.

Argentina.—E.L. Schemes.—A local company is being formed at Laprida (Province of Buenos Ayres) for the installation of electricity in the town. A concession has been granted to Senor Facundo Escalera for the installation and working of a power house at Cosquin (Cordoba). The residents of Santa Elena (Buenos Ayres) have decided to install an electric lighting scheme in the town.—*Review of the River Plate*

Australia.—E.L. Schemes.—The Queanbeyan (N.S.W.) Council is taking steps to borrow £20,000 for the purpose of installing an E.L. system; the Mittagong (N.S.W.) Council is endeavouring to borrow £5,000 for the same purpose; arrangements have been made by the Dunmunkle (Victoria) Shire Council to light the towns of Murtoa and Minyip with electricity.—*Tenders.*

Ayr.—Price Increase.—The T.C. has increased the charges for electricity for all purposes to 50 per cent. above pre-war rates.

Beccles.—Proposed E.L.—The Public Lighting Committee proposes to discuss the question of an electric lighting scheme for the town at its next meeting.

Canada.—Water Power.—The Hydro-Electric Power Commission has given notice of its intention to spend $1,250,000 in the erection, at Ranney's Falls, Campbellford, of a power plant that will produce from 8,000 to 10,000 H.P. It is stated that the work will begin this autumn.

Chorley.—Workhouse Lighting.—The B. of G. has decided to apply to the L.G.B. for sanction to carry out improvements at the workhouse, including the installation of electric light plant.

Continental.—Belgium.—The daily Press states that, among other things, the Germans succeeded in destroying the gas and electricity plant at Ostend before they left the town.

Italy.—The Consiglio Superiore delle Acque has expressed itself in favour of the scheme of the Società Elettrica della Sicila Orientale for the use of the waters of the Alcantara basin for generation of electricity. The scheme provides for the construction of an artificial lake of 66 mill. cb. m. capacity on the Flaxio torrent, about 1,200 m. above sea level, which, by means of an underground conduit, will convey its waters to a second artificial lake on the Alcantara, 1,135 m. above sea level, having a capacity of 24 mill. cb. m. In all, 30 mill. cb. m. of water will be stored and used. The water dammed will create a fall of 440 m., capable of giving continuously 4,200 H.P. This scheme is expected to lead to the development of industries in the Catania and Messina regions and the electrification of the Catania—Palermo railway system, as also to the utilisation of electricity for agricultural purposes.—*Annali d'Ingegneria e d'Architettura.*

Switzerland.—The electricity works now being built at Mühleberg, and belonging to the Berne Electric Power Co., will obtain its power from the section of the river Aare, between the Felsenau works and the junction of the river Saane with the Aare. The illustrations and plans given in the *Schweizerische Bauzeitung* show that the works was well advanced in July, 1918, and it forms the last section for the power development of the Aare between Berne and the Bielersee, the other finished works being those at Felsenau, Kallnach, and Hagneck. Under average conditions there is a volume of water of about 100 cb. m. per second, with a fall of 19 metres. A weir has been constructed across the river forming a storage reservoir, which holds up 9 million cb. metres of water. The turbine house has accommodation for eight groups of machinery, each developing 8,100 H.P. The weir is designed to pass 500 cb. m. per second, which is the greatest high-water capacity of the river, without causing the water-level up-stream to rise above the calculated level of 484·2 m. Part of the generators are built for three-phase current and part for single-phase, and there will be two transformers, each for 5,000 K.V.A. The turbines are of the vertical spindle, single row, high-speed type, by Messrs. Escher & Wyss, of Zurich, and run at 133 to 166 R.P.M., with a frequency of 40 or 50 cycles per second. The switchboard and transformer plant is all placed in a separate building on the left bank of the river. The weir itself forms a bridge, thus affording a long-needed connection between the two banks of the river. It is expected that the works will be completed in 1920.

Sweden.—Among the concerns recently formed to establish small electric lighting stations, or to distribute electricity obtained from the large bulk supply undertakings, are the Beskvarns Kraftstation Aktiebolag, organised at Nashult: the Pengsjo Elektrisk Kraft Aktiebolag, formed at Pengjso; and the Haggenas Elektriska Aktiebolag, registered at Haggenas. A company has been formed at Maffmar, with a maximum capital of £25,000, and the title of Hallens Elektriska Aktiebolag, to establish a plant to utilise water power in the Dammen district for the generation of electricity.

Dover.—Price Increase.—The T.C. has advanced the price of electricity for power to 3½d. per unit, and for heating to 2½d., as from October 1st last. Application has been made to the B. of T. for permission to increase the charge for lighting to 8d. per unit, and for the maximum charge of 11s. 8d. for energy used up to 20 units to be increased to 15s., and 9d. per unit beyond.

Dublin.—Price Increase.—The Corporation has increased its charges by 1d. per unit for lighting and 1½d. per unit on the existing scale for power.

Liffey Water Power Scheme.—The Pembroke U.D.C. has resolved to support the scheme of the Dublin and Lucan Electric Railway Co. to generate electricity from the river Liffey, for railway and general industrial purposes.

Exeter.—Workhouse Lighting.—The Building Committee of the B. of G., after receiving specifications and estimates for installing electric light in the remaining blocks at the workhouse, has deferred consideration of the scheme.

Glasgow.—New Sub-stations.—In view of the early generation of electricity at Dalmarnock station, a Special Committee of the Electricity Committee has considered the advisability of acquiring ground for additional sub-stations. The chief engineer has reported that extensions of the Whitevale and Springburn sub-stations and new sub-stations at Possilpark and Polmadie are now urgently required. For the purpose of providing a new sub-station for the Central District, ground is to be acquired at a cost of £13,500.

Electric Welding.—In connection with the proposal by the Admiralty Welding and Labour-Saving Division to start schools in various shipbuilding centres for the training of electric welding operators, premises at the T.C. electricity works at Partick have been let, the lessees to provide the entire fitting up of the premises, including welding equipment and power wiring.

Halifax.—New Generating Station.—In compliance with the request of the Government for municipalities to prepare schemes for public works which will be required after the war, the Electricity Committee has instructed the borough electrical engineer to prepare plans and specifications for a new generating station to be erected at Copley. The matter is the subject of much local controversy, and the decision, which was passed by a majority of one vote, may be reversed by the Town Council.

Iceland.—Water Power.—The Iceland Telegraph Bureau announces that a company at Reykjavik has decided to erect hydro-electric works for the utilisation of the Ellida River, 4·34 miles from that city. The expenditure is estimated at 7,000,000 crowns, and the work is to begin at once.

Ireland.—Lighting Restrictions Order.—The Irish Lighting Restrictions Order, sanctioned by the Viceroy, provides for the prohibition of all shop window and outside lighting; the closing of all offices, warehouses, and shops at 5.30 p.m. on four days per week, 7 p.m. on Fridays, and 9.30 p.m. on Saturdays, with certain exceptions, which must not consume more than 50 per cent. of the energy used for lighting in 1914, and the prohibition of the cooking of meals in hotels after 8 p.m. Private premises, other than shops, factories or warehouses, are allowed two-thirds of the lighting used before the war. Factories are to have the preference of electricity and gas for power purposes, but factory lighting is to be limited to 80 per cent. of that of 1914, except by special permit. Outdoor lighting at places of amusement is prohibited, and they are to close at 10.30 p.m. Public lighting is not to exceed 50 per cent. of that of 1914.

India.—At the last annual meeting of the Calcutta Electric Supply Corporation, the chairman stated that during the year the supply had to be curtailed in order to economise boiler power, and because bitumen and other materials required for extensions were unprocurable. Their coal contracts had been cancelled, and they were doing the best they could with such coal, both as regards quantity and quality, as Government permitted to be delivered to them. A scheme had been approved for gradually changing sections of the overhead mains to underground, but owing to lack of material the work had to be postponed.

Linthwaite.—Street Lighting.—At the conclusion of the war the U.D.C. has decided to discuss with the Huddersfield Corporation electrical engineer the question of street lighting with electricity.

London.—Stoke Newington.—Price Increase.—The E.L. Committee has recommended the B.C. to adopt the following revised charges for electricity:—Power supply during day-time, from 2d. to 3d. per unit., and 10 per cent. increase on power charges generally; the abolition of all discounts under scales A, B, and D, and under special agreements; and the abolition of the rebate to lighting consumers, whereby the average charge was limited to 4½d. per unit.

Bermondsey.—Year's Working.—The annual accounts of the B.C. electricity department show that the total expenditure for the past year was £36,381, whilst the income amounted to £51,140. After paying capital charges (£13,973), the net surplus was £1,185, to which was added £1,133 transferred from the general fund of the Council in connection with allowances to employés with the

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Forces. The total deficit now stands at £9,823 ; 6,550,260 units were sold during the year, including 237,436 for public lighting.

Kensington.—It is stated that the reports of the inspectors to the Electric Supply Co. show that since October 1st there has been a decrease of 20 per cent. in the consumption of electricity, compared with the corresponding period last year. About 80 per cent. of the electricity generated by the company is for lighting purposes. This figure understates the measure of household economy, it is stated, inasmuch as there has been an increased demand for power purposes.

Mytholmroyd.—Prov. Order.—Having received a draft of the Electrical Distribution of Yorkshire's E.L. Bill, and a request for the consent of the Council to the same, the U.D.C. has referred the company to the resolution in which it decided to oppose the application.

Paraguay.—Owing to an accident at the power house at Asuncion, the whole of the electric lighting and tramway services in the city were suspended from August 24th to August 29th last ; several daily papers were also forced to cease publication.—*Review of the River Plate.*

Sheffield.—At a meeting of the T.C., the chairman of the Electricity Committee laid before the Council the position as to the Blackburn Meadows power station. Having convinced the Ministry of Munitions as to the urgent need for the provision of a large additional supply of electric power for war purposes, the Council commenced the erection of a new power station, and placed orders, as authorised by the Ministry, for the necessary plant. Recently the Ministry recalled its promise to acquire this plant, and, in his opinion, the Council was placed thereby in a most serious position. The present plant was most inadequate to meet the demands upon it for munition purposes. It was being run to an extent considerably beyond its proper capacity, and he feared that a serious breakdown might take place at any time. Even if the supply proposed to be given by the Rotherham Corporation was available—and this certainly would not be the fact for several months yet—the supply would not be adequate to meet outstanding requirements. The Council authorised the Lord Mayor to take such action in the matter as he might think fit.—*Sheffield Telegraph.*

Spenborough.—Price Increase.—The U.D.C. has increased the net price of electricity as from November 1st by 25 per cent.

Wolverhampton.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for permission to borrow £10,000, in order to bring the contingency amounts in certain loans to 11 per cent. of the total of such loans.

TRAMWAY AND RAILWAY NOTES.

Argentina.—Strike.—At the beginning of September a general strike took place in Cordoba, and spread to Buenos Ayres and Jujuy. After the whole of the public services had been suspended for a week, most of the demands were acceded to or referred to arbitration, except in the case of the tramway employés at Cordoba, who refused to resume work until their demands were granted.—*Review of the Rirer Plate.*

Australia. — N.S.W. — Australia's "greatest electric railway system" serves a large area in and around Sydney. The system comprises 350 miles of track, 1,387 motor-cars, 11 trailers, and 105 service cars. Between 4,000 and 5,000 cars pass the centre of the city between 6 a.m. and 12 midnight. Some of the gradients on the Spit-Manly section, where the lines rise from sea level to the top of the cliffs, are so steep that a dummy truck has to be used to pilot cars up and down. The track supply is 600 volts, D.C., overhead, and there are three generating stations and several sub-stations. More than 295 million passengers are carried per annum, and the car-mileage exceeds 25 million miles.

Birmingham.—Fuel Economy Bonus.—To encourage the drivers to reduce the consumption of power, the Tramways Committee has offered a monthly bonus of 50 per cent. of the value of the energy saved.

Dublin.—Wages.—As the result of an arbitration held by Sir Plunkett Barton, the male employés of the Dublin United Electric Tramways Co. have been granted an increase of 5s. per week in wages from September 1st, making a total of 23s. per week on pre-war wages.

Large Trolley Wheels.—The Oakland, Antioch, and Eastern Railway is obtaining excellent service from various makes of 10-in. trolley wheels. Formerly 6-in. wheels were used, and with a trolley pole pressure of 35 to 40 lb., these often gave a life of only 90 miles. With the 10-in. wheels the pole pressure can be reduced to 25 or 30 lb., a life of 6,000 miles or more is obtained, and dewirements and pole troubles are reduced.

Lancashire.—Wages.—Through the Transport Workers' Federation, the employés of the Lancashire tramway systems are asking for a further 10s. per week for men and 17s. per week for women. This would bring the war wages up to 35s. per week for workers over 18 years of age, and would be equal pay for men and women. The suggested basis of employment is a six-day week of 10 hours a day. For time worked over 10 hours a day and under 12 time and half rates are asked, and double pay for time worked over 12 hours a day. The last award was made four months ago, and its terms prohibited the reopening of the question for that period. The matter was brought before the Lancashire and Cheshire Authorities Joint Committee last week, and referred to the Municipal Tramways Conference Executive.

London.—L.C.C. Pays Damages.—Judge Parry, at the Lambeth County Court, last week, awarded Mrs. A. E. Hearn £175 damages, with costs, for injuries sustained in a collision between two L.C.C. tramcars at Greenwich, on February 6th. The plaintiff was on her way home from work when the two tramcars collided, throwing her off the seat ; she sustained severe injuries. The L.C.C. did not dispute the liability, but maintained that the claim was inflated.

Fuel Economy Bonus.—The L.C.C. Tramways Department has distributed £1,614 among the drivers and conductors, representing half the amount saved on the fuel account for the quarter ended September 25th last ; the amount of coal saved amounted to 1,175 tons, or nearly 5 per cent. of the average consumption.

Accident.—By a tramcar collision at Kennington, on Saturday, a conductor was injured.

Proposed Fares Increase.—Brentford District Council is seeking to combine the local authorities of the Thames Valley into an opposition to the proposal of the L.U.T. Co. to ask for an order empowering it to raise its fares. When the company sought its recent Bill this power was asked for, but was withdrawn. The proposal now is to charge 1d. per mile, with ½d. per mile for workmen's fares, which would about double the present fares.

The T.C.'s of Wimbledon and Kingston and the Surbiton U.D.C are urging the Board that in no case should the fares be advanced more than 50 per cent.

New Zealand.—Electric Vehicles.—The Christchurch City Council has placed a contract with the New Zealand agents for Edison electric motor vehicles, whereby it undertakes to sell annually, within a radius of 20 miles of the city, and at a moderate commission, a minimum of 12 electric vehicles. The Council incurs no liability for failure to dispose of the total number agreed upon, but the agents have the right to cancel the agreement in such an eventuality. The reason for entering into the arrangement is that the probable increase in the number of electromobiles will find profitable business for the municipal electric power station, which can charge the vehicle batteries in the "off" hours of the day, when the energy costs practically nothing. This is possible under the system of charging adopted by the Public Works Department, which supplies from the Lake Coleridge hydro-electric station. The charge is based on the peak load, and whatever the maximum demand may be at any time of the day the city is charged for that quantity as if it had been used continuously for the whole 24 hours. Therefore in the slack hours, when there is no danger of increasing the peak load, the Council can charge an extremely low rate.

Oldham. — Proposed Extensions.— The Tramways Committee proposes to construct a new route to the new factory in the Chadderton district.

Taunton.—Electric Vehicle.—The T.C. has referred back to the Health, Streets, and Highways Committee a recommendation to purchase an electric vehicle, at a cost of £1,300.

TELEGRAPH AND TELEPHONE NOTES.

A Cable Monopoly ?—A German report states that an Anglo-American syndicate has presented to the Allied Governments proposals for the establishment of a world-wide cable monopoly.

Holland.—As reported recently in this column, an agreement has been entered into between the Dutch Government and Herr Bredow, representing the Telefunken Co., for the erection of a station in Holland for direct connection with other countries, particularly Netherlands Indies. It is now stated that the station is to be similar to that at Nauen, near Berlin, and is to permit also of communication with North and South America. It is said that great political importance is attached to the agreement in Holland, as it will enable the country to liberate itself from English control in transmarine telegraph services.

India.—Telephonic communication has recently been established between Bangalore and Mysore, a distance of 87 miles.

Swedish Telephone Merger.—A Swedish trade journal reports the consolidation of the Aktiebolaget L. M. Ericsson and Co. and Stockholms Allmänna Telephone Co., in order to meet expected competition and possible business extensions after the war. The former company mainly manufactures telephone instruments and materials, while the latter installs and maintains the wires, and also has concessions for wires in other countries.

As competition sometimes arose between these two, a new com-

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pany was organised to take over both companies' interests in Russia, and has installed a large number of telephone wires there. The Russian Government has taken over the wires without as yet granting compensation, the question still being under consideration.—*T. and T. Age.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Queensland. November 29th. Electric lifts for the Department of Public Works, Brisbane.—*Industrial Australian and Mining Standard.*

Bedford.—November 13th. Two water-tube boilers, mechanical stokers, and induced-draught plant for the Corporation. See "Official Notices" October 4th.

Dublin.—November 7th. Gt. Northern Railway Co. of Ireland. Six or 12 months' supply of stores, including various electrical items. See "Official Notices" October 18th.

London.—October 25th. H.M. Office of Works. Electric cable. See "Official Notices" October 18th.

South Africa.—Johannesburg.—November 27th. Municipal Council. 2,000 copper ribbon bonds, and 2,000 copper solid bonds (Contract No. 424). A copy of the specification can be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence), London.

York.—November 1st. N.E. Railway Co. Telegraph apparatus, wire and line stores for 6 and 12 months. See "Official Notices" to-day.

CLOSED.

Australia.—Sydney.—Electricity Committee. Recommended :—

One set of spare coils and insulating material for the 2,000-K.V.A., 33,000/5,000-volt transformers installed at the power house and abattoirs sub-station, £259.—British Westinghouse E. & M. Co., Ltd.
Spare parts for stoker gear, £185.—Babcock & Wilcox, Ltd.

Melbourne.—Electricity Supply Committee. Accepted :—

Porcelain insulators, £131.—Australian Porcelain Co., Pty., Ltd.
2,400 gas-filled metal-filament lamps, £2,020; 1,500 Goliath Edison screw-holders, £328.—Australian General Electric Co.
Electrically-driven hoist, £255.—G. S. Morrison.

P.M.G.'s Department, Queensland :—

One mile silk and cotton-insulated, lead-covered switchboard cable, 4 pairs, £85; 1,430 do. do., 25 pairs, £246.—B. I. & Helsby Cables, Ltd.

Commonwealth Railways :—

Electrical spares, Port Augusta, £202.—I.R., G.P. & Telegraph Works Co., Ltd.

Victorian Railways Department :—

Switches, for remote control, £50 each.—Electric Equipment Mfrs., Pty., Ltd.

—*Tenders.*

Government Contracts.—List of new contracts placed in September, 1918 :—

War Office.

Dynamos.—H. T. Boothroyd, Ltd.; Phœnix Dynamo Mfg. Co., Ltd.
Fans.—General Electric Co., Ltd.
Generating sets.—R. A. Lister & Co., Ltd.
Magnetos.—Fellows Magnetos Co., Ltd.
Motors, &c.—E. Brook, Ltd.; General Electric Co., Ltd.
Insulator pins.—Bullers, Ltd.
Switchboards.—British Westinghouse E. & M. Co., Ltd.
Insulating tape.—British Rubber Manufacturers, Ltd.
Iron and steel wire.—Duke, Waring, Crisp & Co.; J. Lysaght, Ltd.; J. Rigby & Sons; J. Royston & Co., Ltd.; Rylands Bros., Ltd.; Shropshire Iron Co.; J. Smith, Ltd.; Standard Wire Co.; Tyne Wire Weaving Co., Ltd.

Post Office.

Repairing wire apparatus.—J. Barker & Co., Ltd.; George Plumpton, Ltd.
Telegraph apparatus.—Automatic Telephone Mfg. Co., Ltd.
Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; B.I. and Helsby Cables, Ltd.; British L.M. Ericsson Mfg. Co., Ltd.; Peel-Conner Telephone Works, Ltd.; Western Electric Co., Ltd.
Testing and protective apparatus.—British L.M. Ericsson Mfg. Co., Ltd.
Submarine cable.—Telegraph Construction & Maintenance Co., Ltd.
Telegraph and telephone cable.—B. I. & Helsby Cables, Ltd.; General Electric Co., Ltd.; Hackbridge Cable Co., Ltd.; Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.; H. W. Smith & Co., Ltd.; Telegraph Construction & Maintenance Co., Ltd.; Yorkshire Cable Co., Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Secondary cells.—Pritchett & Gold and Electrical Power Storage Co., Ltd.
Cords for telephones.—London Electric Wire Co. & Smiths, Ltd.; Peel-Conner Telephone Works, Ltd.
Insulator bodies and covers.—J. Bourne & Son, Ltd.; Bullers, Ltd.; Doulton & Co., Ltd.; J. Macintyre & Co., Ltd.
Terminal irons.—McGregor Bros., Ltd.
Glow lamps.—British Thomson-Houston Co., Ltd.; Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.
Fuse mountings.—H. White & Co.
Telegraph spring ratchets.—H. Brindley.
Rings for insulator spindles.—Rubber Co. of Scotland, Ltd.
Zinc rods.—Eyre Smelting Co., Ltd.
Telegraph spindles.—Bayliss, Jones & Bayliss; Bullers, Ltd.; Guest, Keen and Nettlefolds, Ltd.; J. W. Leach, Ltd.
Four wire strainers.—S. Venables & Son, Ltd.
Telephones.—British L.M. Ericsson Mfg. Co., Ltd.; Peel-Conner Telephone Works, Ltd.
Bronze wire.—B.I. & Helsby Cables, Ltd.
Enamelled and silk-covered copper wire.—London Electric Wire Co. and Smiths, Ltd.
Flame-proof wire.—London Electric Wire Co. & Smiths, Ltd.; Western Electric Co., Ltd.
Galvanized iron wire.—Shropshire Iron Co.
Installation of water pumping plant at the Mount Pleasant Station of the P.O. (London) Railway.—Brightside Foundry & Engineering Co., Ltd.
Repair of battery at Manchester (city) telephone exchange.—Pritchett and Gold and Electrical Power Storage Co., Ltd.

India Office, Store Department.

Cable.—C. Macintosh & Co.
Insulators.—Bullers, Ltd.; Taylor, Tunnicliffe & Co., Ltd.
Wire.—B.I. & Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; Dorman, Long & Co., Ltd.

Hammersmith.—Electricity Committee :—

500 yd. ·25 in. and 880 yd. ·1 in. extra-high-tension cable.—**Callender's Cable & Construction Co., Ltd., £942** (recommended); Johnson and Phillips, £944; W. T. Henley's Telegraph Works Co., Ltd., £948; Siemens Bros. & Co., Ltd., £967.
80 coal elevator buckets.—**Aland & Co., £100** (recommended); E. Allen and Co., Ltd., £125; W. B. Bawn & Co., Ltd., £80; C. A. Harvey and Co. (London), Ltd., £64.
540 lap welded air heater tubes.—J. Howden & Co., Ltd., £260; Stewart and Lloyds, Ltd., £217; **J. Wilson (London), Ltd., £217** (recommended.)

Taunton.—Electricity Committee :—

2,600 tons of coal, 38s. 6d. per ton.—Cory Bros. & Co., Ltd.

Wolverhampton.—T.C. :—

Piping.—Staveley Coal & Iron Co., £17 10s. and £27 10s. per ton.
Valves.—J. Hopkinson & Co., Ltd., £179.
Repairs to canal boats.—J. E. Perry & Sons, £166.
Traversing conveyor.—Gibbons Bros., £367, plus 10 per cent. for contingencies.

Additional payments in respect of contracts owing to revision of labour rates have been granted as follows :—

Strachan & Henshaw, Ltd.—Telpher machines and coal grab, extra £64.
Stirling Boiler Co., Ltd.—Three boilers, extra £598.

The Council has accepted the offer of F. Gilman for the purchase of the 300-KW. reciprocating set at the destructor works, for £1,150.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, October 25th. At 7.30 p.m. At 39, Victoria Street, S.W. Paper on "Cooling Towers," by Mr. J. Elliott. **(North-Eastern Section.)**—Tuesday, October 29th. At 7.15 p.m. At the Mining Institute, Newcastle-on-Tyne. Paper on "Coal and Ash Handling Plants," by Mr. N. Thorton.

Manchester Association of Engineers.—Saturday, October 26th. At 6.30 p.m. At the Grand Hotel. Paper on "Fuel Oil and its Application," by Mr. A. F. Baillie.

Industrial Reconstruction Council.—Wednesday, October 30th. At 4.30 p.m. At Saddler's Hall, Cheapside, E.C. Lecture on "The Functions of the Government in Relation to Industry," by Mr. W. L. Hichens.

Salford Technical and Engineering Association.—Saturday, November 2nd. At 7 p.m. At the Royal Technical Institute. Members' short papers for the Larmuth Gold Medal.

NOTES.

Water Power from the Dee.—In the course of a lecture on the utilisation of water power, read before the Aberdeen Rotary Club, Mr. C. H. Roberts stated that the River Dee represented about 50,000 H.P.; but this was not directly available. From the tributaries of the Dee, however, water power could be profitably obtained; about 15,000 E.H.P. could be made available at Ballater during a 12-hour day, and 2,000 to 3,000 E.H.P. at Banchory.

Irish Coal Mines.—It is announced that the Irish Coal and Lignite Co., Ltd., is about to commence operations in County Tyrone at an early date. Systematic borings will be made at Coalisland and in the country between that town and Lough Neagh, under which both coal and lignite exist, it is believed. About £5,000 will be spent in this way, before shafts are sunk, to prove the existence of coal in paying quantity. The Tyrone coal burns with an intense heat and largely is of a good quality, some of the Coalisland seams being equal to Wigan coal. With regard to the lignite, operations are to be started at once, the machinery, if not actually *in situ*, being on the way from London. Mr. Bath, the engineer of the undertaking, at great personal risk, obtained details of the secret process of converting lignite into coal substitute in Germany. The lignite will be separated from its bed by a rotary cutter, taken to an elevator, treated by the secret process and pressed into briquettes—10 × 5 × 3 in.—and will be ready for use within three hours. It is estimated that the machinery will be capable of turning out from 10,000 to 15,000 tons of briquettes per week. The deposits of lignite round Lough Neagh are very extensive, and other deposits exist in County Antrim, County Derry, &c.

The Eight-Hour Day.—According to the *Manchester Guardian*, the demand put forward by the Engineering and Shipbuilding Trades Federation for a 44 hours' working week without reduction in wages and on a one-break per day system, to come into operation on the cessation of war, has been considered by the shipbuilding employers, who have replied accepting the principle of a shorter working week, without, however, committing themselves to any definite number of hours. Negotiations are proceeding jointly with the Engineering Employers' Federation, and it is expected that conditions will shortly be agreed on which will economically safeguard the industry.

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Electric Welding Operators.—The Admiralty proposes to start schools in various shipbuilding centres for the training of electric-welding operators.

Volunteer Notes.—Royal Engineers (Vols.), London Army Troops Companies.—Headquarters: Balderton Street, Oxford Street, W. 1.

Corps Orders No. 44, by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Captain of the Week.—Capt. W. Hynam.
Next for Duty.—Capt. W. Darley Bentley.
Sunday, October 27th.—Commandant's Parade for work, "Obstacles," at Esher. Parade Waterloo Station, 9 a.m. Drill order. Great coats. Mid-day and tea rations to be carried.
Monday, October 28th, to Saturday, November 2nd.—Drills as usual.

C. Higgins, *Capt.* R.E., *Adjutant.*

We are informed that the Corps is in a highly efficient condition, as shown by the Inspection Reports, but, owing to the alteration in military age and other causes, the numbers are considerably below the establishment. Although the Corps is under the control of the War Office, the Government funds are quite insufficient to maintain it on a satisfactory basis, and at present it is supported mainly by subscriptions from members.

In an Engineering Corps there are many expenses that do not occur in the case of Infantry, and the good work which the Corps is doing justifies us in appealing to our readers for assistance to its funds. Up to the present 800 men from the Corps have joined H.M. Forces, and of these 300 have accepted commissions. It is estimated that the sum of about £400 is required to run the Corps satisfactorily, and of this amount at present about £130 can be regarded as assured. A pamphlet explaining the work of the Corps, as well as explanatory leaflets, can be obtained at Headquarters, Balderton Street, Oxford Street, W. 1.

A smoking concert is to be held to-morrow (Saturday) evening, at the Regent Street Polytechnic, at 7.30 p.m.

British Oil.—Near the village of Hardstoft, six miles from Chesterfield, machinery for drilling for oil was set in motion on October 15th by Lord Hartington, the owner of the estate. This is the first organised attempt to obtain free oil by drilling in the United Kingdom. There are about 40 American drillers with machinery to drill 10 wells, seven sites being already chosen near Chesterfield.

According to the daily Press, home oil-boring produced contention in the House of Lords on October 22nd. A Government Bill from the House of Commons, introduced by Lord Elphinstone, provided that no person should bore in the United Kingdom except on behalf of the Government. A private Bill by the Duke of Northumberland empowered any person who could obtain a licence to bore. He thought the Government Bill set up a monopoly for Messrs. Pearson (Lord Cowdray's firm), and urged the rights of other prospecting firms and landowners. The Duke of Buccleuch said it was impossible to resist the belief that if Messrs. Pearson received preference now they would retain it after the war. Both Bills were accorded a second reading, but the Government one will go to Committee as soon as the Government pleases, while the other one must take its chance.

Accidents in Mines.—About 120,000 men employed at mines were granted compensation during 1917 for injuries received while at work. The great majority of the cases were underground. —*The Times.*

The "Key" Industries Exhibition.—We are informed that the Exhibition has met with success exceeding even the sanguine expectations of its organisers, the Industrial Section of the Tariff Reform League. Between 70,000 and 80,000 persons visited the Exhibition during the short time it was open, or an average of about 5,000 daily, and it has been widely and favourably commented on by the Press of all shades of political opinion. The educational advantages of such an object-lesson in the national value of "key" industries, and the dangers involved in foreign control of such industries, have therefore been very generally appreciated, and Mr. H. J. Mackinder, chairman of the League, makes an earnest appeal for national and non-party support in meeting the demands which reach him from many quarters that other cities of the United Kingdom should be afforded the opportunity of seeing what London has seen. The expense of the Exhibition has necessarily to be met by voluntary contributions to the funds required. That expense, especially in existing conditions, is very heavy, and as the Exhibition is opened free to the public, and no charge is made upon exhibitors for space, the organisers of the Exhibition look to those interested in the success of the undertaking for help in meeting the expense involved.

So far as the expense incurred in London is concerned, generous support has already been assured by many of the great firms who have helped with exhibits. The League, however, desires to raise a substantial fund for the purpose of showing the Exhibition in the various large industrial centres throughout the country. Cheques and postal orders should be made payable to Mr. Edward J. Duveen (Chairman of the Industrial S ction of the Tariff Reform League), and crossed "Key Industries Exhibition."

The Batti-Wallahs and the Huns.—At the monthly luncheon of the Batti-Wallahs' Society, on Monday, Mr. C. H. Wordingham (Director of Electrical Engineering, Admiralty, and President of the Institution of Electrical Engineers) said he had been asked to attend and address the members on the subject of Germans. He always had an intense loathing for anything German. His instinct against the Germans was very strongly developed. The German was essentially a thief, and was dishonest in his bargains. Many of those who had bought German plant had found to their cost what the German's idea of a contract was. He hoped also the bestiality and horrible cruelty of the German would not be forgotten. No part of the German nation, from the scientists downwards, had dissociated itself from the acts of which the Germans had been guilty. We could not afford to have contempt for the Germans, however much we despised their character. The moment the war was over we should be assailed again by the German, who would take advantage of another failing of the Englishman, who was apt to take the article that cost 19s. 11½d. rather than the British-made article that cost £1. Years before the war, he (Mr. Wordingham) had made a practice of asking whether an article was made in Germany or not. He hoped the propaganda which he understood the Society had started against the Germans would result in bringing Englishmen to see how vile the Germans had been, and to be determined that they would no more have dealings with them than they would allow their sons and daughters to sit down with pickpockets, burglars, and murderers. Our children should be taught about the conquest of the Germans, and warned against their evil character. A boycott of the Germans had always seemed to him a simple remedy. If every Englishman were determined never knowingly to buy anything from a German, no legislation would be needed. He would like to see the Germans precluded from trading with any of the Allies or Neutrals. He could not understand why a high opinion of the German had been entertained. They were very fond of getting hold of other people's brains and exploiting them to get trade for their country.

Mr. F. Pooley (hon. secretary) gave some information regarding the steps taken by the Committee in regard to the matter under discussion, and intimated that further details would be given at a luncheon which would take place after further communication with the Merchant Seamen's League.

Fatalities.—A boy, aged 12, son of a Hamsterley collier, climbed an electric light pole in the street to place his cap on top. He touched a live wire, and received a 220-volt shock, which instantly killed him. A miner who tried to release his body was burned on the hands.

When taking a short cut to his home along the electric railway a man stepped on the live rail near Pinner and Hatch End Station and was killed.

Pulverised Coal Systems in America.—Mr. Leonard C. Harvey, of Red House, Malden, Surrey, has returned from the United States, after having carried out for the Director of Fuel Research a full investigation into the progress made in recent years in the application of pulverised coal for metallurgical and general industrial purposes, for steam raising in land and marine boilers, and in locomotives on railways. The purpose of the Director of Fuel Research, in accepting Mr. Harvey's offer to make this investigation, was that the most recent information on the subject of pulverised fuel should be available to all who are interested in the more scientific use of fuel.

In order that effect may be given to this intention, the information and data collected by Mr. Harvey, together with descriptions of numerous installations inspected and statements as to the actual experiences of the owners of these installations, are now being collated in the form of a report. This report will be issued as a Government publication by the Department of Scientific and Industrial Research at an early date.

Important developments have taken place in America in the utilisation in pulverised form of low-grade coals of high ash contents, and it is hoped that similar developments will follow the adoption of the system in this country. It is possible that in this way considerable quantities of material, which is at present regarded as waste at the coal mines, may ultimately be made available as fuel, and thus supplement the restricted supplies of coal.

An Electric Speedometer.—A speedometer which is intended for measuring boat speeds has been patented by Mr. R. W. E. Moore, says the *Electrical Review*, of Chicago. It comprises a thermo-couple immersed in the water; one junction is kept at constant temperature, and it is claimed that the difference between the temperatures of the junctions then measures the speed of the boat.

Institution and Lecture Notes.—Institution of Mechanical Engineers.—At the meeting on Friday last, Prof. C. A. Edwards and Mr. F. W. Willis read a paper on the resistance to penetration of metals when tested by impact with a 10-mm. steel ball, and showed that their investigation led to a new hardness scale in energy units. The method of testing eliminates the effects of time and degree of deformation, and is superior to the Brinell and scleroscope tests.

Mr. R. G. C. Batson also read a paper on the static and impact methods of testing, and Dr. W. C. Unwin discussed the Ludwik hardness test, pointing out that the use of a truncated cone instead of a ball had material advantages.

Electrical Power Engineers' Association.—The smoking concert held by the Midland Division was very successful, the attendance numbering nearly one hundred. The chairman (Mr. Legge) spoke of the extremely rapid progress of the Association, which was so successful as to excite considerable jealousy in certain quarters. This deplorable situation was not desired or caused by the E.P.E.A. The next concert is provisionally fixed for Wednesday, November 6th.

A special general meeting of the Association was held on October 16th in the Royal Victoria Station Hotel, Sheffield. Mr. F. Langley, the chairman of the Sheffield and District Section, presided over a fully representative gathering. The president, Mr. A. L. Lunn, of Manchester, and one of the vice-presidents, Mr. R. C. Atkinson, of Leeds, addressed the members. A general review leading up to recent events was the topic of the evening;

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also a brief account was given of the work of this Section, which was enthusiastically received by those present.

Institution of Automobile Engineers.—Among the papers to be read during the new session of the Institution is one on "Electric Vehicles," by Mr. Carl Oppermann, one of the pioneers of the electromobile in this country.

Institution of Electrical Engineers.—The following is the official programme of papers for the first half of the session, 1918-19 :—

November 7th, 1918.—L. B. Atkinson, the Tenth Kelvin Lecture: "The Dynamical Theory of Electric Engines." (The premiums awarded for papers read or published during the past session will be presented at this meeting.)
November 21st.—J. H. Shaw, "The Use of High-Pressure and High-Temperature Steam in Large Power Stations."
December 5th.—Prof. Miles Walker, "The Supply of Single-Phase Power from Three-phase Systems."
December 19th.—P. Hunter-Brown, "Carbon Brushes: Considered in Relation to the Design and Operation of Electrical Machinery."
January 9th, 1919.—M. B. Field, lecture, "The Navigational (Magnetic) Compass as an Instrument of Precision."
January 23rd.—A. P. M. Fleming, "Planning a Works Research Organisation."

Keighley Association of Engineers.—At a joint meeting of the Association and the Keighley Textile Society, last Saturday evening, Mr. Thomas Carter, of Newcastle, gave an address on "Some Working Principles of Electrical Machinery."

Electrical Association of Australia.—At the meeting of the Victorian Section, on August 29th, a paper on "Automatically Controlled Sub-Stations and Power Stations" was read by Mr. G. G. Cree. After referring to the remotely controlled sub-station at Detroit, which has operated successfully since 1912, the author pointed out that a degree of protection had been attained, not only to the sub-station apparatus but also to the car equipments, excelling any that could be given by the most painstaking operator. It was practicable to dispense with the services of an attendant in the majority of railway sub-stations, and it was evident that the design of converting and distributing systems would be vitally affected by these new conditions of operation.

A comparison was made between the total distributing costs of an interurban railway, operated in the three following ways :—

1. Three 600-volt hand-controlled sub-stations.
2. Two 1,200-volt " " "
3. Six 600-volt automatically controlled sub-stations.

The ratio of total distributing costs, including all charges, worked out as follows :—

1. 600-volt hand-controlled	124
2. 1,200-volt hand-controlled	105
3. 600-volt automatically-controlled	100

Between systems one and three there was a saving of 117 tons of feeder copper.

In the automatic station the protective resistance is bridged in successive steps, so that after an overload has caused the insertion of the resistance, the trolley voltage is restored to its normal value gradually. With hand-controlled units, prolonged and therefore dangerous overload of the converters may result, but in the automatic stations the current-limiting devices have the effect of a drooping voltage characteristic, and as these come into operation assistance is automatically summoned from adjacent stations, and additional machines will be started there. The protection from overload which is afforded by these automatic machines will eventually lead to economies in the construction of the rotary converters which will compensate for the additional total cost of the smaller units involved.

A 300-KW., 25-cycle, synchronous converter is delivering power 25 seconds after the voltage relay drops. Even if an operator were on the alert, he would take much longer than this.

The energy required to start and connect a 300-KW. synchronous converter is only 0·5 KW.-hour. The running-light losses of this machine are 0·34 KW.-hour per minute, and would, therefore, in 1·44 minutes equal the energy required for starting.

In a hypothetical case, the energy saved by automatic operation is 32·5 per cent. with two-hour headway, and 13·3 per cent. with one-hour headway. Obviously the automatic sub-station is absolutely necessary for the economical operation of an interurban railway with a small number of cars per day.

At a recent meeting held in Sydney, a paper was read by Mr. R. C. Simpson on the subject of "Electrotechnical Education in New South Wales."

Appointments Vacant.—Chief electrical engineer, £650, for St. Helens Corporation electricity undertaking; electrical engineer and manager, £300, for Burgh of Stirling Electricity Department. See our advertisement pages to-day.

A Magdeburg Explosion.—Seventy persons have been killed and about fifty injured, owing to an explosion at the engine works at Magdeburg.—*The Times.*

British Metals Co.—It is stated in the Press that considerable progress has been made with the scheme for a £5,000,000 British Metals Co. to promote and develop Empire Trade in non-ferrous metals, and regain trade which had been taken by the German metal interests. Mr. A. W. Tait, of the British Aluminium Co., Ltd., is among those interested in the undertaking. The company is not yet registered, but £2,000,000 of the capital is understood to be forthcoming.

Swiss Suggestions for Dealing with Unemployment.—The following proposals for remedying unemployment, adopted by the Special Committee of the Bundesrat, are given in *Soziale Praxis* for September 12th :—"All wage-earning workers in private industrial undertakings, who make by piecework or otherwise less than 14 fr. per day, are, when out of employment, entitled to unemployment relief. The proprietor, if the activities of his factory are reduced, shall not dismiss workmen, but shorten the hours of work. If this shortening amounts at most to five hours per week, or 10 per cent. of the ordinary working hours, the proprietor is not bound to compensate the workmen for the lost time. If, however, this shortening amounts to 60 per cent. of the ordinary working hours, the proprietor pays, in addition to the normal wage for the work done, a supplement which, added to the wage, makes up, as maximum, 90 per cent. of the ordinary wage. If the shortening of working hours is more than 60 per cent., or if the concern is shut down entirely, the compensation to the workman for the period of unemployment will be paid in equal parts by the proprietor, by the canton where the workman is domiciled, and by the State. The workman is bound to accept any suitable work assigned to him, otherwise he forfeits his claim to an allowance. Disputes will be settled by an Arbitration Board, on which two independent persons and two representatives of employers and employés will sit."

Calorific Value of Kent Coal.—Some remarkable testimony as to the calorific value of Kent coal was given by the engineer of the Dover electricity works at a recent meeting of the Borough Council, when he stated that working results proved that its heating power was quite 10 per cent. above that of the Yorkshire coal which constituted the bulk of their consumption. Owing to the pronounced caking quality of the Kent coal they were unable to use it entirely, as it required more draught than they had at their command. It was therefore recommended that the boilers be equipped with a system of induced draught, the cost of which for each unit would be £735, against which the engineer estimated he could effect a saving of about £650 on his coal bill. The Council decided upon the immediate equipment of one boiler, as suggested by the engineer, the cost to be provided out of revenue, and it will apply for sanction for a loan to cover the cost of similarly dealing with the other three boilers. The caking properties of the seams now being worked at Snowdown and Tilmanstone largely account for the fact that local consumers have not used Kent coal to anything like the extent they might. The excuse has been that their stokers could not keep up the required steam pressure, and complained of the extra labour in firing. The first user on a large scale was the engineer of the Folkestone electricity works, who several years ago adapted his furnaces to the requirements of the local coal, paid the whole cost out of the savings on his first year's working, and has continued to save a very substantial sum on his yearly consumption ever since. Owing to the fact that so large a percentage of slack is being produced there has been a very general tendency to depreciate the value of the coal itself, but anyone acquainted with the facts knows that its calorific value is exceptionally high.—*Iron and Coal Trades Review.*

Engineering Labour Organisation.—It is no exaggeration to say that the reorganisation of the trade unions is one of the most important of all the problems of reconstruction. A hundred years ago trade unions were fighting for life itself against the power of the law. Fifty years ago their position was insecurely established. To-day they have taken their place in the governing forces of the country. They have played a great part in the conduct of the war; they will play a greater part in the future. Consequently their efficiency and their representative authority matter to the country scarcely less than the efficiency and the representative authority of the House of Commons. Unfortunately, in respect of organisation they are as much out of date as was the House of Commons before the new Reform Bill. There are numberless craft unions looking jealously at each other, and the relations of skilled and unskilled unions are profoundly unsatisfactory. Much of their labour and money is spent on the defence of small vested interests, to the neglect of vital issues. Unless some of these problems are resolved before peace they will enormously complicate the difficulties that will follow the demobilisation of the Army and the demobilisation of the civilian war-workers. We are glad, therefore, to see that a proposal to amalgamate the craft unions in the engineering industry is now before a big conference at York. Some thirteen unions are taking part, and they represent three-quarters of a million members. In no industry has the war been so disturbing an element, and reorganisation is consequently most urgently needed. Of this industry, therefore, we may say even more emphatically than of others that the man who makes one union grow where two unions grew before is a public benefactor.—*Manchester Guardian.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Central Station and Tramway Officials.—The Huddersfield Tramways Committee has accepted, with regret, the resignation of Mr. R. H. WILKINSON, the tramways manager, who has received the appointment of manager of the Bradford City tramways. Mr. Wilkinson was thanked for his 14 years' services.

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The Hackney B.C. Electricity Committee has had the salary of Mr. L. L. Robinson, the borough electrical engineer, under further consideration. It now reports that since the date of the previous report and recommendations the chief electrical engineers of Stepney, Poplar, and many other undertakings have had granted to them the war wages and bonuses in accordance with the various awards made to the technical staffs of such establishments by the Committee on Production. It is of opinion that Mr. Robinson should be treated in a similar manner, to take effect from the date when the several awards were made applicable to the Council's staff. At present the total amount of the awards is 23s. 6d. per week and 12½ per cent. on the amount of the total earnings, and it is advised that this amount should be granted by the Council to the borough electrical engineer in substitution for the existing bonus of 16s. per week. The additional amount to be paid for the period to the end of October will be £116, and subsequently, on the assumption of the awards to date continuing at the same figures, at the rate of £162 per annum in addition to his present salary of £750 per annum.

Mr. W. J. Papworth, the burgh electrical engineer, Stirling, has received an appointment at Bristol.

Mr. E. M. Hollingsworth, having accepted a position on the staff of the chief engineer of the United Alkali Co., Ltd., has just resigned his appointment as chief electrical engineer to the St. Helens Corporation, which he has held for 16 years, having succeeded Mr. J. S. Highfield in 1903. Mr. Hollingsworth commences his duties with the United Alkali Co. in January next, and will take charge of their new electrical scheme, which includes the new power station at present under construction at Widnes, and the E.H.T. transmission system.

Mr. H. Ingham, assistant engineer to the Mexborough and Swinton Tramway Co., on leaving to take up a position with the Rotherham Corporation, has been presented by the staff and employés with a watch and card case, also a butter dish for his wife.

The War Office has informed the Barnsley T.C. Electricity Committee that Major Barker has been brought home from France for special services, and that it is impossible for him to be released for regular duties at Barnsley. The War Office has no objection to his being consulted, or giving assistance in any special matter, provided it does not interfere with his work at Woolwich. In view of this, the T.C. has decided to apply for the release of Mr. J. A. T. Carr, formerly outside assistant at the works.

For the appointment of second technical assistant at Newport (Mon.), there were 41 applicants. Five were interviewed, and Mr. T. H. Wood, chief draughtsman and clerk of works, Battersea, was appointed.

Mr. C. J. Spencer, the retiring manager of the Bradford city tramways, who is coming to the London Underground system, was the recipient, on Monday evening last, of a silver flower vase, the gift of the Tramways Committee. The presentation took place at the Town Hall, under the chairmanship of the chairman of the Tramways Committee (Ald. Enoch Priestley), and amongst those present were the Lord Mayor (Mr. H. H. Tetley), Sir James Hill, Bart., M.P., and the new manager (Mr. R. H. Wilkinson). Ald. Priestley paid tribute to the worth of Mr. Spencer, and wished him success in his new labours. Sir James Hill, under whose chairmanship the electric tramways undertaking was started, said that Mr. Spencer had been their only manager up to the present, and the fact of his being a fully-qualified electrical engineer had been of great benefit when the city had taken over and electrified the old steam and horse service. Mr. Spencer, in reply, dated the beginning of the real success of the undertaking of the Bradford tramway from the introduction of covered-top decks, when the winter receipts were almost equal to those of summer. In Mr. Wilkinson, the new manager, Bradford had secured one of the pioneers of goods traffic in this country.

Mr. Frank Castle, municipal electrical engineer, Oudtshoorn, Union of South Africa, left the service of the municipality in September, in order to take up a position with the Griffin Engineering Co., Ltd. His address is now P.O. Box 798, Mutual and New York Buildings, Cape Town.

General.—Dr. J. A. Hosker, previously vice-chairman of the Bournemouth and Poole Electricity Supply Co., Ltd., has been elected chairman of that company, and Mr. H. B. Renwick has been elected deputy-chairman.

Mr. H. E. Boaz, who recently retired from the chief electrical engineer's branch of the New South Wales Government tramway department, after 36 years' service, received a number of presentations.

Sir George Gibb has retired from the Committee on Production, and Sir Cyril Jackson has been appointed chairman.

Mr. A. Henderson, manager of the electrical department of Messrs. Scott's Shipbuilding & Engineering Co., Ltd., Greenock, has been presented with a tea and coffee set and tray by the directors, officials, and electrical department staff, &c., of the firm, on the occasion of his marriage. Mr. Henderson was on the electrical department staff of Messrs. John Brown & Co., Ltd., Clydebank, for many years before he received his present appointment 9½ years ago. We understand that he has been responsible for the electrical equipment of many very large warships and merchant ships, &c. He is a member of the Institution of Electrical Engineers' Ship Electrical Equipment Committee which is at present preparing rules for the electrical equipment of merchant ships.

Roll of Honour.—Private W. R. Y. Kneller, Essex Regiment, formerly on the office staff of the rubber department of the India Rubber Co., Silvertown, died in Turkey on October 29th, 1917. The news has only just been received. He joined up at the outbreak of war, and was wounded at Gallipoli. He was then sent out to Egypt, and was taken prisoner when the first attack was made on Gaza. Gunner S. A. Rushan, R.F.A., who was in the general office, and Private R. Blythe, Sussex Regiment, formerly in the rubber department of the same company, have been wounded. Lance-Corporal F. G. Kane, Berkshire Regiment, who was in the waterproofing department of this company, has been awarded the Military Medal.

Private J. Bowden, Royal Warwickshire Regiment, who has fallen in action, was on the staff of Messrs. Drury and Chaffe, electricians, Torquay.

Private E. C. Bygrave, who has died of wounds, was employed by the Edison Swan Electric Co., Ltd., of Ponders End.

Gunner R. Gem, R.F.A., who was articled at the Carlisle Corporation electricity works, has died of wounds.

Private J. Botten, Royal Sussex Regiment, who has fallen in action, was employed at the Dartford U.D.C. electricity works.

Lance-Corporal J. T. Rose, Guards Machine Gun Corps, who has fallen in action, was employed by Messrs. Siemens Bros., of Stafford.

Private R. D. Howard, Machine Gun Corps, who has died of wounds, was employed by Mr. G. A. Weston, electrician, Southend-on-Sea.

Private W. R. Ward, who enlisted from the electricity works of the Rotherham Corporation, has been wounded in action.

Private F. Millichamp, South Lancashire Regiment, wounded and in hospital at Whalley, was employed by the British Insulated & Helsby Cables, Ltd.

After being missing since August, news has been received of the death in action of Private J. Davies, K.O. Yorkshire L.I., who was employed by the Chloride Electrical Storage Co., Ltd., Clifton Junction.

Private H. H. Mellor, Manchester Regiment, who has died of wounds, aged 38, was employed as a meter inspector in the electricity department of the Oldham Corporation.

Private A. Kettlewell, R.A.F., who was severely wounded and died on October 12th, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Private M. Corrigan, Manchester Regiment, who died on October 4th, whilst a prisoner of war, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Pte. W. Johnson, Machine Gun Corps, who has been killed in action, was employed at the Huddersfield Corporation electric station.

Pioneer H. Brook, R.E., who has died at the front from broncho-pneumonia, was engaged at the works of the Phœnix Dynamo Manufacturing Co., Ltd., Bradford.

Pioneer S. Newbound, R.E., who has died in action, was employed in the Leeds Corporation electricity department.

Private J. Stafford, Royal Munster Fusiliers, an employé of Messrs. A. Reyrolle & Co., Ltd., has been awarded the D.C.M. for exceptional gallantry during a six days' operation. The medal was presented to him at Hebburn Theatre Royal on Thursday evening last week, together with a gold watch from the Hebburn Heroes Fund, and a gold albert from the firm and employés of A. Reyrolle & Co., Ltd. Private Stafford, who is 28 years of age, earned the medal under the following circumstances:—After his company had reached their objective he went back with important messages to battalion headquarters under intense fire; he also went out and brought in a derelict Lewis gun and ammunition, although the locality was being fiercely shelled by the enemy. He volunteered to try and get in touch with the troops on the flank of the company, and this he successfully accomplished in spite of great difficulty.

Pioneer S. Newbould, who was employed in the Leeds Corporation electricity department, has been wounded in action.

Private W. Lowe, S. Lancs. Regiment, previously reported missing, and now presumed killed, was employed at the St. Helens Cable Works, Warrington.

Obituary.—Mr. A. Hatcher.—Mr. Alfred Hatcher, who passed away recently at the age of 72, was in the service of the Electric Telegraph Co. before the transfer to the State in 1870. Subsequently he was attached to the Surveyor's Department of the G.P.O. (S.E. District) as a travelling telegraph inspector, until his retirement under the age limit in 1911. He offered his services in 1917, and for the past year had been employed at Eastbourne Head Post Office.

Mr. J. O. Callender.—We regret to learn of the death of Mr. James Ormiston Callender, Assoc.I.E.E., one of the managers of Callender's Cable & Construction Co., Ltd., at the age of 55 years. Mr. Callender passed away on 19th inst., at Swanage. We hope to refer to the deceased gentleman's career in our next issue.

Mr. W. S. Gibson.—The victims on the liner *Hirano Maru*, torpedoed by a German submarine, included Mr. William Sidney Gibson, who was on his way to duty at Capetown for the Eastern Telegraph Co.

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Mr. T. Dence.—The death occurred at Bromley (Kent), on October 12th, of Mr. Thomas Dence, a director of Messrs. Johnson & Phillips, Ltd., of Charlton. Deceased was in his 79th year.

Mr. P. E. Jones.—The death has taken place, in his 58th year, of Mr. Philip E. Jones, electrician, for many years in business at Bangor.

Mr. B. H. Adams.—Mr. Bernard H. Adams, of the Western Telegraph Co., Ltd., died at Pernambuco on October 12th.

Mr. J. F. L. Crosbland.—There passed away at Hale, Cheshire, on October 21st, in his 79th year, Mr. J. F. L. Crosland, M.Inst.C.E., M.I.M.E., M.I.E.E., late chief engineer of the Vulcan Boiler Insurance Co., Ltd.

NEW COMPANIES REGISTERED.

British Federation of Iron, Steel, Tinplate and Metal Merchants (Inc.) (word "Limited" omitted from the title by licence of the Board of Trade) (151,654).—Registered October 22th as a company limited by guarantee, not formed for purpose of profit, with an unlimited number of members, each liable for £1 in the event of winding up. Objects: To create a federation of (1) the members of all associations of persons, firms, and corporations interested in, or connected with, the business of buying, selling, importing, exporting, stockholding, and distributing iron, steel, tinplate, and metals which shall become affiliated, (2) the members of all affiliated iron, steel, tinplate, or metal merchants' sections of Chambers of Commerce, and (3) all individual merchants or merchant firms or corporations, or members or representatives thereof interested in any such businesses, and not belonging to any such association or section; to promote the discussion among members of questions affecting their interests, to watch all legislative or administrative action affecting such interests, to collect and circulate information, to afford facilities for co-operation, &c. The first members of the Executive Council are:—R. C. Hindon, 85, Gracechurch Street, E.C.; A. Campbell, Spencer House, E.C. 4; J. King, 50, Lever Street, Manchester; W. Gracie, 8, Dutton Street, Liverpool; Sir Johnstone Wallace, K.B.E., Newcastle-on-Tyne; T. Metcalfe, 23, Dean Street, Newcastle-on-Tyne; C. Wiggins, Queen's Square, Middlesbrough; C. G. Briggs, Royal Metal Exchange, Swansea; H. J. Sayer, Summer Row, Birmingham; A. S. John, 1, Vaughan Street, Llanelly; J. F. P. McInerny, 19-20, Llanfair Buildings, Swansea; E. B. Handley, 33, Temple Court, Birmingham; C. J. McAllester, 20, Vulcan Street, Liverpool; J. Miller, 24, Chapel Street, Liverpool; A. H. Robinson, 6, Rumford Place, Liverpool; J. G. Buchanan, 5, East India Avenue, E.C. 3; F. G. Martin, 4, Lime Street, E.C.; H. Falkner, 361, Old Kent Road, S.E. 1; J. E. Kidd (John Kidd & Sons, Ltd.), Salford; G. Addy, King's Chambers, Angel Street, Sheffield; H. Wilkins, 27, High Street, Sheffield; G. H. Cave, Napier Street, Sheffield; J. B. Lees, 64, Cross Street, Manchester; E. Coventry, 110, Cannon Street, E.C.; W. J. Onions, 3, New Street, Birmingham. Secretary: C. T. Everett. Registered office: 5, East India Avenue, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

International Electric Co., Ltd.—Land Registry charge dated October 10th, 1918, securing £600 charged on freehold messuage and garden, Meads Smithan, Downs Road, Purley. Holder: Cyril Woodham Mann, Ravenswood, Bexley, Kent.

Carmarthen Electric Supply Co., Ltd.—Particulars of £2,750 second debentures created September 23rd, 1918, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

CITY NOTES.

Eastern Telegraph Co., Ltd.—The revenue for 1917 was £2,901,579; ordinary expenses £770,354; maintenance of cables, differences of exchange, income and war taxes, &c., £491,963, leaving £1,639,262. Income tax and excess profits duty payable in England, debenture interest, and preference dividend absorb £809,581, leaving £829,681, plus £54,688 brought forward. £500,000 has been placed to general reserve. Dividends and bonus amount to 8 per cent., free of tax, and £64,370 remains to carry forward. Captain H. W. Grant, C.B., R.N., has been appointed managing director, Sir J. Denison Pender having become chairman.

Nairobi Electric Power & Lighting Co., Ltd.—For 1917 the net result is a small improvement over 1916. Interim dividends amounting altogether to 10 per cent. for the year have been paid, less tax, the same rate as for 1916. The units generated were 1,637,990, against 1,495,281; motors connected 793 B.H.P., against 648 B.H.P.; lights connected, 40 watts equivalent, 13,833, against 13,012. The auxiliary steam plant was used to a greater extent than in 1916, and produced about 12½ per cent. of the total units generated. War conditions have prevented the further development of the undertaking.

Victoria Falls & Transvaal Power Co., Ltd.—Net earnings for quarter to June 30th, £229,633, before providing for taxation.

Associated Fire Alarms, Ltd.—Profit £1,617 for year ended June, 1918, against £272 last year. Preliminary expenses and Dominion of Canada stock are to be written down, leaving £515 to carry forward.

Callender's Cable & Construction Co., Ltd.—Interim dividend 5s. per share (5 per cent.).

Electric Supply Co. of Victoria, Ltd.—The lamps connected at March, 1918, were 211,746, compared with 188,402 in the previous year; tramway passengers numbered 4,881,924, against 4,803,895; revenue was £95,009, against £88,238; expenditure £63,567, against £56,990; gross profit £31,443, against £31,248. The balance is £29,730, plus £16,427 brought forward. After deducting debenture interest and redemption, and paying £10,500 on account of arrears of preference dividend, £20,923 remains to carry forward.

Hurst, Nelson & Co., Ltd.—Dividend of 10 per cent. and a bonus of 5 per cent., free of tax, on the ordinary shares. £20,000 to general reserve. £12,000 is reserved for the next half-yearly preference dividend and 5 per cent., tax free, interim dividend on the ordinary shares. Carried forward £20,843.

Electric Supply Corporation, Ltd.: Correction.—On page 379 of our last issue we gave the dividend of this company as 10 per cent. This was, of course, an error, the rate being 1 per cent.

Quebec Railway, Light, Heat & Power Co., Ltd.—Total income for the year ended June, 1918, $2,027,941, a decrease of $34,952. Operating and maintenance expenses $1,235,724, an increase of $79,755. Fixed charges and taxes $696,910, leaving net surplus $95,307.

Dick, Kerr & Co., Ltd.—According to the "Financial Times," the accounts will not be completed in time for the meeting. A notice issued on October 11th that books were to be closed from October 17th to 31st is therefore cancelled, and a further notice will be issued in due course.

STOCKS AND SHARES.

Tuesday Evening.

What ardour there was for immediate peace has been modified into a state of profound gratification at the way in which the war progresses from the Entente point of view, and Stock Exchange markets find there is plenty of business *cum* unlimited confidence. Anticipation seeks eagerly to pierce the *post-bellum* prospects, but there has been a mild rally in some of the stocks and shares which fell heavily in the first rush of exuberant peace-sentiment. On the other hand, further improvements have been secured by prices of securities likely to be affected favourably by conclusion of war, and illumination shares show up well in this movement.

In the Home Electricity list, County of London ordinary have spurted 20s. to 11. City Lights added 10s. to their rise, at 12¾. Charing Cross and the West End shares are decidedly better in tone. The imperative necessity for conserving supplies of coal is thought likely to remain a factor for some time to come yet, but the investor looks well ahead, insisting that electricity and gas are certain of prosperity after the war, and that it is well to buy shares in advance. In the check to general buoyancy produced by the German reply to President Wilson, electricity shares held all their previous improvements.

Home Railway stocks have not been neglected in the present optimism. Those of the steam companies have advanced substantially during the last week, and the Undergrounds have marched with them in a quiet way. Rises of a point apiece occurred in Metropolitan Consolidated, Districts, and Underground Electric income bonds, though 'Bus "A" are 3d. easier. Central London assented deferred stock is 2 up at 62½. Potteries Traction preference went back to 11s.

Pronounced bullishness is the feature amongst all things Mexican. Bonds and shares in the utility companies have gone up by leaps and bounds within the past month, and already anomalies present themselves. It is surprising, for instance, that Mexican Light & Power preferred shares should stand almost as high as the company's second mortgage bonds. It is surprising, also, that Mexico Tramways first bonds should be within 10 points of Anglo-Argentine Tramways 5 per cent. debenture stock, which has always received its interest, whereas nothing has been paid on the Mexico bonds since September, 1914. Some think that this is an argument all to the good of the latter, in that payment of some kind must be made to them in course of time, and that any scheme for funding overdue coupons would afford a handsome "bonus." If, however, new money has to be raised for the physical needs of Mexican properties, those who pay the piper will claim to call the tune, and holders of the present bonds may accordingly find their obligations back-numbered. All this is, of course, a matter for speculation, but it deserves to be carefully weighed in the enthusiasm for Mexicans, be they railway or utility issues.

Meanwhile, Mexico Tramways common have jumped to 37, and the first and second mortgage bonds to 64 and 50 respectively, while Monterey Fives gained 2½ at 51½. Mexican Light & Power firsts rose to 70, and seconds to 51. British Columbia preference is 3 higher. Canadian General Electrics have advanced to 114½. Anglo-Argentine Trams are better, debentures and shares alike. Para Electric Railway improved to 4¾, Manila Electric capital stock to 80.

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Cable securities pursue their monotonous, and satisfactory, advances. The list of good stocks is uniformly strong. Rises are registered by Eastern Extensions, Globe preference, and Anglo-American deferred. Demand is no longer due exclusively to the payments of various dividends free of tax. The reports now in course of issue show that the concerns are doing extremely well, and that dividends could be increased were it not for the incidence of Excess Profits Duty. So the buyers anticipate the time when this shall be taken off, and the companies left free to distribute their profits to proprietors instead of paying them to the Inland Revenue, and the demand is insistent.

Marconis continued to fall until this, Tuesday, afternoon, when a rally occurred. All the various classes gave way, the parent shares crumbling to 4¼ before there was a recovery to 4½. Americans fell to 29s. 6d., and Marines touched 3 3/16 before they picked up to 31s. and 3⅜. The market explanation of the reaction was that holders came in sellers on peace prospects, and that such realisations were supplemented by profit-takers.

The manufacturing group is quiet. General Electrics have dropped 10s. to 18; British ⅛ to 2¼. Callenders fell 5s. to 10, and smaller falls took place in several of the other shares that lately have been in favour. The same trend is noticeable amongst iron, steel, and engineering shares generally, but, on the other side of the slate, improvements took place in rubber shares, which suddenly developed into a good market. Here, again, sellers came in after prices had been rushed up, and the list has receded from the top. Armament shares are beginning to harden up again, and amongst the base-metal descriptions, there has been more inclination to support tin and copper shares after their recent sharp falls.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Oct. 22, 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6⅝	—	£7 17 0
Charing Cross Ordinary	5	4	3½	—	6 3 0
do. do. do. 4½ Pref.	4½	4½	3¾	—	6 18 6
Chelsea	8	5	3⅜	—	7 16 10
City of London	8	8	12¾	+ ½	6 5 6
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	11	+1	6 7 3
do. do. 6 per cent. Pref.	6	6	9½	—	6 3 1
Kensington Ordinary	6	7	5½	—	6 17 7
London Electric	Nil	Nil	1⅜	—	Nil
do. do. 6 per cent. Pref.	4	5	3½	—	7 2 10
Metropolitan	3	4	3⅛	—	6 10 7
do. 4½ per cent. Pref.	4½	4½	3½	—	6 18 6
St. James' and Pall Mall	8	9	6½	—	6 18 4
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	6½	+ ½	6 13 6
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	100	—	6 0 0
do. Def.	1½	1½	23⅜	+ ⅛	6 8 6
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	16¼	+ ⅛	*4 19 3
Eastern Tel. Ord.	8	8	161½	—	*4 19 1
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 5
do. do. Pref.	6	6	10⅜	+ ⅛	5 15 8
Great Northern Tel.	24	22	84	—1	6 9 5
Indo-European	13	13	58½	—	5 12 0
Marconi	15	20	4½	+ ⅛	4 9 0
Oriental Telephone Ord.	10	10	3⅝	— 1/16	3 0 0
United R. Plate Tel.	8	8	7⅞	— ⅛	*5 3 3
West India and Panama	6d.	1/3	1⅜	— 1/16	*3 11 6
Western Telegraph	8	8	17½xd	—	*4 13 5
Home Rails.					
Central London Ord. Assented	4	4	62½	—	6 8 0
Metropolitan		1	27	+1	3 14 0
do. District	Nil	Nil	26	+1	Nil
Underground Electric Ordinary	Nil	Nil	2⅞	—	Nil
do. do. "A"	Nil	Nil	7/8	—3d.	Nil
do. do. Income	6	4	88	+1	*4 11 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅜	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3½	+ ⅛	—
do. do. 2nd Pref.	5½	—	3¼	+ ½	—
do. do. 5 Deb.	5	5	75	+1	6 13 4
Brazil Tractions	—	—	58	—	—
Bombay Electric Pref.	6	6	10⅜	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	61½	+ 3	8 2 8
do. do. Preferred	Nil	Nil	42½	—	Nil
do. do. Deferred	Nil	Nil	41½	+1	Nil
do. do. Deb.	4½	4½	60½	—	7 0 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	64	+4	Nil
do. 6 per cent. Bonds	Nil	Nil	50	+5	Nil
Mexican Light Common	Nil	Nil	36½	+1½	Nil
do. Pref.	Nil	Nil	49	+1	Nil
do. 1st Bonds	Nil	Nil	70	+3	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅜	—	4 2 8
British Aluminium Ord.	10	10	37/-	—6d.	5 8 1
British Insulated Ord.	20	20	2¼	— ⅛	4 9 0
British Westinghouse Pref.	7½	7½	2½	—	6 0 0
Callenders	20	25	10	— ½	6 5 0
do. 5 Pref.	5	5	5½	—	—
Castner-Kellner	22	20	3⅛	—	5 8 4
Edison-Swan, "A"	—	—	⅜	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	10	1⅜	—	7 5 6
Gen. Elec. Pref.	6	6	10⅜	—	6 2 4
do. Ord.	10	10	18	— ½	*5 11 1
Henley	25	25	2¼	—	5 11 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	—	*5 14 3
Telegraph Con.	20	20	49	—	*4 18 0

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

No changes having taken place in prices during the past fortnight the list published in our issue of October 11th holds good.

A 25,000-KW. Turbine Damaged.—One of two 25,000-KW. single-cylinder impulse turbines in the new West End station of the Union Gas & Electric Co., of Cincinnati, Ohio, was badly damaged in its seventeenth (last) stage at 9 a.m., Wednesday, September 4th. According to *Power*, the seventeenth diaphragm showed evidence of being distorted at top and bottom, causing the wheel blades to rub the diaphragm buckets, crushing and burning them, and also burning off the upper side of all blades on the seventeenth wheel. The speed was 1,800 R.P.M. This turbine, which was of the same general design as that of the 35,000-KW. single-cylinder type,* had been installed about two months. It had been satisfactorily carrying trial loads frequently during this time. On the Tuesday morning before the accident the machine was started at 8 a.m., carrying 12,000 KW. all day. At a little before 9 a.m. Wednesday, the erecting crew had about 20,000 KW. on the turbine, which carried the load well. There was no alarming vibration or sign of serious rubbing. At 9 a.m. there was a loud bang inside the casing, followed by others accompanied by violent vibration which shook the station. The throttle was immediately tripped, but the noise and vibration continued, much modified, until the machine slowed down to about 700 R.P.M., when vibration and noise ceased and the speed decreased normally. The turbine is damaged only in the seventeenth, or last, stage. The seventeenth diaphragm was lifted out and the two halves placed together on the floor, when its warped condition was plainly apparent. There were approximately 350 buckets in this diaphragm, and all but eleven were burned or crushed. The bottom and top halves rubbed badly over an arc of about 3 ft. at both the extreme top and bottom. The bottom half rubbed harder than the top half. The projection of the annular ring where the buckets were fastened in and which was near the key or fastening of the diaphragm, took the severest of the rubbing; the metal of this projection was rubbed away over the 3-ft. arcs mentioned to a depth of nearly half an inch. Other projections at these points made less severe contact. The blades on the seventeenth wheel were 28 in. long and of steel, and had a shrouding over their tips, but no rosary fastening was used. There were about 200 blades on the wheel. It is peculiar that about every tenth blade broke off immediately above where it was fastened on to the wheel; 20 blades broke in this manner, breaking clean and sharp. All the blades which remained on the wheel were burned away at their top edges. The projections on the tips of the blades did not appear to have rubbed; they merely showed the effect of having the shrouding pulled away from them. It is difficult, if not impossible, to tell the exact sequence of events. However, the machine did not overspeed, neither did it take on load suddenly or warm up suddenly. Just before the seventeenth stage let go the switchboard operator noticed that the load increased from 20,000 to 22,000 KW. That distortion of the diaphragm was the primary cause of the trouble was indicated by the fact that the projections on the sixteenth diaphragm top and bottom showed signs of rubbing on both halves. The seventeenth diaphragm was about 11 ft. in diameter over all, and the rim speed of the disk was about 1,000 ft. per second. The turbine was closed up after the removal of the damaged disk and was in operation on the Monday following, or five days after the accident. It could have been put back in service sooner had it not been kept open for the inspection of the engineers of the builders.

Improving Power Factor and Voltage Regulation.—For the last fourteen months the Duquesne Light Co., Pennsylvania, has had in operation on its lines a 7,500-K.V.A., 11,000-volt, 600-R.P.M. synchronous condenser for raising the power factor of the system and maintaining voltage regulation. After this condenser was put in service and its ability to handle the conditions was successfully demonstrated, the company ordered two duplicate machines. One of these was installed during April at the Beaver Falls sub-station, 32 miles (51.5 km.) from the Brunot's Island plant, and connected by two 66,000-volt transmission lines, each having a capacity of 20,000 K.V.A. This station is at the end of the 66,000-volt system, and the load at that point at the present time is only about 500 K.V.A., so the condenser for the present will be used for controlling the voltage, some method of regulation being necessary on account of the line impedance and the comparatively high reactance of the transformers now in use. The other set, when completed, will be placed in the Lawrenceville sub-station, where the conditions are somewhat similar. As the company expands and the load on the system increases, it will very likely continue to place synchronous condensers at the principal load centres, and the time may come, it is stated, when it can obtain practically a flat voltage curve notwithstanding variations in the power factor. Details of these machines and their operation are given in the *Electrical World* of September 14th, in an article by Mr. J. T. Peyton.

* Elec. Rev., October 4th, 1918.

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Exports and Imports of Electrical Goods during July, August, and September, 1918.

The official returns of electrical export and import business for the third quarter of the year show a falling-off of over £200,000 as compared with the previous quarter, the large increase in exports for the June quarter being due to an item of £247,000 for submarine cable in May. The figures are as follows :—July, £232,708 ; August, £246,080 ; September, £280,438 ; the record for the previous quarter being—April, £255,771 ; May, £446,448 ; and June, £156,311. For comparison we give the export totals for the September quarters of 1916-17-18 : £1,092,468, £1,077,177, and £759,226 respectively.

The returns for the past nine months show, under the adverse circumstances, a surprising steadiness in export values, the figures, after eliminating the special item for submarine cable, giving an average monthly total of £234,000.

The electrical import figures for the three months under review are :—July, £152,091 ; August, £116,656 ; September, £124,233 : these comparing with £87,164 in April, £102,316 in May, and £156,311 in June.

It will be noted that there has been a revival of lamp importation, the September glow-lamp total reaching £29,160. The re-exports of foreign and Colonial electrical material has been on a small scale during the three months, the values being :—July, £3,078 ; August, £3,331 ; September, £6,630. The principal item for September was £5,325 for glow-lamps.

Exports and Imports of Electrical Goods and Machinery during July, August, and September, 1918.

	July.			August.			September.		
	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exports.
Electrical goods and apparatus unenumerated	£34,392	£52,080	£1,201	£33,065	£52,248	£563	£25,580	£23,351	£268
Insulated wire and cable (not telegraphic or telephonic)	19,183	33	389	16,446	—	—	29,218	2,598	—
Electric glow lamps	6,779	14,520	251	7,818	2,643	393	4,095	29,160	5,325
Arc lamps and parts (not carbons)	2,683	19,952	—	4,157	—	—	684	13,580	—
Meters and instruments	11,183	8,891	200	8,131	750	17	13,461	1,713	80
Electrical machinery (including switchboards and transformers)	76,043	37,083	636	86,544	49,732	2,321	98,247	41,027	568
Batteries	8,261	7,261	6	19,025	8,320	5	8,406	5,814	292
Carbons	277	2,837	—	1,080	1,693	16	1,986	185	17
Telegraph and telephone cable, wire, and apparatus	73,907	9,434	395	69,814	1,270	16	98,761	6,805	80
Totals	£232,708	£152,091	£3,078	£246,080	£116,656	£3,331	£280,438	£124,233	£6,630

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Western Centre.

In his inaugural address as chairman of the Western Centre of the Institution of Electrical Engineers, Mr. H. I. Rogers said that all industry should be treated in the future not only as a national question, but as an Imperial one, because if the war had taught Britain any lesson it was surely the value of the Empire to the whole nation. Instead of each individual working as if he were guarding a great national trust, they were all engaged in unnecessary and destructive competition amongst themselves. Manufacturers instead of being prepared freely to exchange the results of their experience and knowledge amongst themselves, were engaged in a fratricidal war. They had now learned the advantages of protection, and (while not perhaps of Government control) of Government co-operation, and they had also fully realised the enormous importance to industry of standardising their products to the greatest possible extent. The workers in the industry, as in all others, were in a state bordering on revolution, and it would be one of the most difficult problems in dealing with the question of reconstruction to teach the worker that if he wanted higher wages, shorter hours, and consequently improved conditions of life, he must produce to the utmost of his capacity. He ascribed the extremely unsatisfactory state of affairs to the following causes :—

1. The extremely unsatisfactory method of power distribution which led to high cost of power, thus crippling the industry.
2. The policy of free imports.
3. The disadvantages of municipal control.
4. The status of the engineer.
5. The divorce of science from industry.
6. The harm often done to the industry by the consulting engineer.
7. The criminal folly of allowing merchants to compete with the home industry by selling cheap foreign manufactures.
8. The want of proper education of the worker.

Our Government, with the approval of a majority of the people, allowed foreign manufacturers to dump their products into this country without their paying anything towards our taxes or rates, making it more difficult for the British manufacturer, who was already sufficiently handicapped, to make his business a properly paying concern. The policy of municipal control of electricity supply had proved most disastrous. At the commencement of the electrical industry not much could have been said against it except on political grounds, but from an engineering point of view it had now proved to have been a gigantic mistake, which would have to be remedied immediately. The whole business must be raised to a much higher plane, and engineers must control their own affairs with perhaps Government co-operation. This would release many of our best men for industry. If the industry was to flourish as it might, the cost of power must be enormously reduced. The war had proved the enormous importance, and, indeed, the indispensability, of the engineer, and they had to see that the country did not forget it in future. How was this to be done? Had even their Institution in the part taken the proper steps to improve the status of the electrical engineer? Why had this question of obtaining a charter, which would once and for all put the matter on a right basis, not been settled. Let them see that it was pushed through energetically. He entered the strongest protest against the policy of the Institution in attempting to separate the technical side of the business from the industrial one. The thing could not be divided, and in the future the industrial side of electrical engineering would have to be looked upon as the all-important one.

Given their charter and the settlement of their little differences, was the engineer going to take his proper place in society? He was afraid not at once; they must inculcate into the budding engineer much more idea of the enormous importance of his work to national life; he must take more interest in the national life, but above all, they must see that he was very much better educated, not only from a technical point of view but also from that of a man of the world. There was not nearly enough ambition among engineers, and too many splendidly equipped men remained in the ranks of the consulting and distribution side of the industry, sometimes, alas, with an extraordinary idea in their minds that they were improving their social position.

A great effort ought to be made in Bristol and other cities where such a thing did not exist, to start a club or institution where engineers and scientific people might gather together for exchange of views, and meetings, and where a good reference library and all the technical papers, both British and foreign, might be available for the members. The present time offered a most suitable opportunity for the starting of an institution of the kind.

He looked forward to a great advance on the part of manufacturers in applying science to their work, and the consequent necessity of employing scientific men. He hoped, too, that the scandal of the low pay of the scientific worker would be done away with, and that a greater number of them would be employed in industrial work.

With the development of the industry, the consulting engineer's occupation would largely disappear. The manufacturers would be invariably able properly to advise and engineer their contracts. Consulting engineers of the future would fulfil similar functions to those of the consulting physician or surgeon. This would lead to a great increase of standardisation, which was a question of the utmost importance to the industry. His firm had been engaged for the last three and a half years in the manufacture of shells, and had found that while the wages per head had rather more than doubled, the output per head had quadrupled in value, though the price of shell had been greatly reduced since the war began. The most successful manufacturing firms were engaged in repetition work. The best example of this in the engineering world was the Ford car, the price of which had been down to practically £90, and they hoped to get down after the war to £75. Meanwhile the firm paid £1 a day minimum wage, had £17,000,000 in the bank, and had 38,000 contented workers. If these figures did not force them to see the paramount importance of standardisation, nothing would. The objection would be raised by many that if standardisation were taken too far progress would suffer, but they were quite wrong; standardisation meant bigger profits, which, broadly speaking, meant advance; it was the want of standardisation that meant stagnation in industry.

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Then again, they must see that a stop was put to the too great activities of the merchant. Of his value as an exporting agent everybody was convinced: there were firms which had been of the greatest value to the British producer, but there were too many who had directly injured the manufacturer by simply factoring foreign machinery and apparatus to the obvious detriment not only of the manufacturer, but also of the worker, and thus of the whole community, and in many cases by doing so they had helped to arm the nations who were our enemies in the field at the present time.

Perhaps the most important cause of the failure of the industry was the excessive and unnecessary competition between different manufacturers. In reply to an inquiry, one great firm said that restrictive legislation, and the fact that the home industry was not supported by Government Departments and municipal and other public bodies, were the principal reasons for its failure, and that what was wanted was that manufacturers' standard models should be accepted, and that increased standardisation was required. Another thought that hostile legislation and the policy of buying in the cheapest market were to blame.

Our workpeople wanted better conditions and higher wages, and the only way to do this was to increase the productivity of the workers. The consumer must, however, standardise his requirements. Another firm believed in commercial and technical alliances between manufacturers, leading to an interchange of the best points in the several designs of each concern, and thus doing away with the old keen competition.

A matter of vital importance to the industry was the want of properly educated workers in it. Much more interest in educational matters should be taken by the engineer. Since the commencement of the war the manufacturing engineers in Bristol had approached the Educational Committee, and asked it to afford better facilities for giving technical education to their prospective employés. In September, 1917, a junior technical school was started, which he thought was going to prove of enormous value to the industry. The boys went to the school after leaving the elementary school, and had two years' whole-time education, with a considerable technical bias, and at the same time, quite rightly, general education was by no means neglected. The manufacturers had undertaken to absorb these boys in their works when their time expired. The effect on the boys was most remarkable. He strongly recommended engineers in all districts where such a thing was possible to approach their Education Committees with a view to starting similar schools. Several firms were sending a number of their apprentices for one whole day a week to the technical school, where they received a more advanced course in technical education which would have the result of doing away, as far as these boys were concerned, with the miserably inefficient and unsatisfactory evening classes. With the spread of education amongst the workers, and the awakening thereby of a fuller realisation of the enormous importance to the nation of each man giving his best, not for any selfish purpose, but for the good of the community, he felt sure that industrial unrest could be greatly reduced. At the same time, the workers who were now in the industry must be taught to realise by practical means that production was the basis on which all wages were paid; by improved methods of production, standardisation, and the willingness of the worker to do his best, this result could be obtained, and they would be able to avoid the cloud of industrial unrest which so many feared was going to burst on the country after the war.

To sum up, what they wanted was not to buy cheaply, but to produce cheaply, and the co-operation of all branches of the industry, the scientific men, manufacturers, consulting engineers, distribution engineers, merchants, and last, but not least, the workers, was wanted to bring about the desired result. How this co-operation was to be achieved was a difficult question. They could ask for Government co-operation, and not control, in the management of the industry. He thought, too, that the Institution should at once forsake its old policy of aloofness from the industry, and take its proper place in leading them, without entering into controversial matters, in the desired direction. The old order had changed, and if competition between firms was, as it would be, reduced to a minimum, they might surely be prepared to give their knowledge and experience to the community through the instrumentality of Institution meetings freely and fully. He believed that if the Institution was prepared to act in this way it could play a great part in reconstructing the electrical industry on lines which would give it the successful future they all looked forward to.

French Glow-Lamp Output.—In a recent communication to the *Bulletin* of the Société Internationale des Electriciens, M. A. Larnaude remarks that the present capacity of French glow-lamp factories amounts to 15-20 millions of lamps per annum, but this figure may be doubled in the near future. The tonnage required for the transport of materials needed in this industry is small, and one ton of ore will provide sufficient material for 3,000,000 lamps. An important element in the manufacture of gas-filled lamps has been the production of argon required for the smaller types. This gas is now being made in considerable quantity by the process of M. Claude.

THE FUTURE OF WOMEN IN ENGINEERING.

In an address delivered before the Conference of the National Union of Women Workers, on October 8th, Mr. Ben. H. Morgan stated that throughout the country there were no fewer than six millions of women employed on works of various kinds. Approximately, a million women were employed on munitions work in engineering and allied trades. This was the great new departure of the war—one million women suddenly projected into a highly technical industry, requiring on the one side a large measure of knowledge and skill, and on the other the utmost physical endurance. These women were producing no less than one-third of the total output of munitions. There were thousands of women engaged on turning operations which involved a considerable measure of skill, some working to 1/1,000th of an inch. Many of these women set up their own work and tools, and ground their tools. They not only did plain turning, but non-repetition work direct from drawings, some, again, working on pieces with seven or eight measurements, practically all using gauges of various kinds, and many using micrometers. While many had acquired a large measure of skill, extremely few could be regarded as skilled in the same sense that men were skilled after having served an apprenticeship to the trade.

In fitting, women had not been so successful as in turning, but nevertheless very large numbers were employed on subdivisions of what was regarded as skilled work. Women were doing all ranges of drilling work; this was a line of work in which women had been as successful as men.

In milling, shaping, slotting, and planing women were executing a great deal of work, and many were capable of setting up in the machine and carrying out a wide range of simple jobs from working drawings. The war had not, however, produced a skilled woman miller or planer. In planing the setting-up was nearly always done by a skilled man, and the woman acted as a machine minder.

Women had made exceptional progress on the marking-off table, reading the most complicated drawings, and using measuring instruments with much greater facility than the average male apprentice. Women had made excellent tracers, and in some cases could piece drawings together, but there were no women draughtsmen at the present time. Acetylene welding was a branch in which women were eminently satisfactory. Women were specially capable of being trained in woodworking, and in the operating of woodworking machines. They were also doing extraordinarily good work in the laboratory as assistants in research work; in the testing room, testing metals, instruments, and engines; in the smithy, the forge, and all kinds of metal-shaping and heat-treating work.

What part were they going to play in our premier industry after the war? There was no more serious question than this for the National Union of Women Workers to consider. Women had opened up a vast field of activity which they should never again relinquish. When peace came, bringing with it the demobilisation of our armies, men would very justly wish to resume their places in the engineering factories of the country. But when this position had been liberally and generously dealt with, vast opportunities would present themselves to women in both the trade and the profession of engineering.

The conference should carefully examine the work which women had done, and estimate what special branches of engineering women should be encouraged to persist in after the war. In some branches of work they were as good as men in both quality and output; in other branches they were superior to men in both respects, while in a large number of other sections of work they were inferior to men, and in peace time they should be discouraged from pursuing any operation in engineering practice that was unsuitable to them.

INDUSTRIAL COAL ECONOMY.

On Saturday, October 12th, Mr. David Wilson, Technical Adviser to the Coal Controller, gave an address to the Association of Engineers-in-Charge on the above subject.

Skipping the opening paragraphs, we will begin to abstract the address at the point where Mr. Wilson tells his audience at least to make an effort to cover as much of the field in this country as possible, and to gather information at first hand. He fears that there has been a little too much selfish pride in individual effort, and is doubtful whether we are progressing as quickly as we ought. We have got to recognise what is being done elsewhere, and go one better. He continues:—

It is my desire to confine myself as far as possible to suggestions which might materialise in the immediate future. I leave the larger economy suggestions which embody reconstruction, &c., and must therefore be post-war, to those possessing greater experience than myself.

The total consumption of coal in the British Isles during the year 1917 can be taken at approximately 180 million tons, and of this amount, approximately 7,500,000 tons

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were consumed by the electrical industry, or, say, 4 per cent. The total number of units generated during 1917 was approximately 5,000 millions, so that the average efficiency is represented by a figure of 3.36 lb. per KW.-hour generated. The total coal used by industrial firms, exclusive of railways, coasting steamers, gasworks, and domestic purposes is approximately 100 million tons per annum, and of this, it is estimated that 80 million tons are used per annum directly for power production.

Bearing in mind, therefore, that the electrical industry is collectively the most efficient consumer of coal so far as steam raising is concerned, we cannot expect from this industry any great reduction in total tonnage as a result of further economy.

The absence of detailed information is responsible for a great wastage of coal. The electrical industry has done well in establishing detailed records, but the want of definite knowledge regarding the working of steam plant in many industrial undertakings is deplorable. The Coal Controller sent out a simple questionnaire to all industrial firms in the country, and if the answers had been even approximately correct, I could have put my finger on each inefficient works. I discovered that a great number of the firms had simply approached the boiler contractors or insurance companies, and asked them what number they should multiply the coal tonnage by to get the evaporation figure. I of course fully appreciate the difficulty involved in establishing and maintaining records, but the best managed electrical undertakings have succeeded in doing so, and it should be possible for all industrial firms to at least approach the methods of the key industry. The Coal Controller's records show that even the electrical industry can do much more in this direction.

Coal consumptions vary from 2 lb. per unit to 18 lb. per unit, and the thermal efficiency from 3 per cent. to 16 per cent. The common reply from the inefficient station is that the bad results are due to poor load factor, obsolete plant, &c. But there is too much tendency to let it go at that. How many engineers could supply the detailed information such as the Victoria Falls & Transvaal Power Co. tabulates each week? It is forthcoming from many stations. It should be forthcoming from all stations.

The first thing to do is to establish definitely what each section of the plant is doing. It is unfortunately a fact that in many establishments no interest whatever is taken in the fireman or his work. His selection is often decided more on account of his muscular attainments than upon his ability to burn coal efficiently. I believe that much could be done at once to assist the present coal situation by getting engineers to devote more time to the boiler house. America has done much in this direction. No boiler house of any size should be without some staff fully trained in the scientific combustion of coal. I know of one power station where the engineer in charge is giving weekly lectures to the firemen, which are greatly appreciated, and producing improved results in the boiler house. I suggest that a course of such lectures be given to every boiler house staff, and I shall be pleased to forward information suitable for such lectures to engineers desiring the same.

Much good can be done with simple and obtainable testing apparatus; when I say that relatively few works possess even the pyrometer draught gauges, &c., necessary for intelligently controlling efficiency, it will be agreed that there is much ground to cover before we can say that everything possible is being done. If the average efficiency is going to be raised, the daily performance of each individual boiler should be very closely watched. Every plant should have some simple form of CO_2 analyser. Whilst it is too much to expect in these times that a recorder be fixed to every boiler, one or two "Orsat" sets should be in daily use in every boiler house—an inexpensive, but reliable, piece of apparatus. Much can be done with a few pyrometers, and there is no reason at all why works should be without some fairly reliable data as to the temperature of the escaping gases—yet it is the exception rather than the rule to find such data. In those works, where the average for the complete plant is taken, I would suggest that further economy will follow the close study of each individual unit. Again, I think that arrangements should be made for more accurately determining the actual steam consumption of individual plant. In too many cases do I find that the figures are simply based upon contractors' original guarantees.

I anticipate your question: "What is the good of discussing efficiency when the quality of coal is so variable?" With all due respect, I do not think anyone should approach the problem in that spirit. The present coal crisis confines us very largely to a question of supply and demand. Of course, the highest thermal efficiency is obtained when burning the highest quality coal, but the commercial economic result may be in favour of the low-grade fuel at works where it can be obtained at a low enough price. I have obtained the same thermal efficiency on test with low-grade fuel as with high-grade coal, but with the latter, the good results are maintained automatically after the proper conditions are established, whereas with the low-grade fuel, the fire requires constant attention if the same high efficiency is to be maintained. Whilst, therefore, it is quite possible to show approximately equal results on test, the difference on a month's run may be as much as 10 to 15 per cent., depending upon the amount of attention given to the fires by the boiler-house staff. Some of the best stations in the country have established high thermal efficiencies when using low-grade fuel. For instance, the highest result on record is at an electric power station in the North of England, giving an overall thermal efficiency of 16 per cent., using coal having an average calorific value of 10,000 B.TH.U. per lb. The Victoria Falls and Transvaal Power Co. uses coal having a low average value, and a large quantity having a value of only 7,000 B.TH.U., and the results are excellent. Low-grade fuel cannot therefore be taken as a complete explanation of the serious inefficiency of many works.

Whilst there is a general shortage of other fuels, there is a considerable quantity of anthracite Rubbly Culm available for those who can use it. I believe that the majority of firms could take a small percentage of this fuel to mix with the more bituminous fuel, irrespective of the boiler margin or type of furnace, and I suggest that in this direction all can assist by making a special effort to burn as large a quantity of anthracite fuel as possible. It is to the advantage of the nation to consume as much coke as possible in lieu of coal, as in the preparation of coke all the valuable by-products are recovered. There has been far too much prejudice in the past in connection with the burning of coke; it is surprising to note the quantity of coke which is now being consumed at works where the managers had hitherto claimed that such fuel was totally unsuitable. On a hand-fired boiler, a distinct thermal advantage is obtained by using coke, for the simple reason that the hydro-carbon loss which immediately follows the firing of bituminous coal is obviously absent in the case of coke. With many types of mechanically fired boilers this advantage does not occur, but in both cases the use of coke fuel is limited by the quantity which can be consumed per hour on a given grate area and with a given draught. Apart from special appliances, a large number of firms are now burning a percentage of coke mixed with coal. In many instances the two fuels are simply mixed in the bunkers, and the amount which can be used in this way without reducing the output of the boiler plant seems to vary from 5 to 50 per cent.

The London County Council is now consuming considerable quantities of crushed coke on chain-grate mechanical stokers. In one section of the plant coke is being burned alone, and in another section experiments with coke mixed with coal are being made on what is known as the "Sandwich" system. This system consists in placing a division plate in the stoker hopper. The coal is fed into the back portion of the hopper and the coke into the front portion, so that the combined fuel enters the furnace in two distinct layers, the coal being on the top. The volatile gases given off from the bituminous coal on the top maintain the fire brick arch in an incandescent state, thereby establishing early ignition of the fuel bed at the fire door. The results obtained from this system are most promising, not only at the L.C.C. works, but also at other works throughout the country, where the same arrangement is being tried. I believe that the L.C.C. engineer has succeeded in burning a half-and-half mixture of coal and coke in this way, without suffering any appreciable decrease in output.

Whilst it has been possible to obtain a fair idea of the average thermal efficiency of the electrical industry, it is practically impossible to obtain even a fair approximate estimate of the efficiency of industrial firms. At a rough guess, a 50 per cent. boiler efficiency would certainly not be too low, and when we bear in mind that many individual experts have established that a modern boiler unit complete with stoker, superheater, and economiser will give a combined efficiency of at least 80 per cent. on test, it behoves us to fully explore the margin of difference between test conditions and actual working conditions, as we find them throughout the country. There are far too many boilers around the country installed without stokers, superheaters, or economisers; as opportunity offers, steps should be taken to complete such installations so that the final temperature of the gases entering the chimney does not exceed 350-400 deg. F. I suggest that it is possible to bring up the average efficiency of the boiler house to a figure more closely approaching that of test conditions.

Then there is the question of feed water temperature. It is estimated that 1 per cent. of fuel is saved for every 11 degrees rise in the feed water temperature, provided the heat producing this rise in temperature would otherwise be wasted, yet in a great many works heat is being thrown away which could easily be recovered for heating the water. Only this week I had a case before me where pure hot water was being discharged into a drain to an extent which if directed to the boilers would produce a saving of 15 per cent. in fuel. The exhaust from at least a portion of small auxiliary plant should be directed through an oil separator to the feed-water tank, rather than to a condenser, until a maximum temperature of, say, 200 deg. F. is obtained, and in the case of reciprocating engines, it is often more economical to give the feed-water temperature first consideration, in preference to high vacuum; in fact, I predict that the whole question of exhaust steam heating will receive consideration in the future. This will not be limited to the confines of the power station, but will extend

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to the possibilities of domestic heating, &c., in a way which may completely revolutionise our previous ideas.

When we think of the billions of latent B.TH.U. in the condenser cooling water which are daily discharged to heat our atmosphere and rivers, for no beneficial purpose, and remember that the recovery of this waste would enable us to utilise from each pound of coal at the very least, 50 per cent. of the heat energy contained therein, instead of the present miserable maximum of 18 per cent., we ask ourselves whether after all we are not working at the wrong end of the stick. Arising out of the above, I would refer to the B.TH.U. discharged during the operation of "blowing down" boilers. We are really barbarous in our treatment of the innocent "B.TH.U." We first try to cremate him, and whilst numbers get past our sentries and escape up the chimney, others who have remained to do a bit more fighting in the first trench, are promptly captured and pushed down a drain pipe to be effectively suffocated—whilst the astral bodies of the remainder pass on to the engine, only to find large battalions thrown into the river to meet final death by drowning. "Blowing down" boilers is, of course, essential, but the amount necessary naturally depends upon the care given to water treatment.

In conclusion, I would say a few words about my mission with the Coal Controller. We all detest the necessity of Government control, and no one detests this necessity more than Sir Guy Calthrop. The Controller has always been most anxious to reduce inconvenience to a minimum, and at the very beginning he desired the assistance of some person who could stand between him and the consumer, first, to advise and protect him against any unjust technical opposition on the part of the consumer as to the allocation of coal, and secondly, to protect the consumer against the allocation of any particular coal which might be unsuitable. During the past year I have investigated 3,100 cases on behalf of the Controller, and the majority of the complaints could not be substantiated. Here you have one of the things which make control a necessity. Every technical complaint received by the Controller has received most careful consideration, and, wherever necessary, a technical representative has actually visited the works and considered the conditions on site, so that the Controller received detailed and accurate guidance as to his decision. He has also recognised that whilst so many are doing their utmost to help, there are others who are not doing their full share, and in fairness to the former he is anxious to see that the whole team pulls together, and when this is achieved, a very considerable saving in coal will result to the benefit of the nation and the consumer individually. He therefore started a coal economy campaign, and whilst it has only been in operation for a short time, the prospects are quite hopeful

It will be necessary to investigate 36,000 cases, and out of 364 works visited during the first few weeks, a saving of 106,000 tons per annum is estimated. Four hundred engineers have very kindly given their part services voluntarily, and these gentlemen will each actually visit a group of firms within their local radius, reporting to headquarters any evidence of inefficiency, and answering a detailed questionnaire which has been specially drafted for the purpose. We have endeavoured to cast over the whole country an economy net, having a large mesh in order that it may be operated quickly, and even if a large percentage of the special industrial fish slip through, the remaining result will be of more direct assistance to the immediate coal situation than if we had waited for a perfect net of small mesh which would produce an ideal haul. As it is, I except a saving of several million tons.

I have not said anything new, but if I have by chance planted a germ of thought in any direction, I hope it may develop. Do not wait until the Controller asks you to do certain things—do them on your own initiative.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

16,231. "Electromagnets." E. N. HOLDER. October 7th.

16,242. "Ignition tester for internal-combustion engines." W. CARR. October 7th.

16,248. "Mounting for wireless keyboard on aircraft." C. F. HUDSON. October 7th.

16,250. "Replacing electric fuses." R. HACKING. October 7th.

16,251. "Electrical conductors." S. O. COWPER-COLES. October 7th.

16,261. "Means for attaching shades to electric lampholders." T. CRACKNELL. October 7th.

16,268. "Locating-device for overhead electrical supply wires for tramway cars or locomotives." J. C. M. MADAGAN. October 7th.

16,269. "Electric regulating resistances." E. A. B. TORNBLOM. October 7th. (Sweden, October 8th, 1917.)

16,278. "Electrically-heated water services and systems." H. A. GILL AND A. E. WOODS. October 7th.

16,297. "High-frequency electrical signalling." WESTERN ELECTRIC CO. (Western Electric Co., U.S.A.) October 7th.

16,337. "Electric signalling systems for mines, &c." AUTOMATIC TELEPHONE MANUFACTURING CO. & C. REMINGTON. October 8th.

16,359. "Ignition arrangements of internal-combustion engines." F. W. LANCHESTER. October 8th.

16,368. "Vibrating contacts." A. B. WOOD. October 8th.

16,374. "X-ray tubes, &c." W. D. COOLIDGE. October 8th. (U.S.A., December 4th, 1917.)

16,388. "Ignition systems for internal-combustion engines." A. H. MIDGLEY & C. A. VANDERVELL & CO. October 8th.

16,408. "Apparatus for attachment of electric wires to terminals." H. WINDIBANK. October 9th.

16,409. "Name and number index for telephone apparatus." W. H. DUNKLEY. October 9th.

16,240. "Device for utilising flow of rivers for generating electric power, &c." W. ANDERSON. October 9th.

16,429. "Ball-pivot bearing for contact-breakers." G. W. FINCH. October 9th.

16,444. "Electric welding." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) October 9th.

16,458. "Telephone apparatus." J. W. BETT. October 9th.

16,469. "Electrical speed-indicator." H. N. COBBOLD. October 10th.

16,482. "Electric switches." SIMPLEX CONDUITS, LTD., & L. M. WATERHOUSE. October 10th.

16,491. "Means for controlling alternating currents." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) October 10th.

16,522. "Electrical relays." H. G. BARWELL, EASTERN TELEGRAPH CO. AND W. JUDD. October 10th.

16,536. "Bayonet-joint sockets for electric lamps." F. J. O'NEILL. October 10th.

16,546. "Trolly guide for electric tramcars." C. E. BRAND. October 11th.

16,549. "Apparatus for electric welding." J. CRICHTON. October 11th.

16,570. "Sparking plugs for internal-combustion engines." J. E. BARROWS AND F. MURTAGH. October 11th.

16,575. "Electric switch." F. J. BROOKES. October 11th.

16,576. "Method of securing electric circuit wires in concrete structures." T. KEENAN. October 11th.

16,582. "Automatic telephone systems." W. CROSS & D. S. HULFISH. October 11th.

16,600. "High-tension distributor for multi-cylinder internal-combustion engines." AKT. GES. BROWN, BOVERI ET CIE. October 11th. (Germany, October 20th, 1917.)

16,612. "Portable electric lamps." ETABLISSEMENTS L. ROSENGART. October 11th. (France, October 27th, 1917.)

16,631. "Ignition magnetos for internal-combustion engines." A. ALLTREE. October 12th.

16,653. "Portable accumulators." J. H. BERRY & D. W. JOHN. October 12th.

16,659. "Protective arrangements for electric distributing cables, &c." ELECTRICAL IMPROVEMENTS, LTD. October 12th.

16,669. "Means for utilising waste heat in electrical machinery and apparatus." H. F. J. THOMPSON & T. H. WOOD. October 12th.

16,673. "Current-regulating devices for electrically-heated crucible retorts, muffles, melting furnaces, &c." MORGAN CRUCIBLE CO. & C. W. SPEIRS. October 12th.

16,675. "Measuring instruments." IGRANIC ELECTRIC CO. October 12th.

PUBLISHED SPECIFICATIONS.

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1917.

13,318. ELECTRIC IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. G. E. Turnbull. September 17th, 1917. (119,073.)

13,341. ELECTRICAL DRIVING OF MACHINES. A. Berges. November 6th, 1916. (111,463.)

13,420. ACCUMULATOR ELECTRODE GRIDS. S. Willmer & Apex Electric Accumulator Syndicate. September 18th, 1917. (119,076.)

13,473. RECTIFICATION OF ALTERNATING CURRENTS OF ELECTRICITY. S. A. Pollock. September 19th, 1917. (119,081.)

13,542. MEANS FOR SUPPORTING ELECTRODES IN IONIC TUBES FOR USE MORE PARTICULARLY IN WIRELESS TELEGRAPHY. Osram-Robertson Lamp Works and O. Durdle. September 20th, 1917. (119,088 and 119,089.)

13,547. ELECTROPLATING APPARATUS. J. E. Evans-Jackson (G. T. Potthoff). September 20th, 1917. (119,091.)

13,848. ELECTRICAL SYSTEM FOR INDICATING AN ALARM OF FIRE OR SUCH LIKE SIMULTANEOUSLY AT ANY REQUIRED NUMBER OF POINTS OR STATIONS. A. W. Brown. September 26th, 1917. (119,099.)

13,853. ELECTRIC ACCUMULATORS OR SECONDARY BATTERIES. F. la Roche. September 26th, 1917. (119,100.)

14,187. ELECTRIC HAND LAMPS. M. J. Railing & T. Taylor. October 2nd, 1917. (119,105.)

14,348. MAGNETIC SEPARATION OF METALS OR MAGNETIC BODIES FROM OIL FLOWING THROUGH OIL CIRCUITS. D. Brown & Sons and W. H. Child. October 4th, 1917. (119,110.)

15,040. ELECTRIC ADAPTERS AND THE LIKE. N. McLean. October 17th, 1917. (119,119.)

16,120. PROCESS AND APPARATUS FOR MAINTAINING A CONSTANT VOLTAGE IN LIGHTING CIRCUITS. Akt. Ges. Brown, Boveri et Cie. November 11th, 1916. (111,286.)

16,701. ELECTRIC CIGAR LIGHTERS, PIPE LIGHTERS, AND LIKE APPARATUS. M. J. Railing & R. J. H. Hill. November 14th, 1917. (119,141.)

16,721. LAMPHOLDERS FOR ELECTRIC LAMPS. Fuller Accumulator Co. & A. P. Welch. November 14th, 1917. (119,142.)

16,825. INCANDESCENT ELECTRIC LIGHTS AND SIGNALS. R. J. Rae. November 15th, 1917. (119,143.)

18,689. METHOD FOR TRANSFORMING BY HEATING IN AN ELECTRIC FURNACE ANTHRACITE, COKE, AND OTHER MATERIALS RICH IN CARBON INTO A PRODUCT SUITABLE FOR THE MANUFACTURE OF CARBON ELECTRODES. S. E. Sieurin. December 15th, 1917. (119,164.)

19,126. ELECTRIC INSULATORS. Soc. Ceramica Rivhard-Ginori. December 27th, 1917. (Addition to 24,631/14.) (119,166.)

1918.

2,006. ELECTRIC CONDUCTORS. Fuller's Wire & Cable Co. and G. Fuller. February 4th, 1918. (119,178.)

4,342. ELECTRICALLY-PROPELLED ROAD VEHICLES. Edison Accumulators, Ltd., and J. F. Monnot. March 12th, 1918. (119,192.)

7,074. ELECTRO-DEPOSITION OF IRON. F. A. Shepherd and Brazil, Straker and Co. April 26th, 1918. (119,200.)

9,323. ELECTRICAL INSULATING BUSHINGS. British Westinghouse Electric and Manufacturing Co. June 8th, 1917. (116,892.)

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THE

ELECTRICAL REVIEW.

VOL. LXXXIII. NOVEMBER 1, 1918. No. 2,136.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

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SOME ANXIETIES.

UNLESS the Enemy is already prepared to concede the entire armistice demands of the Allies, we may expect the diplomatic proceedings leading up to the signing of Peace to last over a considerable period. There are plenty of signs that those who, at the dictation of their War Lords, began the war when others were unprepared for it, are now eager to end it as quickly as possible. On the Allied side there is no disposition unduly to hurry the end lest the way be left open to another and even more terrible conflict at some later date. That the Allied peoples desire the end of a carnage into which they were forced quite against their inclinations is everywhere recognised, but it would be utter folly—and, indeed, a crime against future generations—if we were to sacrifice the whole cause of civilisation by any precipitate action which would give us an incomplete Peace. We believe it to be the determined resolution of the Allied peoples and of the Allied statesmen to exercise patience and avoid disaster.

It is, however, extremely important that while we continue to get on with the war we should have constantly before us in these days the certainty that such activities will not continue much longer. With the approach of the end, welcome as it is, we find ourselves at one of the most serious crises of the whole war period. No surprise need, therefore, be expressed at the anxiety which exists in some quarters concerning the position in which thousands of works and millions of workers, and millions of fighters, will find themselves when the last shot has been fired and the order to cease manufacturing has been issued. Manufacturing interests which have been almost entirely devoted to munitions production want to know something about the winding-up of their contracts, the awarding of compensation where conditions justify it, and what arrangements have been made to find employment for war workers in their factories. A question on these points has been asked in Parliament, and the reply is to the effect that the Government has long had such matters under consideration, but cannot at present make a statement about them. This hardly suggests that in the Government mind there can be any expectation of early cessation of large-scale munition manufacturing, though statements have appeared in several papers concerning large discharges of labour which have been already effected. It has long been understood that some shillings a week unemployment insurance will be paid, with, in approved cases, free railway passes back to their former homes. But it is the whole plan that we want to have published as soon as practicable and politic.

A week or two ago it was stated that the War Pledges Bill was soon to be before Parliament, but from replies in the Commons on Monday, it seems that the question of the redemption of pledges regarding restoration of trade-union conditions, though before the Cabinet, is not very far advanced, for Dr. Addison "has no doubt" that both employers and employed "will be consulted" about the matter. According to Mr. Rowntree the workers are getting into a "very doubtful condition" owing to the indecision of the Government on this matter. We are inclined to think that a frank and full statement by a strong Government, to the effect that experience has proved the impracticability of attempting to redeem these particular pledges, would be justified in the long run.

The present crisis is inevitable, but it is none the less serious because of its inevitability. It is the uncertainty of the situation that occasions anxiety, and we can only hope that the Government has very definite plans made which it will announce as soon as possible. It does not seem

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too much to ask that controlled firms may be told, even now, what course it is proposed to adopt in case of such an eventuality as a speedy complete collapse of the enemy.

Very closely related to the possible cancellation of contracts and cessation of munitions production are the questions of economic policy and the new occupations for munition workers. The schemes for demobilisation of the fighting forces have been worked out very fully, and a good deal is known by the public as to the lines along which we shall proceed. The demobilisation of the workers in these islands is probably a question of even greater urgency and difficulty, yet the plans are not known, though probably they have been worked out. It may be that it is not desired to disturb the workers while still in the midst of very essential tasks by suggesting how great will be the difficulties of the coming days. But the controlled firms naturally want to know what sort of conditions they will have to face, so that they may make preparations. In regard to economic policy, that is still dependent upon inter-Allied arrangements; but we are promised a statement in Parliament at an early date. Furthermore, we are to have a General Election shortly, which probably will settle the broad principles to be followed by the nation and Empire during the next few years. For the good of the industrial life of the Empire the issue of the General Election is a matter of the first importance. It seems to us that if the political situation develops in such a way as to inspire confidence there will be less reason for anxiety as we face the financial problems of the future and try to modify the burden of excess profits taxation on new and vital industries, and to discreetly relinquish Government control of certain trades. The sooner we have in power a strong representative Government which will place in the foremost position the well-being of the entire nation during the critical early years of Peace, and will render secure the foundations upon which we may build a permanent home of prosperity and contentment for *all* our people, the sooner we shall remove some of the pressing anxieties which possess many serious minds just now. Our pious aspirations about industrial peace, educative as speeches may have been, will avail us little—the repetition of well-worn platitudes is becoming a trifle wearisome. A strong and wisely led Government, unmistakably representative of the voice and will of the people, and expressly put into office by a vastly increased electorate will do more to ensure Industrial Peace than many things that we may suggest. The seed that has been sown during the past few years concerning industrial relations will germinate and bear fruit more satisfactorily under such a *régime*, for of all the terrors from which we need to shrink, if we have the well-being of the nation at heart—Bolshevism, in whatever attractive garb it may bedeck itself, is the worst.

In regard to our schemes for demobilising the fighting forces we shall all have to approach this question with great patience, as well as with special foresight. The Minister of Reconstruction recognises that there are hundreds of thousands of men in the Forces who have not had the opportunity of earning big wages as multitudes of others have been able to do in the security of Home. It cannot be stated too often that it is because men have fought and run supreme risks abroad that others have been enabled to have a good time here. It is only the most elementary form of justice that under our scheme of demobilisation the Forces should return as early as possible to satisfactory employment. No doubt their just claims will be recognised by munition workers as readily as by anybody, but we have to negotiate some very difficult situations. Dr. Addison has promised that the demobilisation plans of the Government will be made public in detail very shortly—and they will be awaited with interest. In the main, the scheme is described as "demobilisation for industrial purposes"—that is, the release of men according to industrial requirements, whatever military unit they may happen to be in. The demobilisation of a whole battalion would be a comparatively easy matter, but a selective demobilisation according to qualifications requires extreme care and much labour. Long service, marriage, &c., will affect the course of action as well, but the industrial well-being of the nation must be carefully considered and provided for, and regard must be had to grades of industry and to the available raw material. No doubt many manufacturers, traders, and others, including masters of small businesses, will have been thinking a great deal about the place of the "pivotal" man in connection with their own coming works and business developments, and we expect that they already have in contemplation requests for the early return of particular managers, special staff men, &c., upon whom will depend the preparations for the return of the rank and file to industrial life.

We are all eager to "get a move on" with our practical measures for reconstruction and for the resumption of normal industrial operations, under whatever altered conditions experience has imposed. Let us hope that the Safe and Permanent Peace for which we all pray will come speedily, so that such may be possible.

The I.E.E.

On Thursday next, the London meetings of the Institution of Electrical Engineers will be resumed, and it will be noticed that the first item on the programme on this occasion is the Kelvin lecture, to be delivered by Mr. L. B. Atkinson; the list of papers given in our last issue covers a variety of subjects, and shows that the session will be full of interest from the technical point of view.. But that is not the only important aspect of the Institution's present-day activities. A glance at the "Institution Notes" of the last two issues of the *Journal* indicates that the Council and its numerous Committees have in hand a very heavy and exacting catalogue of undertakings, some of which are of immense importance to the electrical industry; in particular, we would draw attention to the inquiry which is in progress with regard to the Board of Trade Reports on Electric Power Supply and Electrical Trade after the War; the proposed development of the Provincial Centres of the Institution; the formation of a "Commercial Electrical Development Committee"; the Conference on Overseas Engineering Trade; the Electrical Appointments Board; and the National Electrical Proving House. Most of these references speak for themselves; progress in each case will be watched with the keenest interest, and we hope that the new practice which has been adopted by the Council, somewhat gingerly perhaps, of keeping the members informed as to its doings will be continued and extended, for we believe that a large proportion of the dissatisfaction which has undoubtedly been felt by them in the past has been due to ignorance of the nature and extent of the Council's labours.

There is one item, however, of which the significance may not be readily appreciated. It was announced in the *Journal* for June that a Committee had been appointed to prepare a scheme for the formation of an Electrical Cooking and Heating Association; in July it was stated in an unobtrusive paragraph that as the result a new body entitled the "Commercial Electrical Development Committee" had been formed, which was "a separate organisation independent of any Institution or Association." We most cordially welcome the inauguration of this body, which, free from the trammels of tradition, will be able to fill the gap in our organisation to which we have so often drawn attention; it should take the place of the ill-fated Industrial Committee of the I.E.E., and of the similar Committee of the I.M.E.A., and do the work that is so ably carried on by the Society for Electrical Development and the N.E.L.A. in the United States, to the great advantage of all branches of the electrical industry.

But the items mentioned above by no means exhaust the programme outlined by the President in his inaugural address—a schedule of reforms which we should think beyond the power of any man to carry out in its entirety. We are certain that he will do his utmost to that end, for which purpose he accepted office for a second year, and, in particular, we hope that his dearest wish will be achieved—the acquisition of a Royal Charter for the Institution. That matter was forcibly referred to by Mr. H. I. Rogers, as chairman of the Western Centre, and we trust that other chairmen will follow his admirable lead, and that the members generally, for their own benefit and that of the electrical industry, will give the most cordial support to Mr. Wordingham in his heavy task.

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ELECTRIC TRACTION ON THE CENTRAL ARGENTINE RAILWAY.

(*Continued from page* 389.)

The protective gear used for all high-pressure apparatus in the power station and on the system is of the Merz-Price type. Low-pressure panels with oil switches are equipped with overload trip coils and time limit fuses.

When the scheme was under consideration the split-conductor system of feeder protection had not been sufficiently tried out to justify its adoption in foreign work of such importance. Accordingly, the high-pressure transmission system consists of 20,000-volt underground feeders, with three simple cores, and of pilot cables for the protective devices. A system of telephone cables was also installed. Two high-pressure cables are laid through the streets from the power station to the nearest point of the electrified railway track. Then they run, one on each side of the line, to Olivos sub-station, the western one being looped into Victoria power and lighting sub-station. A third feeder is taken from the power station to Olivos along the track *viâ* Anchorena. Two feeders run from Olivos sub-station to Palermo sub-station, and two from Palermo sub-station to Retiro power and lighting sub-station.

The high-pressure cables are 0·1 sq. in. in section, and the pilot cables for the protective gear are 0·005 sq. in. in section, all being three-core paper-insulated, lead-covered, single-wire armoured; the telephone cables are eight-pair, dry-core, air-spaced, paper-insulated, lead-covered, single-wire armoured, and suitable for the use of superimposed circuits where necessary. Both below and on top of the armour all cables are served with specially-compounded waterproof preservative coverings.

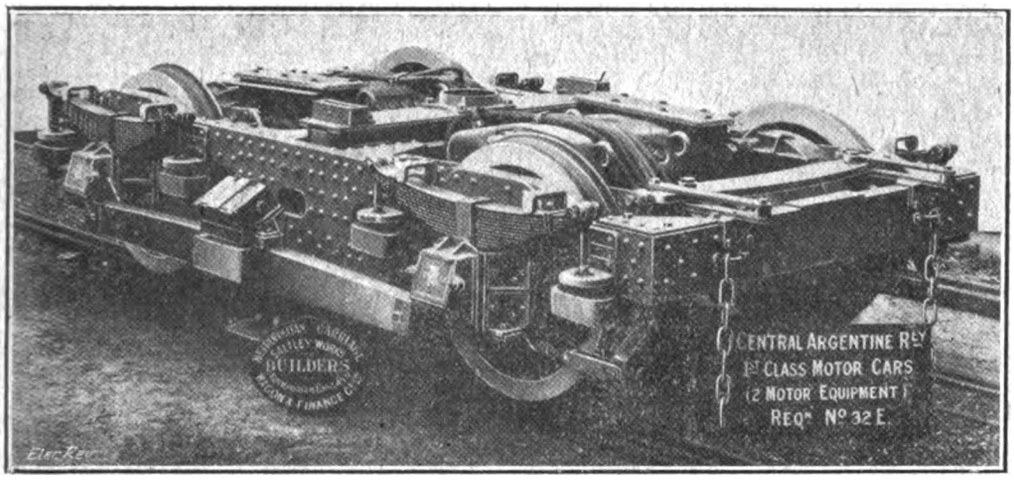

Fig. 8.—Motor Bogie.

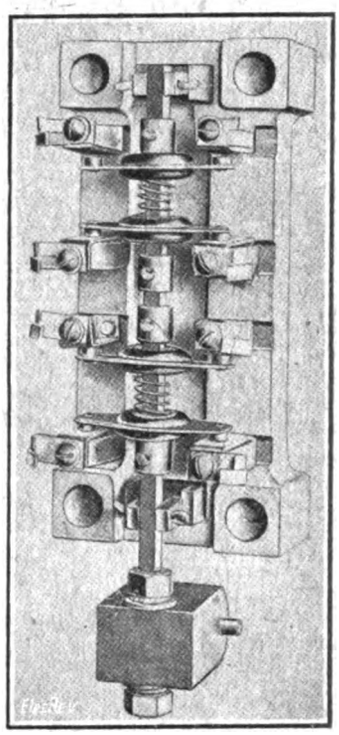

Fig. 9.—Contactor Interlocks.

In general the three types of cable are laid in the same trench at a distance of about 1 in. from each other. Above the high-pressure cable, and about 4 in. from it, is laid a creosoted plank, 8 in. by 2 in., to protect the cable in case of future excavations.

The feeder from the power station to Olivos *viâ* Anchorena is taken across the Canal San Fernando, which is navigable for barges and small boats, in a concrete tunnel laid in a trench in the bed of the canal.

All joints in the high-pressure cables were made in gun-metal sleeves, wiped to the lead of the cable, the sleeves themselves being surrounded by a creosoted wooden box with an iron cover. The sleeves were filled with compound, great care being taken to avoid producing cavities in the filling. Wherever the armouring is interrupted the joint is spanned by a copper bond of 0·05 sq. in. section.

After laying and jointing, the high-pressure cables were tested by applying for 15 minutes a pressure of 40,000 volts between any core and the lead and between any two cores.

The direct-current feeders from the sub-stations to the track and the jumpers spanning gaps in the conductor rail are of 1 sq. in. section, paper-insulated, vulcanised-bitumen sheathed, taped and braided. They are laid solid in Key fibre conduit filled with Trinidad bitumen. The conduits are 4⅜ in. external diameter and about 5 ft. long, the joints between conduits being made by fibre sleeves. The cables are supported in the conduits by fibre bridges. A creosoted plank is laid over the conduits.

The telephone system installed in connection with the electrification works provides communication between the power station and the sub-stations, the carsheds, and the signal cabins in the electrified area. Twenty-two-wire exchanges of the Sterling automatic type are installed at Victoria and at the power station.

In Olivos sub-station a panel is installed carrying two centre-zero voltmeters connected to pilot wires running to the negative bus-bars of the three sub-stations. A permanent deflection of one of the pointers indicates to the sub-station attendant that there is a difference of potential between the bus-bars in two adjoining sub-stations, and that one sub-station is "motoring" the other. He can then instruct one of the sub-stations to raise or lower its voltage of supply till it is taking its proper share of the load and the transference of current ceases.

Two sub-stations are provided in the electrified section to give a supply for general purposes, one situated at the Retiro terminus and the other at the Victoria workshops. The Retiro sub-station contains a B.T.H., 400-kw., motor-generator, a British Westinghouse three-phase, 600-k.v.a. transformer, and a Chloride storage battery of 4,000-a.h. capacity at 240 volts, controlled by a Bertram-Thomas battery regulating switch. The Victoria sub-station is equipped with three single-phase transformers of 375-k.v.a. capacity, made by the British Electric Transformer Co., Ltd.

The lighting of wayside stations along the electrified track is taken from the third rail, the circuits being arranged to take four 200-volt lamps in series. Vulcanised bitumen-sheathed, paper-insulated cables of 0·1 sq. in. section are taken from the third rail and track rails respectively to a "casilla," a small brick chamber, in which the switches are housed.

As the passenger service on the lines to be electrified is frequent and suburban only, the rolling-stock equipment was naturally laid out on the multiple-unit system. The stock ordered was as follows:—55 motor coaches, each equipped with two motors; 12 motor coaches, each equipped with four motors; 50 trailer coaches.

The coaches equipped with four motors will be used for hauling trains made up of a motor coach at each end and between them six trailer coaches taken from the old steam stock.

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The end vestibules of the coaches are arranged to serve either as entrance ways for passengers or as driving compartments for the motormen. They are 4 ft. wide, and contain the driver's brake valve, master controller, and hand-brake wheel. Duplicate doors are provided, so that when the vestibule is used for passengers the electrical gear is all closed off. In the motor coaches the vestibule also contains the panels carrying the switches for auxiliaries and sundry tools.

The service duty required the provision of a brake pump for each two-motor equipment, capable of exhausting

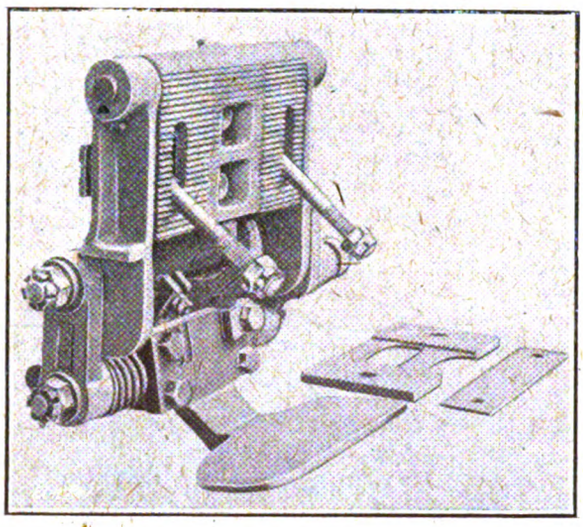

Fig. 10.—Collector Shoe.

50 cb. ft. of free air per minute ; under working conditions of joint and valve leakage this equipment produces a 20-in. vacuum in the train system within 22 seconds after complete destruction.

A view of the motor bogie is given in fig. 8.

The collector gear consists of an under-running shoe (fig. 10), which makes contact with the under surface of a channel-shaped conductor rail. The shoe casting is carried on an oak beam fixed to lugs on the axle boxes. The collecting skate has two motions :—

(*a*) An up-and-down movement to follow the level of the conductor rail ; this is controlled by helical springs on a

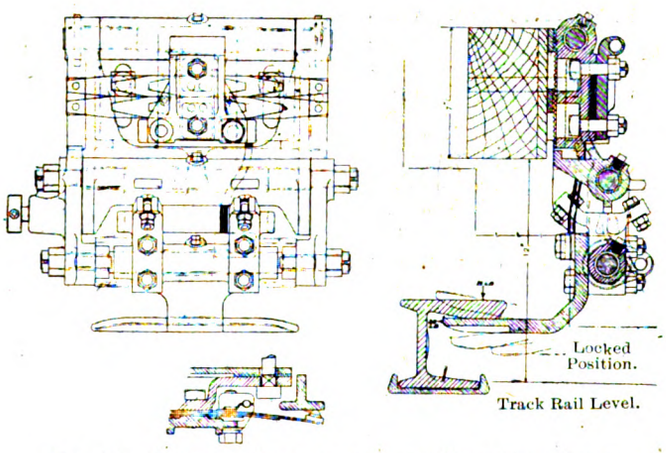

Fig. 11.—General Arrangement of Collector Shoe.

horizontal axle passing through the block to which the skate is bolted.

(*b*) A sideways movement to allow for the end play of the axle boxes and want of alignment of the rail ; this is controlled by leaf springs bearing on the suspension links of the skate.

The difference in the heights of the top of the skate in its extreme positions is 2½ in. ; its horizontal movement is 3 in. The average upward pressure of the skate is 28 lb. The shoe body and suspension links, fig. 11, are of cast steel, machined to gauge ; the skate is of cast iron, and is designed to break when it strikes an obstacle. If desired, the skate can be locked down in such a position that it clears the conductor rail altogether, thus enabling the equipment of a coach to be isolated. Skates run about 130,000 miles before becoming worn out.

The following are some of the details of the motor-coaches and bogies :—

Length over buffers	65 ft. 3 in.
„ „ body	63 „ 3 „
External width of body	10 „ 3½ „
Height from rail to top of roof	13 „ 2¾ „
„ „ to floor	4 „ 2⅛ „
Distance between centres of bogies	40 „
No. of first-class passengers seated	72
Wheelbase of bogie	9 „
Diameter of wheels	3 „ 6 „
„ „ axle at centre	7 in.
Distance between centres of journals ...	7 ft. 6 „

	Two motor coaches.	Four motor coaches.	Trailer.
Weight of coach body, underframe and bogies	39·0 tons	40·5 tons	33·2 tons
Electrical equipment	11·5 „	20·5 „	1·3 „
Total weight	50·5 „	61·0 „	34·5 „
Weight per passenger seat ...	0·74 „	0·84 „	0·48 „

The average distance between stations on the Tigre (Victoria) route is 1⅓ miles ; the present timing of electric trains which stop at all intermediate stations is 47 minutes, giving a scheduled speed of 22½ miles per hour. This can be increased to 25 miles per hour when desired, without overloading the equipment. As the average length of run is comparatively great, and as there are no severe gradients on the line, it was not necessary to utilise the whole of the weight of the motor coaches for adhesion by gearing a motor to each axle. Consequently, a two-motor equipment was adopted, each motor dealing with a load of about 45 tons.

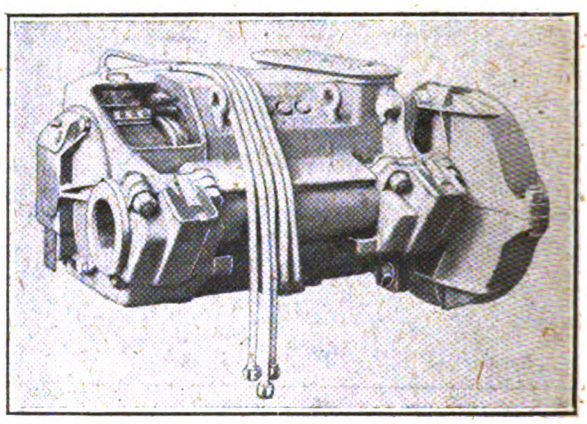

Fig. 12.—250-h.p. Motor.

With the width between wheels available on the broad gauge (5 ft. 6 in.), it was possible to design a motor (fig. 12) of ample capacity without interfering with the normal proportions of its various parts. In addition to the stopping service, the trains are also required to make express or semi-express runs, stopping only at one or two intermediate stations, and performing the journey at a scheduled speed of 37½ miles per hour. This condition is provided for by reducing the excitation of the main fields by 50 per cent. in one step. The motor, known as "G.E. 235," is rated at 250 h.p. (one-hour rating, 75° C. rise) at 800 volts ; it measures 5 ft. ¾ in. overall, and the armature is 20 in. in diameter, with a core length of 17½ in. The weight of the motor, including gears and gear case, is 8,430 lb. ; armature bearing (commutator end), 4½ in. × 8⅞ in. The pinion has 22 teeth and the gear wheel 70.

The two motors mounted on each motor bogie are arranged for nose suspension from the bogie transom. The motor carcass is a single steel casting, with machined seats for the four main and four commutating poles. Provision for ventilation is made in the form of a rectangular opening of 160 sq. in. at the pinion end, arranged to take a flexible duct communicating with the interior of the coach, through which the air can be drawn if it is found that there is too much dust in the air taken direct from beneath the coach.

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The motors are built and insulated for a working pressure of 800 volts, and the control system provides for operating with two motors in series—in parallel with full field and in parallel with tapped field. The control at starting is automatic, the rate of cutting out series resistance being determined by a "notching" relay, which allows the contactors to close in the proper order as the main current falls to a predetermined value. The main contactors (fig. 9) are wound to operate with any line voltage from 480 to 850. They are 15 in number, and are mounted in a sheet-steel box with the front covers hinged to swing open in case of heavy arcing. All cables beneath the coaches are carried in solid drawn steel conduit, screwed into the cases containing the apparatus; where breaks are required in the cable, junction boxes are provided. The conduit was erected in this country and shipped in position on the underframe, the cables being pulled in during the re-erection of the coaches at Buenos Ayres.

The leads which run from end to end of the train are three in number:—

(*a*) The train line, a single-core cable.

(*b*) The pump line, a twin-core cable, one core being the full-speed and the other the half-speed lead for the pump motor.

(*c*) The control line, a bundle of seven cables coupling up controllers, circuit-breakers, &c.

These leads bifurcate at the end of each coach and terminate in sockets attached to the headstock. Connection between coaches is made by removable jumpers and plugs.

The vacuum pump and motor are mounted in a framework slung to the underframe. The pump is a single-acting two-cylinder machine coupled to the motor through a helical spring coupling. It is geared down 4 : 1 by a chain inside the pump casing. The motor is of 3½-H.P. capacity, series wound. A series resistance which can be short-circuited permits it to be run at two speeds, one approximately double the other. Normally the motor is run at half-speed to maintain the vacuum against leaks and the use of the vacuum horn; when the driver's brake-handle is put into the "release" position the brake controller cuts out the resistance, and the motor runs at full speed till the required vacuum is obtained, whereupon the brake-handle is put to the "running" position, thus inserting the resistance again into the circuit.

The "dead man" device on the controller consists of a pilot valve operated by a knob on the main handle. When the knob is released, this valve admits air to the emergency valve, which is thus actuated, and opens the train pipe to atmosphere, blanking off the pump pipe.

For the reception of the electric rolling stock the company built a new car shed at Victoria, 230 yards long, and containing 10 tracks. Power for moving the coaches in the shed is supplied from overhead trolley wires carrying little carriages, from which hang cables that can be plugged into the train-line sockets on the coaches. An existing shed was adapted as a repair shop by raising the roof and installing 20-ton travelling cranes.

(To be concluded.)

"THE END OF THE WAR."

We have received the following communication from a lawyer, dealing with a question of considerable interest at the present time:—

In sending you a communication with the above title, I hasten to clear away certain impressions to which it may give rise. In the first place, I am not going to attempt to prophesy *when* the war will end. So many "experts" have proved their incompetence as prophets, that it is no time for an amateur to enter the lists. In the second place, it must not be said that, because I write under the above heading, I am of opinion that the war *is* at an end. Four-and-a-half years of Hun *camouflage* have not been without their lesson. I cherish no such belief. All the recent developments are part of the great peace offensive against which the country was warned long since.

But what I want to do is to say a few words about the legal meaning of the phrase, "the end of the war." It is by no means too early to pay attention to this matter. Numerous statutes, "emergency" and other, which have been placed on the book since August 4th, 1914, are timed to expire at the end of the war. All persons affected by these Acts of Parliament are, therefore, interested. Again, countless regulations have been made under, and by virtue of, these temporary enactments. If the statute goes, the regulation made in accordance with powers conferred by it must of necessity be affected.

Strange to say, although phrases like "the end of the war," and "during the present war," are constantly used, the period is never defined. One Act of importance to electric lighting companies (which came into force on August 8th, 1918), entitled the Statutory Undertakings (Temporary Increase of Charges Act), 1918, is to "have effect during the continuance of the present war and for a period of two years thereafter and no longer."

The Legislature has left the phrase undefined. Possibly it was thought that a certain nebulosity of duration would give added beauty to its emergency legislation. Some statutes have been described as the artistic creations of the Legislature, and did not Mr. Birrell, K.C., M.P., say on one occasion: "Nothing lends such beauty to a landscape painting as a bank of clouds in the background"?

For obvious reasons, the judges have not yet been asked to say what is meant by "the end of the war." But where Legislatures and judges have hesitated to tread, certain "mere lawyers," at the bidding of the Attorney-General, have rushed in. Having considered the matter in all its bearings, this Legal Committee, over which Mr. Justice Atkin presided, came to the following conclusion:—

We assume that the war will be ended by a treaty or treaties of peace. In order to arrive at the final conclusion of the treaty, various stages will probably be required, such as agreements for armistice, cessation of hostilities thereunder, articles of peace, agreement of terms, signature of terms, ratification, exchange, or deposit of ratification.

In our opinion, speaking of the legislation generally, the war cannot be said to end until peace is finally and irrevocably obtained; and that point of time cannot be earlier than the date when the treaty of peace is *finally binding* on the respective belligerent parties, and that is the date when ratifications are exchanged.

The italics are mine. It may be asked, When shall an agreement be regarded as finally binding on the Hun? The answer is that those who make treaties—the High Contracting Parties, as they are generally called—are not responsible for the *sanction* which is behind the agreement to which the plenipotentiary attaches his signature. When the Hun broke the treaty with Belgium, he treated it as not binding.

Having regard to the learned opinion set out above, it is obvious that "the end of the war," in the statutory sense, is as yet very far removed. It has taken four and-a-half years to get Europe into its present mess. How long must it take to draft final agreements which shall so deal with the multifarious problems created by the war, as to enable the treaty to be finally signed and exchanged!

But apart from the emergency and other statutes which are of temporary duration, one has to consider the Regulations made under these Acts, and, in particular, under the Defence of the Realm Act. As to these, the same Committee of lawyers say:—

In our opinion, the true construction of the section [they were referring to a section in the Defence of the Realm Act] is that the Regulations so issued can operate only during the continuance of the war. The purpose expressed is for securing the public safety and the defence of the realm, which we think mean the public safety so far as threatened by our enemies in the present war and the defences of the realm against those enemies. The powers are given by reason of the national emergency, and vest the Executive with an authority so wide that we think it must have been intended only to exist during the existence of the emergency. The provisions for the trial and punishment of offences against the Regulations by Court Martial are not such as one would expect to remain in force after peace has been restored. This last consideration is obviously not affected by the provisions of the later Defence of the Realm (Amendment) Act, 1915 (5 Geo. V., c. 34). These considerations force us to the conclusion that Regulations issued under Section 1 (1) cannot have any valid operation after the termination of the war.

They then add this:—

The provisions for the trial and punishment of offences against the Regulations also cease to have any effect after the termination of the war. It follows that after that date no offence against the

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Regulations could be punished as such, though committed during war, and proceedings against such offenders, though instituted during the war, would automatically pass on its termination.

The general result, therefore, is that, so far as any Department of Government or executive officer is exercising any power given by a Defence of the Realm Regulation, such power will be lost on the day of the termination of the war. It follows that if such powers were exercised after that date the individual exercising them would be liable in a civil action for any infringement of rights, whether to person or property, that he might commit, whether wilfully or not.

It is difficult to exaggerate the far-reaching results of the above conclusion. It points clearly to the necessity for passing some special Act which shall enable some of these regulations to be continued.

There is one power in particular which must be provided for. I refer to the power to *take* possession of land—a power which has been very freely exercised during the war. There is no express power to "keep" possession, but the Committee are of opinion that the power to take implies a corresponding power to keep and use. As to property so taken which, in fact, exists in specie at the end of the war, there would be no legal right to detain it from the owner after the date of the termination of the war.

I have said enough to put forward the views of a number of lawyers on these difficult questions, and venture heartily to agree with them. In my opinion, persons concerned will be quite justified in shaping their various courses upon the basis that the law as above stated is the law of the land, and will remain so until varied by the Legislature.

ELECTRIC ARC WELDING.*

By A. M. CANDY.

Generators for welding service are usually compound wound, and should be provided with commutating poles because of the momentary overload produced when the arcs are struck. The capacity of the generating equipment required is determined by the character of the work to be performed and the number of operators who will work simultaneously. As a rule, welding service is of a very intermittent nature, but if the equipment is used for cutting work, such as risers on steel castings, the service may be practically continuous.

Switchboards and control apparatus for arc welding service have been materially improved within recent years. The successful application of arc welding has increased to such an extent in the industries that it has been found desirable and profitable to expand the one-man outfit into a system permitting a number of operators to work simultaneously at various positions distributed over an extensive area. This development has resulted from a more extensive use of the metallic electrode process, which has been generally adopted in railway and locomotive shops for many varieties of work.

The metallic electrode process generally is most satisfactory if the current required is within the limits of 50 to 175 amperes. Some applications, however, may require a minimum of 25 amperes, and still others a maximum of 225 amperes. For the carbon electrode service satisfactory results cannot be secured with less than 300 amperes. For some applications as much as 500 to 800 amperes may be required, especially if much cutting is to be done at an appreciable speed.

Because of the intense heat generated by the arc it is necessary to secure the electrode (carbon or metallic) in a properly designed holder. There is a distinct type of holder designed for each of the two types of electrodes. The carbon holder comprises an aluminium rod, one end being fitted with a suitable connection for attaching the feeding cable; to the other end a tube is welded, which contains two jaws or clamps for holding the electrode. The portions of the clamps in the tube are tapered, and the clamps grip the electrode when they are forced into the tube. The cable end of the holder is provided with an insulating, heat-resisting handle and a disk shield to protect the operator not only from electric shock, but also to protect his hand from the heat of the arc. The electrode is a solid carbon, or more strictly speaking a graphite rod, 1 in. in diameter, and from 6 to 8 in. long. This holder is sufficiently light to be handled easily, and is strong mechanically; the current-carrying parts have ample capacity for 500 amperes. For currents about 500 amperes, up to and including 800 amperes, a larger holder of similar design is available.

The metallic electrode holder is considerably lighter than the carbon holder, and the disk shield is omitted because the heat generated at the arc is much less intense. The electrode is clamped in the holder by a cam device, which is designed so as to accommodate electrodes of various sizes.

* From the *Journal* of the American Institute of Electrical Engineers, Vol. 38, No. 9. Abstract.

The intense brightness of the light rays radiated by the electric arc necessitates thorough protection of all parts of the human body. For this reason, if at all practicable, it is advisable to perform all welding within an enclosure, especially if other persons such as workmen are located within the vicinity of the welding equipment. Furthermore, it is essential that the head and hands of each operator and helper be effectively protected. Simply shielding the eyes with coloured glasses is not sufficient, because the rays emanating from the arc will produce a burning quite similar to, and equally as painful as, sun burn. The effect will not be noticed at the time of exposure, but will manifest itself within a period of 10 to 12 hours thereafter. For the protection of the body, ordinary clothing is usually sufficient, but the wrists and hands should be protected by heavy gauntlet gloves. Under no circumstances should the arms be exposed by rolling up sleeves. For the protection of the head and eyes, nothing is superior to a cylindrical helmet of micarta or aluminium normally held in place by leather straps, and suitably shaped at the lower end so as to rest easily on the shoulders. At the front of the helmet is an offset or recess, at the end of which is a frame containing glasses through which the operator observes the work when welding. This frame is held in position by springs, and is designed to be turned up, so that the glasses are out of range when the operator desires to inspect welding work performed, thus obviating the necessity of removing the hood so frequently. The glasses are mounted an appreciable distance from the operator's eyes to minimise the heat radiated from the glass to the eyes of the operator.

The glass window of the helmet is of primary importance, because it is absolutely essential to protect the eyes against the ultra-violet rays which are very abundant in an arc drawn between carbon and iron or iron and iron. Scientific investigations have revealed the fact that ultra-violet rays will penetrate human tissue to a depth of approximately one inch. Recent investigations have indicated that continued exposure of the eyes to the ultra-violet rays will lead to the formation of cataracts, resulting ultimately in total blindness. The helmet glasses must, therefore, successfully absorb these harmful rays. The best possible arrangement is that of three layers of glass. The outside layer (towards the arc) should be ordinary clear glass. The second and third layers should be of a greenish or amber tint, and must be capable of absorbing the ultra-violet rays, as will "Noviweld" glass, which has proved very satisfactory.

In many applications of the metallic electrode process the actual periods of welding are short, and, furthermore, the operator has one hand free. It has been found, therefore, that a shield is much more desirable than a hood or mask. Such a shield is similar to the mask; if a mask were flattened out into a sheet and a handle provided, it would be practically the same shape as a shield.

The principal materials used for arc welding comprise metallic electrodes, carbon electrodes, and filler material. The most satisfactory metal for general metallic electrode work probably is welding wire, which can be readily procured in rods of 3/32 to 1/4 in. in diameter, and about 14 in. long. Carbon electrodes are usually of special graphite material about 3/4 to 1 in. in diameter, and about 12 in. long. These electrodes are consumed slowly, but are subject to breakage, and therefore may require replacement frequently. Filler material may be classified the same as metallic electrodes as it serves the same purpose, namely, that of supplying the bond for the piece or pieces welded. As a rule no flux is necessary; however, authorities disagree on this point, and a flux is used by some operators. The theory of the functioning of the flux is that, if carbon is introduced into the weld from the carbon electrode, it will unite with the oxygen of the flux, thus leaving pure iron in the weld, the carbon having disappeared in a gaseous form, namely, that of carbon dioxide. In practice, it produces additional slag which must be removed from the weld.

Welding by the electric arc process is an art, and is not subject to any definitely fixed rules of execution. The degree of success attained will depend almost wholly upon the skill and intelligence of the operator.

One of the most important factors in producing good welds is the absolute freedom from dirt, grease, scale, &c., of the surfaces to be welded so as to produce good fusion and eliminate slag. A stiff wire brush is very useful for such purposes, although in many instances chipping must be done. A sand blast, if available, will be found very desirable, especially if much area has to be cleaned. Frequently it is permissible, or even advisable, to clean the work with the carbon electrode arc, no attempt being made to weld until the impurities have been burned off. If necessary, the article to be welded may be tipped, so that the molten impurities will flow off readily.

The next step is to properly shape the surfaces on which the weld is to be made. If a crack in a plate or a bar is to be filled in, it should be chipped so that a V-shaped 90 deg. groove is formed. In some instances it may be necessary to preheat the article before welding in order to prevent unequal cooling strains in the metal.

Practically no difficulty will be found in striking and maintaining an arc with the carbon electrode. With the metallic electrode, however, considerable difficulty may be experienced, especially at first, because the electrode will have a tendency to stick (freeze) to the work. Furthermore,

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it is not possible to successfully maintain the arc much in excess of 3/16 in. long. As the electrode melts and forms the weld it is necessary for the operator to feed the electrode toward the work at practically the same speed as it melts in order to maintain the arc and prevent its rupture. The novice or beginner will do well to master the handling of the carbon electrode first.

When an arc is struck there is no arc voltage, and the contact voltage drop between the electrode and the work is comparatively small. The flow of current, therefore, is limited only by the resistance and reactance of the circuit including the welding or ballast resistance. A test curve indicated that when the metallic electrode was touched to the work the current increased from 0 to about 220 amperes in about 1/50 of a second, at which value it remained for about 1/20 of a second. The current then decreased to about 125 amperes in 1/20 of a second, after which the average value was somewhere near 140 amperes. Therefore, the entire period of time between striking the arc and obtaining the welding current was about 3/25 of a second. A similar curve illustrating the current and voltage fluctuations incident to striking an arc with a carbon electrode, indicated that the initial current was but little in excess of the normal welding current. This is no doubt due to the high contact resistance between the carbon electrode and the metal.

After striking the arc it should be played over the surface of the piece to be welded by a rotary motion of the hand, so as to heat a considerable surface uniformly. When the metal becomes molten, the flux (if any is used) and the filler material should be fed a little at a time. Sufficient filler should be melted and deposited at the proper location to form a satisfactory weld when the metal cools and solidifies. As the metal begins to cool it should, if possible, be hammered thoroughly to prevent sponginess and produce a finer grain in the finished weld. The metallic electrode is at once the heating electrode and filler material, therefore the arc must be played at the exact spot where the welding is to be done. Otherwise, the manipulation of the weld is the same as specified for the carbon electrode, except that a short 20-volt arc should be maintained.

It is essential that the electrode be of the proper polarity, namely, negative, for several reasons. First, for carbon electrode work, if the arc is maintained comparatively long, hard welds which are difficult to machine will not be formed. This is because the direction of the flow of current is from the work to the electrode, and therefore the possibility of injecting carbon from the electrode into the weld is minimised. Secondly, a greater proportion of the heat developed by the arc is generated at the positive terminal, and therefore is generated where it is most desirable, namely, at the surface of the metal to be welded.

If the weld to be executed is of considerable size and if strength is not of paramount importance, the carbon electrode process will produce satisfactory results in less time than is required for the metallic electrode. The carbon electrode is always used for cutting.

If the ultimate strength of the finished weld is an important factor the metallic electrode should be used. It should also be used if it is essential to have the heating of the work localised and restricted to a small area; furthermore, small welds can be better executed with the metallic electrode.

The field for the application of electric arc welding is a very broad one. Practically every industry making use of iron and steel can utilise the arc welding process to advantage.

(To be concluded.)

REPORT ON THE MEYER & CHARLTON MINE ACCIDENT.

The S.A. *Mining Journal and Engineering Record*, of Aug. 31, publishes an abstract of the report and findings of the Court of Inquiry into the accident at the Meyer & Charlton mine, in which 21 white men lost their lives. The report was issued on August 29th last by the S.A. Government mining engineer. The findings were: (1) That the men were killed owing to the man trolley cage, in which they were being lowered, breaking away and crashing to the bottom of the shaft; (2) That the breaking away of the man trolley cage was due to the snapping of the wire-rope sling by which it was attached below the skip; (3) That the sling snapped owing to an abnormal strain being put upon it through the sudden application of the electric hoist brakes following the automatic opening of a circuit breaker, which was set too lightly to meet the ordinary contingencies of working; (4) That the accident was not due to any act or omission of a criminal nature, or contravention of a statute or a statutory regulation. After setting out several more or less obvious recommendations, the report details the conditions at the shaft at the time of the accident, and in the course of the narrative of the accident it is stated that the sling between the trolley and the skip broke owing to the severe surging stress upon it caused by the combined action of the speed attained by the conveyances, the sudden stop of the hoist drum due to the brakes, and the spring of the long winding rope.

Experiments made after the accident showed that if the engine driver, when lowering unbalanced under regenerative control, moved his control lever slightly more rapidly or further than usual, the circuit breaker was thrown out by the excessive current generated, and it was considered that the circuit breaker acted at that time for the same cause as in the experiments. The driver was working under disabilities; his limit on the ammeter, according to his instructions, was the 1,000 ampere mark, which in subsequent experiments was found to coincide approximately with the current which opened the circuit breaker, the ammeter being incorrect; his speed indicator also was out of adjustment. At the time of the accident the driver may have misjudged the distance for stopping, his speed, or his load, and endeavoured to reduce too abruptly, but it appears clear that his hoist allowed no sufficient margin for the inevitable variations in human action, and that even if by manipulation of his lever he inadvertently caused the circuit breaker to open, he could not be held blamable.

The maker's peak load for the hoist was given as 1,300 amperes, and when it was first erected, seven years ago, the circuit breaker was set for 1,500. The mine electrician shortly afterwards raised the setting to 1,700 amperes. The driver was allowed to approach that amount though ostensibly limited to 1,000. Expert evidence was given at the inquiry that there should have been a large margin between the circuit breaker setting and the peak load, and therefore the responsibility for permitting the hoist to be worked practically without margin must be considered.

As, so far as known, the mine officials who made changes in the lowering procedure, which constituted no unusual winding practice, had no reason to imagine that the hoist was so delicately adjusted that such changes might be risky, they could not be blamed for failing to consult the engineering staff. According to his evidence the electrician knew prior to the accident what was being done. Unfortunately, he did not protest or take any special precautions. His error was considered excusable, and one which did not indicate neglect. Unless he thought deeply he would not realise that if the breaker did open when men were descending out of balance, an accident might occur, especially as it had several times opened harmlessly with upcoming loads. The position appears to be that all reasonable precautions were taken to deal with upcoming loads, which were those giving the greatest pull on the hoist, but that the peculiar conditions with down-going loads were not realised. Before the accident the circuit breaker never had opened while the load was descending, and evidently no one foresaw that it would do so and bring the automatic brakes into action, or realised that if the effect of regenerative control were suddenly cut off the time lag of two seconds would permit a down-going conveyance to acquire considerable velocity before the brakes acted. On the whole the brake adjustments were not condemned. Tests and inspection indicated that the sling was in good condition, and had an ample margin of safety under ordinary conditions.

In conclusion, it was stated that several errors of judgment for each of which no one was seriously blamable, contributed to the disaster, but that the most important, and one without which the accident would not have occurred, was in the circuit-breaker setting.

NATIONAL ELECTRICITY SUPPLY.

The Situation on Tyne-side.

At a meeting of the Newcastle-upon-Tyne City Council on October 23rd, a report of the Parliamentary Committee relative to the reports upon electric power supply of the Coal Conservation Sub-Committee, and of the Electric Power Supply Committee, was submitted. The report stated that the committee feared that, if the proposals of these reports received legislative sanction, the monopolies of the private electricity companies in this district would be maintained and consolidated, and that the publicly-owned undertakings which generated and supplied electricity in bulk in Newcastle-upon-Tyne and in other parts of the north-east area of England might pass from the ownership and control of the municipalities and be wholly dominated by a company or aggregation of companies conducted for private profit, enjoying (possibly with financial assistance from the Government) a monopoly of electrical enterprise in this area; while, at best, municipal electricity undertakers would be reduced to the position of distributors in their own areas of electricity supplied to them in bulk by the companies.

The committee was of opinion that it would be contrary to public policy that a public utility service of this character which was a monopoly should be under the control of private companies, the tendency during recent years having increasingly been to place such services under the management or direction of local representative bodies; and, in view of the circumstance that the Corporation had a right of acquisition within six months of July 3rd, 1922, of the electric lighting undertakings in the city of the Newcastle-upon-Tyne Electric Supply Co. and of the Newcastle and District Electric Lighting Co., and itself already generated and supplied electricity

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for purposes of traction and power, the matter was regarded as one of extreme importance in the interests of the city.

The town clerk had prepared a statement which had been settled in consultation with representatives of other local authorities in the north-east area who were owners of electricity undertakings, and the principal grounds of objection to the proposals of the reports were formally enunciated therein. It was proposed that this statement, when approved by the other authorities, should at an early date be formally presented on behalf of the municipalities to the President of the Board of Trade and to the Minister of Reconstruction.

The Lord Mayor (Sir George Lunn) said the Parliamentary Committee had no objection to the creation of large electric power stations to supply wide areas with electricity, always provided that those power stations and those using them and governing them were not private bodies working only for private profit. Many municipalities might have, and some had, up-to-date plant for generating and distributing electrical energy; and if a huge trust of the kind were created, it meant that there would be no popular local control. The Municipalities that had generating stations should have representatives, and these representatives should be in a majority. Public interests should be supreme over private interests of any kind whatsoever. Therefore, a series of conferences of municipalities generating and distributing electricity in the north-eastern district had been held, with technical experts and legal advisers, and a reasoned statement had been drawn up, a copy of which had been sent to each member of the Council representing their views. He asked the Council to endorse this reasoned statement, as being their statement and that of the other municipalities; and they asked, also, that the Government should do nothing of the kind except after exhaustive inquiry, at which the municipalities might be represented to give evidence in the interests of the public at large.

The report was agreed to.

A B.T.H. BLAST-FURNACE BLOWER.

It is a matter of common knowledge that a *sine qua non* in the operation of blast furnaces is an absolutely assured supply of blast to the furnaces, since the failure of the air supply with the furnaces on blast would lead to most disastrous results, with very heavy pecuniary loss to the owners. A step in the right direction has been made by the British Thomson-Houston Co., Ltd., of Rugby, in a special form of blast furnace turbo-blower unit which it has recently completed, and which has satisfactorily passed the tests applied to it.

The unit consists of a synchronous motor driving the blower, this motor being operated in addition as a power factor adjuster on a 3,000-volt, 50-cycle supply. Additional to the synchronous motor for driving the blower, a turbine of the Curtis type is provided in case of failure of current to the synchronous motor, or breakdown of the latter. The conditions laid down by the company to whose order this set was built were such that maintenance of a continuous supply of blast must be assured at all costs. These conditions, therefore, made necessary the provision of clutches between the synchronous motor and the blower, and between the turbine and the blower of some type that would be self-engaging and disengaging (whilst running), so that the turbine could be clutched to the blower shaft in order to drive the same in place of the motor. Moreover, it was specified that such a change over of the driving means should take place automatically in the absence of attendants from the engine room.

In view of the fact that the normal speed of operation of the set when driven by the synchronous motor is 3,000 R.P.M., and that the change over from synchronous motor drive to turbine drive must take place whilst running, it will be appreciated that the design of the clutches to meet these conditions required a considerable amount of attention. These conditions have been successfully met in the design of clutch which has been evolved and patented by the British Thomson-Houston Co. for the driving of this unit. These clutches can be well seen in the illustration (fig. 1) between the blower which is the centre member of the unit, the turbine on the left of the picture and the synchronous motor with its exciter on the right.

For the starting up of the turbine in the case of the failure of the motor, a special starting valve is provided on the turbine steam supply main, which consists of a balanced valve, the opening or closing of which is controlled by the delivery air pressure of the blower. In running up the set, the synchronous motor is started as a squirrel-cage induction motor, the clutch between the motor and blower engaging as soon as the motor rotor commences to revolve. When the motor approaches synchronous speed it is paralleled by closing the field switch of the motor rotor circuit, and then operates as a synchronous motor with all the attributes of a power factor adjuster.

The delivery air pressure of the blower holds the starting valve for the turbine, previously referred to, closed so that the turbine cannot run under normal conditions of operation.

If failure of the motor should occur at any time, the set commences to slow down in speed, with a consequent fall in air delivery pressure, and the starting valve on the turbine opens up, running the turbine up to speed; at the same time the clutch between the turbine and blower engages itself as soon as the turbine and blower shafts reach the same speed. This occurs with a small drop in air pressure. The blower is then driven by the turbine, and the synchronous motor rotor automatically disengages itself and comes to rest.

The change over from motor drive to turbine drive, owing to the type of friction clutch provided, takes place without shock; in fact, it is almost impossible to detect the moment of engagement, although the speeding up of the turbine is extremely rapid, as also is the deceleration of the blower shaft.

The blower of this unit is of the British Thomson-Houston Co.'s standard two-stage design of balanced impellers in which no balancing devices for end thrust are necessary. All the bearings of this unit are provided with forced lubrication, and in the case of the blower and turbine, the housings of the bearings are in addition water cooled.

This design of clutch should prove very useful in the future under conditions where it is essential to maintain continuity of supply of circulating water to the condensers of large turbo-generators, and where, in the case of motor-driven auxiliaries, failure of supply of current to the driving motor might cause a very serious temporary shut-down. In such a case, the circulating pump would be provided both with a motor and a turbine to drive the same, two of these patented clutches being provided, and the turbine being started up in the same manner as the blast furnace unit described, by means of a starting valve controlled by the delivery pressure of the water to the condenser.

There are numerous other fields of usefulness for this type of clutch which will present themselves to the minds of operating engineers.

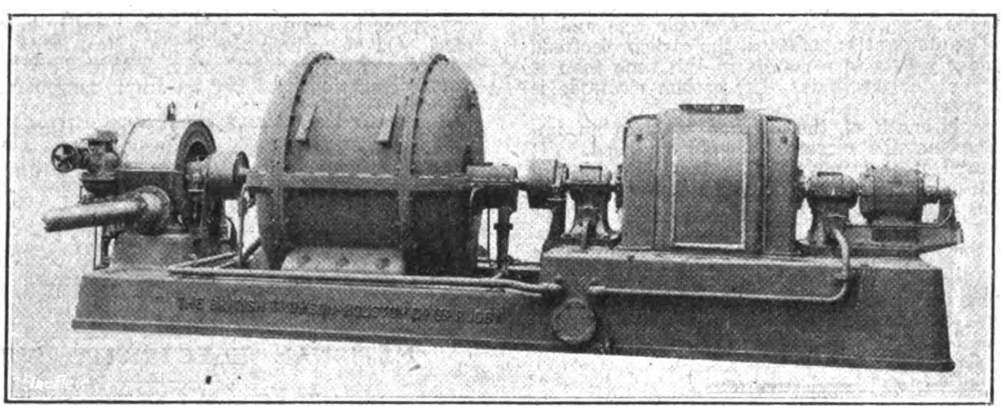

Fig. 1.—B.T.H. Blast-Furnace Blower.

Increasing Pressure by Means of Electrolysis.—It is a well-known fact that water is decomposed by an electric current, the rate of decomposition being 0·3354 gm. by one ampere of current in one hour. The products of that quantity of water are 0·416 litre of hydrogen and 0·208 litre of oxygen. If, when suitable arrangements for setting up hydraulic pressure have been made, a current be passed through the water, decomposition will take place, and the gases generated will produce pressure of any desired intensity. A writer in the *Chemiker Zeitung* tells of pressures so produced as high as 1,860 atmospheres.

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CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Prepare for After-War Trade NOW!

You are no doubt aware of the fact that with the object of facilitating trade between the United Kingdom and the Netherlands, more particularly with a view to post-war connections between the two countries, a list is being compiled at the British Consulates of Dutch firms desirous of entering into business relations with British firms.

I may conclude from this that the British Board of Trade fully realises the importance of making connections now, and my grief is that practically all the British firms I have hitherto approached on this subject follow the "wait and see" policy, and put me off till after the war.

May I point out that to my mind (and your Consul here is of the same opinion) it will then be too late.

I think it would be well for you to point out in your periodical that this is the time to make preliminary arrangements, to gather information, and to feel one's ground.

There is plenty of work to be done before the rush begins, and the rush is sure to come. Other countries cannot, under present circumstances, supply much either, but they are not sitting still meanwhile.

N.V. Technische Handel Maatschappij.
J. Mulder.

Amsterdam, *October 12th*, 1918.

"Fraternity"—or Tyranny?

I think the publication by the E.T.U. of Mr. Wordingham's letter, presumably with the object of discrediting the E.P.E.A., will actually have the result of largely increasing the membership of the E.P.E.A.

I entirely agree with the advice given by Mr. Wordingham, and trust that all station engineers who are eligible will join the E.P.E.A. The doctors and lawyers have shown us what professional trade unions can accomplish, and I think we are a lot of fools if we do not follow their example.

Borough Electrical Engineer.

October 26th, 1918.

["Unity" is requested to send us his name and address. —Eds. Elec. Rev.]

Work Without Pay.

Under the Board of Trade coal economy scheme power-station engineers throughout the country have been appointed district engineers, for which, however, they are allowed no remuneration whatever, although the work takes up a considerable portion of their time, and involves the exercise of professional abilities of a high order.

This seems most unfair, as their brother officials who have been appointed coal overseers and road transport officers (both of which appointments could be filled by an intelligent clerk) receive considerable remuneration.

District Engineer.

October 26th, 1918.

The Electrical Power Engineers' Association.

I am desired by the Marylebone branch to ask your permission to be allowed to reply to Mr. Jones through the medium of the Review.

The branch was under the impression that the Power Engineers' trade union was merely a thing of mushroom growth; it thought, in fact, that it might have been organised by some members who had seceded from the A.E.S.E. However, the branch learns from a score of sources that it is one and the same organisation with a change of name only.

I am desired by the branch to ask Mr. Jones if his trade union is taking the necessary steps to join the Labour Party; also if it is instructing its members to give full recognition to shop stewards. The branch desires a reply through the Review, and not privately, as suggested by Mr. Jones.

John Vincent,
Secretary,
National Amalgamated Union of Enginemen, Firemen, &c.

London, N.W., *October 28th*, 1918.

Salt in Leclanché Cells.

With regard to your issue dated October 18th, page 377, *re* "Salt in Leclanché Cells," we beg to inform you that prior to the war we manufactured a special exciting compound which we registered under the name of "Salectron." This compound consisted of salammoniac, common salt, and other ingredients.

In view of the shortage of salammoniac and the still greater shortage of the other ingredients which we use, we investigated the possibilities of using a simple mixture of salammoniac and salt, and found that a proportion of 60 per cent. of the former and 40 per cent. of the latter gave very satisfactory results.

To make the position quite clear: when using salt and salammoniac as an excitant, there should be substituted six parts by weight of salammoniac and four parts by weight of common salt. It is immaterial whether the two crystals are mixed together at first, or whether they are dissolved separately, but the correct weight of salt to be added can only be known from the weight of the salammoniac crystal used.

The General Electric Co., Ltd.,
S. D. White,
Director.

London, E.C. 4, *October 24th*, 1918.

Technical Books for Men on Active Service.

May I ask the assistance of your valuable journal in an appeal to readers of the Electrical Review for any technical books on electrical or mechanical subjects that they can spare from their bookshelves? Classes in these subjects are being formed here with a view to giving the man now serving every possible chance to make himself thoroughly efficient for return to civil life; this will not only benefit the individual, but the nation also. I should like to add that the classes are being held after the day's work is completed; this fact alone points to a sincere desire of the men to attain real technical efficiency, and any books sent along will be greatly appreciated by them. I am sure your readers would be only too pleased to assist in the manner suggested.

H. Bligh Hill.

78th Labour Group,
Tanks C.W.S., B.E.F.
October 26th, 1918.

Empire Water-Power Development.

Whatever the object of the writer of the article under the above heading in the *Times* Engineering Supplement for October was, the fact is a complete condemnation of the capabilities of British engineers to at present deal with hydro-electric propositions.

Untold injury is done to the British engineering profession, and to the manufacturing industries of this country, by articles of the character mentioned.

The effect would be bad enough if the reading were confined within the shores of this country, but such articles are widely read in the British Overseas Dominions, the Indian Empire, and the Crown Colonies.

It is a stultification of British engineers, and an advertisement of the assumed capabilities of engineers of other nationalities without the slightest justification in fact.

Within the British engineering profession there are engineers capable of dealing satisfactorily with all the hydro-electric propositions ever likely to come forward, either in Great Britain, Ireland, the Overseas Dominions, or any other country.

If a *bona-fide* application is made to me to provide engineers capable of carrying out the five projects suggested by the writer of the article, I could at once name five British engineers each of whom would be thoroughly competent to satisfactorily carry out any hydro-electric proposition, whatever its dimensions might be.

A great deal is heard of the "Hidden Hand" working in the interests of Germany. British engineers would do well to discover and amputate the "hidden hand" which upon every conceivable occasion seizes the opportunity of discrediting their profession.

In my judgment the writer of the article displays lack of knowledge when he ignores the fact that the water powers of this country have largely remained undeveloped owing to (1) the strangulating effect of the Board of Trade and other regulations, and (2) the impracticability, until quite recently, of transmitting energy long distances due to the backward development of the high-tension side of the proposition.

My personal experience in carrying out hydro-electric schemes has not been exceeded by any engineer of other nationality. I enclose my card, and subscribe myself

British Engineer.

October 28th, 1918.

WAR ITEMS.

Post-War Priority.—Dr. Addison stated in reply to a Parliamentary question that the Government had, upon his advice, appointed a Standing Council upon Post-War Priority to consider all questions connected with priority and the allocation of materials and machinery where a shortage was to be anticipated. This council would consist of representatives of industry and commerce and of labour, together with representatives of certain Government Departments, and upon broad questions of policy would be under the direction of a Committee of Ministers presided over by General Smuts. Representative bodies of the industries concerned would be consulted by the council. It was hoped that the Standing Council would hold its first meeting at a very early date.

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Feeding the Guns at Birmingham.—The Birmingham electrical undertakings warmly supported "Big Gun Week" by which about 8 million pounds was raised. The General Electric Co. invested £120,000 in War Bonds, and the employés £2,000; the Electric & Ordnance Accessories Co. paid £50,000 for war savings certificates for the Ward End, Aston, and Neamen Street Works' Associations, and the company itself subscribed £30,000. The Midland Electric Corporation for Power Distribution, Ltd., invested £5,000, and the War Savings Association of the Birmingham Electric Tramway Department £8,137.

Hours of Labour.—Lord Leverhulme, speaking at Manchester on Sunday, advised the utmost caution in connection with the readjustment of affairs after the war. Under our present lack of system with regard to hours of work, we could never have the education we should have. The sons and daughters of the workers, he held, must be as well educated as those of the employers. If we ran our machinery twelve hours per day, and men and women worked for six, then we could organise things better in the matter of education.—*Manchester Daily Dispatch.*

Economic Policy.—The annual meeting of the National Union of Manufacturers, the body which organised the monster deputation at the House of Commons last July to the Prime Minister and the Chancellor of the Exchequer on the Government's economic policy, has been fixed for November 19th. Considerable importance attaches to the proceedings, for by that date it is anticipated the country will have been placed in possession of the full promised statement of Ministerial policy. This announcement will be made in the Commons by the Prime Minister as soon as the international situation admits, and will include an intimation of policy regarding the Paris resolutions and other important post-war problems.—*Manchester Daily Dispatch.*

Industry and Drink After the War.—In pre-war days a good deal appeared in these pages concerning the bad effects of excessive drinking upon industrial operations. We need not cover the ground again just now, but it is unthinkable that in the days to come, when there will be a greater need than ever for all-round efficiency from men and masters alike, there can be a return to the former very unsatisfactory state of affairs. We shall all welcome freedom from unnecessary control, whatever form it may have taken, after the war, but we should profit by the experience of the war years and war measures in this connection as we are going to do in others. Lord D'Abernon, chairman of the Central Control Board, has suggested the following points for consideration in the formation of any permanent scheme of drink control:—

1. Curtailment of the hours of sale to the minimum consistent with reasonable requirements.
2. Avoidance of continuous opening periods of excessive length.
3. Diversion of consumption to meal hours.
4. Dilution of spirits and encouragement of the brewing of lighter beers.
5. Provision of canteens and other alternatives to the public house.
6. Abolition of compulsory drinking (*i.e.*, of "treating").
7. Maintenance of the price of alcohol at a proper level in relation to the prices of prime necessities.
8. Establishment of a Central Authority of Control to co-ordinate and supervise licensing.

Exemption Applications.—At Mansfield, six months were granted to W. Baguley (40), motorman on the tramways, and E. Harrison (49), electrician, was released from volunteer duty.

Somerset Appeal Court has refused a National Service appeal against exemption granted to G. H. Crawford (38, Grade 1), engineer in charge of the electric plant of the Tone Valley Manufacturing Co., Bridgwater, who was employed on Government contracts.

Amersham Tribunal has granted four months' exemption to E. C. Davis, electrician, of Beaconsfield.

At Ryde, H. F. Jolliffe (29, Grade 1), engaged with the Isle of Wight Electric Light Co., who is outside the age of reserved occupations by one year, has been given a further three months' exemption.

At Oxford, on October 21st, the Electric Tramway Co. appealed for D. Campbell (38, Grade 2), traffic superintendent, V. Hill (36, Grade 2), and T. Smalley (34, Grade 1), drivers. The last-named was stated to have been decertified, and could not be appealed for. The Tribunal recommended that his calling up should be suspended for a month, and the other cases were adjourned.

Before the Herts Appeal Court further exemption was claimed by T. H. Swansborough (46, Grade 2), manager and electrician, with Messrs Rogers & Gowlett, of Watford. As he is now in a certified occupation he was granted six months.

Sydney Consulting Engineers' Protest.—Consulting electrical engineers of Sydney have protested to Mr. Ball, Minister for Works, against the action of the Department in allowing the chief engineer to report on country electric lighting schemes. They claimed that the Department was doing work which might be left to private enterprise.

LEGAL.

London Electric Railway Arbitration.

Mr. H. F. Lofts, F.S.I., as arbitrator, has just given his decision in a claim against the London Electric Railway Co. for £3,210 as purchase money and compensation in respect of the compulsory acquisition of certain land in the district of the Broadway, Westminster, under Parliamentary powers. The claimants were Mr. H. C. Wheeler (the freeholder) and his mother, Mrs. Wheeler, who was tenant for life.

The Arbitrator has awarded £2,458.

The claim was based on a valuation of Mr. W. H. Mills, who was supported by Mr. H. M. Rogers.

On behalf of the Electric Railway Co., Mr. S. Walker, auctioneer and surveyor, valued the purchase money and compensation payable at £1,604, while Sir Alexander Stenning, surveyor and architect, of Cannon Street, E.C., submitted a valuation amounting to £1,692.

It appeared that Mr. H. C. Wheeler was carrying on a coal and wheelwright's business on the property, and a claim by him in respect of this trade had been agreed to at £500. By the request of the parties the Arbitrator added this amount to his award, and the total of the award was thus £2,958.

Cosmos Lamp Works, Ltd.

In the Chancery Division, on Friday last, before Mr. Justice Sargant, Mr. Jenkins, K.C., mentioned the case of Cosmos Lamp Works, Ltd., against Cosmore, Ltd., and said this was a motion to restrain the defendants from using their present name in connection with their business. The defendants had shown that they took the name *bonâ fide*, but they recognised that confusion might arise between theirs and the plaintiffs' name, and they were prepared to give an undertaking to take another name, with the consent of the Registrar. Counsel, therefore, asked his Lordship to make an order staying all further proceedings on that undertaking, and to make no order as to costs.

Mr. Ward Coleridge, K.C. (for the defendants): That is right.

His Lordship accordingly made an order staying all proceedings.

A Birmingham Appeal Case.

On October 18th, a Divisional Court of the King's Bench Division heard an appeal by Samuel Allsopp & Sons, Ltd., from a decision of the Birmingham County Court awarding the Birmingham Corporation £29 11s. 1d.

According to the *Birmingham Post*, Mr. Norman Birkett (for Messrs. Allsopp) stated that in March, 1917, the Birmingham Corporation gave his clients notice that an electric switch, which stood on the pavement at the corner of two roads in Birmingham, had been damaged by a lorry belonging to them. The four men on Messrs. Allsopp's lorry denied having touched the switch box, and so liability was repudiated. A summons was issued in the Birmingham Police Court, and the appellants were ordered to pay £5 and costs, the maximum allowed by the Gas Works Clauses Act. The Corporation then claimed a balance of £24 11s. 1d. in the County Court in respect of the damage done to the switch box, and recovered judgment for the full amount. The appellants now submitted that the County Court Judge was wrong in law, and asked that his judgment should be set aside.

Their Lordships allowed the appeal, with costs.

BUSINESS NOTES.

British Industries Fair, 1919.—For next year's Fair the Board of Trade has again secured from the Port of London Authority the great warehouses in Pennington Street. The Fair will open, as usual, on Monday, February 24th, and will remain open until Friday, March 7th. In order that preparations shall in no way interfere with the production of munitions, the exhibition will again be restricted to glass and pottery; paper, printing, and stationery; fancy goods and toys. The invitations to visitors will be issued by the Board of Trade, and admittance will be restricted to *bona fide* buyers interested in the above trades. Over 2,000 forms of application for space have already been issued to manufacturers in the trades concerned, and it is expected that the number of firms anxious to participate will be considerably in advance of last year, when orders to the value of over a million and a half were placed. Eligible manufacturers who have not received application forms should communicate at once with the Director, British Industries Fair, Board of Trade, 10, Basinghall Street, London, E.C. 2.

U.S. Foreign Trade Developments.—Forty-four manufacturers, whose domestic sales aggregate $100,000,000, have formed the Allied Industries Corporation to develop foreign trade. Agents representing this corporation will be sent to Cuba, Central and South America, Porto Rico, the Dominican Republic, the Philippines, and the Straits Settlements to introduce their goods. Combination was effected under the recently-enacted Webb-Pomerene Act.—*American Machinist.*

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List.—Messrs. Johnson & Phillips, Ltd., Charlton, London, S.E. 7.—Leaflet No. T1/47 illustrating and briefly referring to their colliery transformers.

The Supply of Electrical Plant for Australia.—As briefly indicated in our last issue, a Conference of the managers or engineers of each of the authorities supplying electricity on any considerable scale in any of the six capital cities of the Commonwealth has been held at Melbourne, with regard to the importation of additional electric plant from overseas.

The Director of Munitions, in the course of a summary of the situation, said that a supply of electricity for the carrying on of certain industries, which might be designated essential industries, was obviously, if not a necessity, at any rate of very great importance to the Commonwealth and to the Empire. To allow of a supply of electricity to additional consumers, and to allow of a supply of electricity to existing consumers being maintained, additional plant was required, which plant could not, in practice, be imported from Europe or America without a recommendation from the Director of Munitions that the British or American Governments should issue a Priority Certificate for the manufacture and shipment of that plant.

Up to the time of the Conference, the Director of Munitions had received from each of the authorities supplying electricity on a large scale separate applications from time to time for Priority Certificates for separate items of plant required to enable the authorities to supply additional consumers of electricity and to maintain the supply of electricity to consumers already connected.

The Director of Munitions pointed out that the Ministry of Munitions in Great Britain and the corresponding department in America had recently shown signs of an inclination to refuse to issue Priority Certificates for any new plant required for Australia. The Director of Munitions was inclined to think that this was because, from time to time in the past, Priority Certificates had been refused for particular items of plant, and there was a tendency, once a Priority Certificate had been refused for a particular item of plant for Australia, to repeat the refusal for similar items of plant. The Director of Munitions also thought it was difficult for the Ministry of Munitions in Great Britain, for instance, to appreciate the fact that a large turbo-alternator was of no use to a supply authority without the boilers required to provide steam for the turbine, and that the boilers, again, were of little use without feed pumps, pipe work, coal conveyors, &c., such as were required to enable the boilers to be effectively used.

The Director of Munitions stated that, in any case, there was an increasing tendency on the part of the Munitions Departments in Great Britain and America to refuse Priority Certificates for the manufacture and shipment of plant for Australia. If this tendency to refuse to issue Priority Certificates was maintained, there was a possibility, if not a probability, of the electricity supply authorities in Australia finding themselves unable, not only to supply additional consumers of electricity, but even to maintain the supply of electricity to existing consumers. The Director of Munitions, therefore, suggested that requirements in the direction of additional plant and apparatus should be pooled, and that if this were done, and if he was assured that the list of requirements for the whole of the supply authorities was the minimum practicable, he would put forward their requirements, as a whole, to the Ministry of Munitions in Great Britain and the corresponding Department in America, with a recommendation that as they had reduced their requirements to what was absolutely necessary to maintain the supply of electricity and to provide for essential industries, Priority Certificates should be issued for the manufacture and shipment of all plant on the list. The Director of Munitions made it clear, however, that he could only pass forward the list of requirements with a recommendation for the issue of Priority Certificates if he were assured that—

1. The plant on the list would satisfy their requirements for two years.
2. The list contained only such spares as were absolutely necessary.
3. That in future, and until restrictions were removed, no additional lamps or motors would be connected by any of the supply authorities represented at the conference, unless the consumers applying for the additional lamps, motors, &c., required them for the carrying on of an essential industry or could be prevented from using electricity during the hours when the generating and transforming plant was most fully loaded.

It was pointed out to the Director of Munitions that the Acts of Parliament under which most of the electricity supply authorities worked, prevented the supply authority from discriminating between one applicant for a supply of electricity and another applicant, and that, therefore, under the law, as it stood, a supply authority, in the position to supply electricity to additional consumers, if it refused the supply to one consumer and gave the supply to another consumer, might lay itself open to an action of law, and might find itself liable for large sums of money. The Director of Munitions assured them that if the request was made, the Commonwealth Government would see to it that provision would be made, by the issue of a regulation under the War Precautions Act, for the protection of any electricity supply authority which, during the war, discriminated in giving supplies of electricity between an applicant for a supply of electricity proposing to use the electricity for an essential industry, and an applicant for a supply of electricity proposing to use it for another purpose than the carrying on of an essential industry.

The representatives of the electricity supply authorities in the six capital cities sat in conference after the Director of Munitions had left, and passed a number of resolutions, the object of which was to prepare such a list of requirements as was suggested by the Director of Munitions, and such assurances, with regard to the items on the list being the minimum requirements of the supply authorities, as the Director of Munitions asked for.

Metal Manufacturers' Difficulties.—At a meeting of the Walsall Chamber of Commerce it was stated that there was much dissatisfaction among manufacturers with the small proportion of metal that they were receiving from the Chamber's Allocation Committee compared with the extent of their requirements. It was felt that strong representations ought to be made to the Government Department concerned regarding the way in which Colonial customers were being treated at the present time. The trade was being driven to the United States.

Trade Announcements.—Messrs. British Electric Vehicles, Ltd., have removed from Hoghton Street to their new works, Churchtown, Southport. Their output of trucks will now be very considerably increased. We understand that when the new premises are fully fitted up they will be turning out at least ten trucks a week.

Messrs. Rose Bros. are opening a branch in Manchester (25-27, Miller Street) under the management of Mr. Harold R. Pearson, where a general stock of electrical goods and accessories will be carried.

Strike.—What is stated to be the first strike that has taken place at the B. I. & Helsby Cable Works, Prescot, since 1891, occurred last week, some 2,000 employés being affected. The men asked for a 47-hour week, instead of 53, and a 45-hour week for the night shift, without reduction of pay.

The Work of our Trade Commissioners.—It is announced in the *Board of Trade Journal* that, in consequence of representations made to the Department of Overseas Trade (Development and Intelligence), H.M. Trade Commissioners in the British Empire have been empowered to appoint an expert, or experts, to examine and report upon consignments of goods in respect of which a dispute has arisen when these goods have been imported from the United Kingdom, or any other part of the Empire that the Trade Commissioners represent. The Commissioners will only take such action when requested to do so by both parties to the dispute. Claims arising under insurance policies for goods damaged during the voyage do not come within the scope of the Commissioners' instructions.

British Honduras has been added to the sphere of H.M. Trade Commissioner in Trinidad (Mr. A. J. Pavitt), and he will visit the colony from time to time as opportunity offers.

Book Notices.—*The Employer* made its appearance in January last as a confidential circular issued by the National Employers' Federation. With the October number it appeals to a wider circle, at the price of sixpence. It is published at 2 and 3, Norfolk Street, Strand, W.C., and the number before us contains a good deal of matter that we think would be useful to employers at the present time. Its objects are to strengthen the relations between individual employers and their federation, and to present, ultimately, an agreed case to the public.

Modern Engineering Measuring Tools. By Ernest Pull. London: Crosby Lockwood & Son. Pp. viii + 115, figs. 110. Price 4s. 6d. net.—This small book serves to emphasise the change which has taken place in workshop practice during recent years, and which has been forcibly driven home by war conditions and the universal adoption of repetition methods in the manufacture of munitions of war. Jigs and gauges are the rule, but to arrive at these, accurate measurements are first necessary, and the author describes all kinds of shop measuring instruments, explaining very fully how to read micrometers and verniers with the aid of many examples, and dealing with a number of gauges for special purposes. He then treats of limit systems, giving tables of tolerances and allowances, and describing various forms of limit gauges. Finally, descriptions of the construction and use of accurate measuring machines are given, a number of tables of constants used in mensuration, decimal equivalents, &c., being appended. It is a timely and useful work, well printed and clearly illustrated.

"Handbook of Mechanical and Electrical Cost Data." By H. P. Gillette and R. T. Dana. Pp. xvii + 1,732; figs. 336. 1918. London: Hill Publishing Co. Price $6.00.

"I Fenomeni Elettro-Atomici Sotto l'Azione del Magnetismo." By Augusto Righi. Pp. xvi + 435; figs. 121. 1918. Bologna: Nicola Zanichelli. Price lire 17.50.

"*Journal* of the American Society of Mechanical Engineers." October, 1918. The Society: 29 West 39th Street, New York.

Liquidations.—United Vacuum Cleaner Co., Ltd.—Meeting, November 28th, at 17, Dacre Street, Westminster, to hear an account of the winding-up from the liquidator, Mr. F. G. Fuke.

Rotherham Electrical Engineering Co., Ltd.—First and final dividend 3s. 5½d. in the £, payable October 31st by Official Receiver, Figtree Lane, Sheffield.

Bankruptcy Proceedings.—Samuel Smith (trading as Smith & Sons), electrical engineer, &c., Victoria Square, Widnes, Lancaster.—An application was made on October 25th, at Liverpool, for the discharge from bankruptcy of the above-named debtor. The receiving order was made on March 10th, 1913, on the debtor's own petition. The debtor, it was stated, commenced business as a music and musical instrument dealer about 1890. The business appeared to have been carried on fairly successfully, and about two and-a-half years before the receiving order he, although without any experience, added to the business that of electrical engineer. He stated that two of his sons had some knowledge of the trade, and they superintended the businesses, the style of which had been changed to Smith & Sons. He attributed his position to "bad management of the business by sons, which he was unable to check."

His Honour Judge Thomas suspended the discharge for two years, the debit balance of £6 4s. 7d. to be paid before the order was drawn up.

Football.—The Sterling Lady Footballers (connected with the Dagenham Works of the Sterling Telephone and Electric Co.), who were undefeated last season, are again going very strongly. Against Handley Page, at Cricklewood, they registered their 50th goal of the season, and the 150th since their first game in September, 1917. This season they have scored 53 goals to nil, and in all 156 in 26 games against 10.

A football match took place on Saturday last at the Borough Polytechnic Ground, Herne Hill, between a team which irreverently denominated themselves "The Old Crocks of the G.E.C.," and the commercial apprentices of the same firm. The former team consisted exclusively of veterans who had been from 15 to 27 years in the service of the company. Their captain was Mr. E. A. Joyce, whilst the commercial apprentices were captained by Mr. G. W. Towers. The result, after a good fast game, every minute being played, was in favour of the former team by 6 goals to 4, whereat there was much rejoicing.

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LIGHTING AND POWER NOTES.

Australia.—Victoria.—A deputation of the Melbourne E.S. Committee has waited on the Minister of Public Works to urge the Government to make an early decision regarding the supply of electricity for the future requirements of the State. It was stated that in a few years the present plant would be totally inadequate, and the Council would either have to obtain energy from the Government, or erect a new station itself, in which case it might find afterwards that the Government had adopted a scheme which would render the Council's undertaking unnecessary and unprofitable. It was desired that the Government should make a statement regarding the proposal to establish a central station in the brown coal area at Morwell, and the Minister stated that this would be brought before the next meeting of the Cabinet.

E.L. Schemes.—The Narracoorte (S.A.) Council is borrowing £5,000 for the installation of an electric lighting plant; the Flinders (Victoria) Shire Council is borrowing £3,600 for the same purpose, Messrs. Gardiner & Christie, of Melbourne, being the consulting engineers; a local company is being formed to install an E.L. scheme at Braidwood (N.S.W.).—*Tenders.*

Tasmania.—The Governor's speech, at the opening of the Tasmanian Parliament, stated that negotiations were proceeding for an early development of the King River hydro-electric scheme, in connection with the Mount Lyell Co. The scheme is estimated to cost £1,000,000, and will take three or four years to complete, and as the Government is not in a position to undertake the work, it is considered very probable that the grant to the Mount Lyell Co. will be ratified by Parliament.

Bingley.—Unsatisfactory Supply.—The U.D.C. has written to the Keighley Corporation complaining of the frequent failures in the supply of electricity.

Blackburn.—Proposed New Sub-Station.—The Corporation is considering the erection of a new sub-station, adjoining the technical school.

Bolton.—Wages.—The application of the E.P.E.A. that an increase of 20 per cent. of the present salary, plus £90 per annum, be granted to all technical engineers, has been referred by the Electricity Committee to the town clerk and the borough electrical engineer for report.

Bradford.—Wages.—The Committee on Production has awarded an advance of 3s. 6d. per week to the local textile trade electrical workers, making a total advance on pre-war wages of 28s. 6d. per week.

Continental.—Switzerland.—The following announcements on the control of electric power have been made in recent issues of the *Recueil des Lois Suisses*:—The Federal authorities have assumed control of the distribution of Swiss electrical power, and will take any measures which may be necessary to ensure a rational and economic use of Swiss water power. They will hasten the completion of hydro-electrical works under construction, or arrange for the building of new works for which concessions have been granted. The cost of these undertakings will be distributed among the users, who will ultimately benefit. If necessary, the authorities will instruct existing establishments to pool their supplies or to supply an additional undertaking or group of undertakings in the neighbourhood. Where there is a shortage of electrical power the authorities will prescribe the necessary economies. In practice the power stations will be authorised to order such economies as may seem fit, but the interests affected will have the right in all cases to appeal to the authorities against these private assessments. The authorities will settle all disputes arising between the various undertakings as to the use of energy, and certain enterprises will be expressly exempted from a reduction of their power. If necessary, the authorities may requisition at fixed prices any material, machines, or tools necessary for the production or transmission of electrical power.—*Board of Trade Journal.*

Sweden.—The Digersbergs Belysningstech Kraft Aktiebolag is the name of a new concern formed at Orsa to establish an electricity station.

Damascus.—We learn that one of the first acts of the Arab Administration was to restore the electric lighting system in the town. This was in working order by the evening of October 2nd, although the plant had been disused for weeks under the Turks. The tramway service, owing to incapable administration, was discontinued in 1917. This service was also resumed on October 5th.

Dewsbury.—Year's Working.—The past year's working of the electricity department resulted in the credit balance being increased from £1,226 to £1,309.

Dublin.—Wages.—The Arbitration Court dealing with wages claims of Dublin Corporation employés, has allowed the extension of the July award of 3s. 6d. per week to clerks, canvassers, meter readers, slot meter collectors, and others engaged under the Electricity Committee, and to the clerical staff of the Public Lighting Committee.

East Ham.—Year's Working.—The accounts of the Corporation electricity undertaking for the year ended March 31st last show that the total revenue amounted to £29,936, against £27,872 in the previous year, while the expenditure was £27,804, against £23,205. After meeting capital charges, the gross profit of £2,132 was converted into a loss of £2,203, against a loss of £244 in the previous year, and after adding the charges for the redemption of the debt, together with a deficiency of £3,606 brought forward, and deducting £4,250 transferred from the borough fund, the total deficiency was £7,784.

Glasgow.—Fire.—A fire which broke out in the control-box of an electric travelling crane at the Dalmarnock gasworks caused damage estimated at £350.

Glossop.—Street Lighting.—The T.C. has accepted the tender of the Urban Electric Supply Co. for lighting the electric lamps at the two fountains, and for the maintenance of street lamps in the North Road and Newshaw Lane districts.

Grimsby.—Proposed Extensions.—The E.L. Committee suggests that, as large extensions will probably have to be undertaken in the near future at the electricity works, the surplus on the working of the department be transferred to the reserve fund for that purpose.

High Wycombe.—Street Lighting.—The restricted public lighting is to be modified, and 40 additional electric lamps are to be lighted.

Iceland.—Hydro-electric Scheme.—As announced in this column on April 26th last, a hydro-electric development of considerable magnitude is planned by an Icelandic company, financed principally by Norwegian interests in Iceland. This scheme contemplates the development of over one million horse-power from the River Fjorsaavasdraget, in Iceland. The necessary river property has been acquired by the company, and surveys have been made on the basis of which it is proposed to build six power houses capable of producing 697,000 H.P. during low water and 1,114,000 H.P. during high water. The execution of the scheme seems to offer many difficulties owing to the great distance of the power house from the coast and the lack of railroads. Before the work can be started it will be necessary to build a railroad, the first in the island. Material for the farthest inland power station will have to be transported over a distance of 40 miles.

Lighting Regulations.—Lighting Allowances.—The Coal Controller has decided to reduce by another 25 per cent. the lighting allowances in hotels, restaurants, and large shops in London and the big provincial towns.

To-day is the last day for making applications for coal and light rationing forms in England and Wales. Later applicants will receive less consideration.

Minimum Charge.—At a meeting of the Controller with the representatives of electrical undertakings throughout the country it has been arranged that the "minimum charge"—the amount charged whatever is used—should extend over the year, and not be a fixed charge for each quarter. Where the quarterly minimum was 5s., and only 3s. worth was consumed, say, in the September quarter, that 2s. will be deducted from the account if in the succeeding quarter, say, 7s. worth is used. The yearly charge is not to exceed £1, and where the charge has been a smaller amount that will now be the maximum.

London.—Hammersmith.—Wages.—The B.C. has increased the war bonus of the employés at the electricity works from 18s. per week to 20s. per week. An application from the E.P.E.A. for an increase of 20 per cent., plus £90 per annum, to technical engineers on the staff of the electricity department, has been referred to the Council of Municipal Authorities Owning Electricity Undertakings, with the object of bringing the matter, if necessary, before the Committee on Production.

Meters.—Owing to the difficulty of having the prepayment meters recalibrated at the present time to measure the new rates in force, the Electricity Committee has recommended the B.C. to discontinue the use of the prepayment mechanism and to convert the meters into ordinary registering meters.

Mains Extensions.—In order to supply a further 300 H.P. to the works of the General Stores and Munitions Co., at Leysfield Road, the Electricity Committee has recommended the B.C. to extend the main to the works, at an estimated cost of £2,700, and to purchase three 111-microfarad condensers from the British Insulated and Helsby Cables, Ltd., at £625 each, such condensers to become the property of the General Stores and Munitions Co.

Kensington.—Fire.—A gas main of the Gas Light and Coke Co., at South Kensington, took fire through an escape on Tuesday, last week, resulting in a troublesome outbreak affecting several properties. About 180 ft. of electric cable of the Knightsbridge Electric Lighting Co., a street lamp, a distribution box, two telephone junction boxes, and 60 ft. of the pavement were damaged or destroyed.

Luton.—Year's Working.—The accounts of the electricity undertaking for the year ending March 31st last show that the gross profit was £16,511 and the net profit £2,203, a decrease of £2,822. The income increased by £8,188 and the working expenses by £8,792.

New Zealand.—Water Power.—The report of the Government electrical engineer on the Arapuni hydro-electric scheme states that it would be capable of producing 40,000 H.P., at an estimated cost of £1,200,000. As, owing to financial difficulties, only a small portion of this power could be developed during the next few years, the Auckland Provincial Industrial Association has recommended the Government to take over the Horahora hydro-electric works of the Waihi Gold Mining Co. This plant is capable of generating 9,000 H.P., and, under the terms of the concession, the Government can take over the complete plant at cost price, which was less than £200,000, and by the expenditure of a further £100,000 an additional 7,000 H.P. could be obtained.

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Rotherham.—Utilisation of Waste Gases.—Under its new Act, the Corporation has obtained power to purchase crude or coke-oven gas, or waste heat, from any company or person within a large area surrounding the town, and also to lay mains to convey the gas to Rotherham. The Corporation is also authorised to install generating plant at any place within its electricity area where it is able to obtain waste heat.

South Africa.—The Mossel Bay (Cape Province) T.C. has appointed a Special Committee to inquire into the possibility of securing municipal electric lighting, and the Committee is making inquiries in various parts of the country.

Johannesburg.—Mr. J. B. Moffat, who recently held a Government inquiry into the causes of the strike amongst the Corporation's native employés, states that "the only conclusion that can be come to is that the Corporation's European employés having secured, as the result of a strike, a very substantial increase in their wages, the natives employed by the municipality followed the example of the Europeans, in the hope that their action would meet with the same success."

United States.—Women Meter Testers.—The *Electrical World* announces that the Department of Labour and Industry has refused permission to the Duquesne Light Co., Pennsylvania, to employ women for the testing of electric meters, on the ground that such employment "would not be proper from a moral standpoint, inasmuch as such work would lead them into out-of-the-way places."

Weybridge.—Price Increase.—The B. of T. has refused to allow the Urban Electric Supply Co. to increase its charges to 8d. per unit.

TRAMWAY AND RAILWAY NOTES.

Australia.—Hawthorn Tramway Track.—The disclosures published concerning the construction of the Hawthorn tramway track are emphasised by a report of the newly-appointed engineer and manager to the Trust, Mr. S. Robertson. The report states that in many respects the construction of the track was not carried out in accordance with the specifications and conditions of the Trust. Mr. Robertson made 22 test-holes, and found that in 18 of them there was less than 6 in. of ballast under the sleepers, and in one case there was no ballast. The ballast was dirty and mixed with small stones and mud. The rails were full of kinks, and the gauge of the track varied from correct to 1 in. out of gauge. In a switch drain-box it was discovered that a pipe leading to the culvert was 6 in. higher than that from the drain-box, being an attempt, apparently, to make water run uphill. On curves, also, the rails had not in all cases been bent correctly. Mr. Robertson states that the overhead construction was not in all cases carried out according to plans; the trolley wire should have been 19 ft. 6 in. from the ground, whereas it varied from 16 ft. to 20 ft.; the wire was not straight on the centre of the track, and had not been properly set off at the curves. The report, which was to have been considered at the next meeting of the Trust, estimated the cost of extra work on certain sections at £7,188, these sections amounting to about one-fifth of the whole.—*Age*.

Melbourne.—Year's Working.—The report of the Tramway Board for the year ending June 30th last, states that the arbitrator awarded the sum of £335,000 to the Melbourne Tramway and Omnibus Co. as compensation. The company has appealed against this assessment, and it is anticipated that the appeal will be heard this month. The action of the Board against the company for breach of the covenants of its lease of the tramways from the Melbourne Tramways Trust was initiated in November, 1916; the Board has now completed its details, and is awaiting the company's defence. The Board's claim totals £565,182. In order to provide additional power at the Richmond power house, the engines are to to be transferred from the Rathdown Street, North Carlton power house to Richmond, and two 125-kw. motors will be installed at the former station to drive the haulage cables. A contract has been entered into for the supply of the motors, which are to be manufactured locally. It is hoped that both stations will be reconstructed by January next. In October, last year, a contract was entered into with the Australian G.E. Co. for the installation of electric lighting on the cars by means of Edison storage batteries. The work has been delayed, but some of the material has now arrived, and one section equipped. The whole of the 27 stations are also to be electrically lighted, and one-half of the work has been completed. Owing to the difficulty of obtaining new wire ropes, the Board fears that some of the services may have to be discontinued. The revenue for the year amounted to £903,020, and the expenditure to £514,453. After allowing for interest, £30,000 was transferred to the renewals reserve account, and £360,207 to the appropriation account, which now stands at £600,227. Passengers carried totalled 113,034,157, against 103,118,379 in the previous year, and 12,833,029 car-miles were run, against 12,423,929; the revenue per car-mile was 16·859d., against 16·261d.

Sydney.—New Cars.—The latest type improved tramway car, which is on its trial, and which was put into commission on August 21st, is on the model of the ordinary type of 80-seater, but the sliding doors have entirely disappeared, and their place is taken by a pull-down blind, of the same type as has been used on the open smokers' seats in the combination cars, but of a much improved type. On first sight these cars appear to possess more glass, but it is not so, as the glass of the sliding doors is utilised to take the place of the wood panels, behind which the doors used to slide, and which now make the cars much lighter and pleasanter. As these glass slides can be pushed up and down in summer and fine weather, the cars are practically open ones, but can be closed up, and yet be light in rainy weather. The strap-hangers' wants are catered for by wooden bars across the entire width of the car. The smokers obtain just half the accommodation provided, while the sliding glass windows are lettered "Smoking," which is equally visible by day or night. Improvements have been made in the destination boards, which are now on top at the front of the car, and can be operated from the inside by the driver. The side boards have also been improved, in that they are lighted from the inside, the same as those in front, and are also operated from the inside of the car by the conductor. It is now much easier for the driver to see passengers getting in and out, owing to the use of glass side windows. New styles of centre lights have been added, while the cars are painted the battleship grey, which has lately found favour with the department.

Bradford.—Wages.—The application of the women tramway workers for a wage of 21s. per week over pre-war rates has been met by the Committee on Production by an award of 18s.

Coventry.—Accident.—As the result of a collision, on Saturday, between two tramcars, a passenger was thrown off the upper deck of a car into the roadway, and killed.

Dearne (Yorks.).—Light Railway Order.—The Joint Committee incorporated by the Dearne District Light Railway Order, 1915, has applied to the B. of T. for an extension of time to November 8th, 1919, for the completion of the railway sanctioned by the Order.

Huddersfield.—Wages.—The Tramways Committee has considered an application of the Tramway Workers' Union for a revision of rates of pay and hours of working of its employés, and has decided that the scale of wages be not altered, and the question of hours and Sunday labour be the subject of a report by the chairman and deputy chairman of the Committee.

Kingston-on-Thames.—Accident.—Two electric tramcars, running through Cambridge Road, on Thursday morning last week, collided at a point where double and single tracks meet. The fronts of both cars were completely wrecked, but the drivers escaped uninjured. Both cars carried a heavy load of passengers, who were thrown to the floor, and a dozen persons were more or less seriously injured. Three were taken to hospital, but the others, after treatment by local doctors, were able to proceed to their homes.

Leeds.—Proposed Extensions.—Further proposals with regard to tramway developments, in connection with the town planning scheme, are being considered by the Improvements Committee, and include lines from York Road to Seacroft, from Killingbeck to Crossgates, and from Harehills to Roundhay. The Committee favours a track laid on sleepers in the centre of the new roads, which are to be 125 ft. wide.

London.—L.C.C.—The Highways Committee, during the three months ended September 30th, settled 937 claims against the Council in respect of accidents arising in connection with the working of the tramways, at a cost of £6,744. Of 20 other cases in which actions were brought against the Council, 12 resulted in a verdict against the Council, and £956 and costs had to be paid; six were decided in the Council's favour, and two were withdrawn.

The Committee has completed arrangements for the sale of 10 tramcars to the Sheffield Corporation, at £550 each.

Arrangements have been concluded with the West Ham Corporation as regards overlapping workmen's fares, subject to an undertaking that the fares may be revised or withdrawn by one month's notice by any of the parties concerned, as follows:—The basis for 2d. return fares to be that already in operation on the Council's system, viz., four sections as against three for ordinary passengers; the 3d. return fares are not to be extended beyond the county boundary, but overlapping stages of approximately the same length as those in London, are to be introduced; the 4d. stages are to be a combination of two 2d. stages, and a maximum workmen's fare of 5d. return is to be arranged.

L.U.T. Bill—The London United Tramways Co.'s Bill, which asks for powers to revise fares and to carry out financial reorganisation and reconstruction, was passed by the House of Lords Committee on Wednesday last.

Ludlow.—Proposed Light Railway.—A public meeting is to be held to consider the question of a proposed light railway from Ludlow to Doddington, *via* Knowbury.

Preston.—Parcel Service.—Tramways Commitee has rescinded a former resolution to discontinue parcel delivery on the tramcars.

Sheffield.—Cable Explosions.—Two street explosions occurred in Sheffield recently owing to the failure of an underground tramway cable allowing current to leak to earth, with the result that the temperature in the cable box was raised, and the explosion forced the heavy metal cover off the box at two points. The explosions were followed by a fire, the cable insulation becoming ignited.

Worcester.—Wind Screens.—The City Watch Committee has received letters from the Electric Traction Co. with regard to the provision of wind screens at both ends of the cars. The company intimated that the directors only agreed to provide

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screens in view of the strong pressure put upon them by the Watch Committee. They further stated that sickness among members of the staff was greater on cars where screens had been provided than where there were no screens, and that the drivers were quite satisfied with the arrangements made by them.

Wrexham.—ACCIDENT.—Two passengers were injured in a collision between two tramcars, at a loop-line junction at Wrexham, last week.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—For having retained several documents which he had no right to do, Sydney Paul Morris, who had been an operator in the wireless telegraph branch of the Navy Service, was sentenced to three months' imprisonment, the accused having been found guilty on eight charges preferred against him. No suggestion was made that Morris had communicated the contents of the documents.—*Sydney Morning Herald.*

The Queensland storms a few months back did enormous damage to telephone and telegraph lines. The cost of repairs is officially set down at about £13 000.

Canada.—According to the *Times*, Mr. Justice Bruneau, of Montreal, has dismissed the petition of the Marconi Wireless Telegraph Co., which asked the Courts to issue an injunction to restrain the Canadian Car and Foundry Co. from installing certain apparatus for wireless telegraphy on ships under construction for the French Government at Port Arthur and elsewhere in Canada.

Confirmation of U.S. Cables.—The United States Censorship Board has published the following announcement:—"On and after October 1st, 1918, no confirmation of a cablegram shall be allowed to leave the United States, its territories, or possessions unless it be in plain language. On and after November 1st, 1918, no confirmation of a cablegram shall be allowed to enter the United States, its territories, or possessions unless it be in plain language. It is to be noted that code confirmations will not be passed by the Postal Censorship even when accompanied by what purports to be or actually is a translation thereof." In accordance with these regulations postal packets addressed to the United States containing the original text of code cablegrams will in future be stopped by the British Censorship.

Telephone Work for Blinded Soldiers.—The operating of telephone switchboards is one of the occupations for which blinded soldiers are being trained by the Australian Repatriation Department. At its central office in King Street the Department has installed one of its blind trainers as a switchboard operator, with a view to submitting his training to the test of practical work. A slight modification in the switchboard has been made, so that the operator can feel with the tips of his fingers whether any particular shutter is up or down. When he hears a shutter fall, he passes his hands over the board to discover on which line the call is being made. He then has to find the corresponding socket, and insert the plug in the same way as with other boards; but he must do it by touch instead of by sight. The switchboard is a busy one, being connected with 15 lines, on which the number of calls is considerably above the average. The operator has beside him a Braille writing set for recording messages and making notes.—*Melbourne Age.*

The Telephone Service.—About 1,000 operators in the London Post Office service have been absent from duty, and subscribers have been asked to relieve the strain on the staff by limiting the number of calls to those that are strictly necessary, and by making calls, as far as possible, during the less busy hours of the day, instead of between 10 a.m. and noon, when the pressure of traffic is at the maximum.

London telephone girls, at a meeting on Friday last, passed resolutions calling for an immediate increase of wages and "the abolition of the reformatory-like discipline, the secret observation tables, and the use of stop-watches," and "a reduction in the work per individual." A resolution was passed demanding "an immediate increase of not less than the amounts stated in the claim recently submitted to the Arbitration Board, both for women and men telephonists."

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdeen.—November 21st. Great North of Scotland Railway Co. Six or 12 months' supply of stores, including telegraph material. Stores Superintendent, 80, Guild Street.

Bedford.—November, 13th. Two water-tube boilers, mechanical stokers, and induced-draught plant for the Corporation. See "Official Notices" October 4th.

Bradford.—November 23rd. Tramways Committee. Stores for 12 months, including lamp fittings, insulating material, &c. General Manager.

Dublin.—November 7th. Gt. Northern Railway Co. of Ireland. Six or 12 months' supply of stores, including various electrical items. See "Official Notices" October 18th.

York.—November 1st. N.E. Railway Co. Telegraph apparatus, wire and line stores for 6 and 12 months. See "Official Notices" October 25th.

CLOSED.

Australia.—MELBOURNE.—City Council:—

300 5-amp. 230-volt meters, £720.—W. G. Watson & Co., Ltd.
200 10-amp. 230-volt meters, £522; 25 amp. 58s. each.—Warburton, Franki, Ltd.
40 15-amp. 460-volt meters, £185; 40 25-amp. do., £187; 30 50-amp. do., £162; 20 100-amp. do., £150.—Australian General Electric Co.
—*Tenders.*

Bradford.—Electricity Committee:—

Mechans, Ltd.—Four circulating water pipes, for Nos. 5 and 6 turbo-generators.
Bertram Thomas.—Switchboard for fan house at Valley Road.
Mather & Platt, Ltd.—100-B.H.P. A.C. motor and starter for Valley Road.
British Westinghouse Co.—Two 1,500-KW. rotary converters at Bolton Road works.

London.—L.C.C. The Highways Committee has purchased during the three months ended September 30th, 24,800 tons of coal and 4,000 tons of coke, for use at Greenwich power station, at a cost of about £58,300.

Material for alterations to coal shoots for eight boilers in connection with the burning of coke, £1,296; dismantling existing material and erecting new on a time and material basis of net flat cost, plus 25 per cent.—Babcock & Wilcox, Ltd.

ST. PANCRAS. B.C.:—

Two circulating pumps, £2,886.—Rees Roturbo Manufacturing Co., Ltd.
Mechanical stoker, £1,906.—Underfeed Stoker Co., Ltd.
Completion of steel work for coal-handling plant at King's Road Station, £2,777.—Strachan & Henshaw.

Salford.—Electricity Committee. Recommended:—

33,000-volt trifurcating box, switches, insulators, transformer, &c., in connection with the bulk supply by the Manchester Corporation, £395.—Callender's Cable & Construction Co.
Six machine stokers and accessories, £1,170.—E. Bennis & Co., Ltd.
One 500-K.V.A. three-phase transformer, £638.—British Electric Transformer Co., Ltd.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, November 1st. At 7.30 p.m. At 39, Victoria Street, S.W. Paper on "Engineering as Applied to Kinemas," by Mr. W. E. Dines.

Chief Technical Assistants' Association.—Saturday, November 2nd. At 3 p.m. At Anderton's Hotel, Fleet Street, E.C. Discussion on Mr. Murdoch's paper on "Voltage Regulation."

Society of Engineers (Inc.).—Monday, November 4th. At 5.30 p.m. At Burlington House, Piccadilly, W. Lecture on "Obstacles to Post-War Trade," by Sir Richard Cooper, Bart., M.P.

Institution of Civil Engineers.—Tuesday, November 5th. At 5.30 p.m. At Great George Street, S.W. Address by the President, Sir John A. F. Aspinall; presentation of medals awarded by the Council. (This is the opening meeting of the 100th session of the Institution.)

National Association of Supervising Electricians.—Tuesday, November 5th. At 7 p.m. At St. Bride's Institute, Bride's Lane, E.C. Paper on "Automatic Telephone Switchboards," by Mr. C. Bowman.

Institute of Marine Engineers.—Tuesday, November 5th. At 6 p.m. At The Minories, E.C. Paper on "Boiler Heating Surface: What is its True Value?" by Mr. G. J. Wells.

Industrial Reconstruction Council.—Tuesday, November 5th. At 6 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "The Place of Conciliation and Arbitration in the Whitley Scheme," to be introduced by Mr. E. H. C. Wethered.

Roentgen Society.—Tuesday, November 5th. At 8.15 p.m. At the Royal Society of Arts, John Street, Adelphi. Presidential Address, by Mr. G. H. Batten.

Institution of Electrical Engineers.—Thursday, November 7th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Tenth Kelvin lecture, "The Dynamical Theory of Electric Engines," by Mr. L. B. Atkinson. Presentation of premiums awarded for papers read or published during the past session.

(South Midland Centre).—Tuesday, November 5th. At 6 p.m. At the Birmingham University. Presidential address by Mr. S. T. Allen.

Birmingham and District Electric Club.—Saturday, November 9th. At 7 p.m. At the Swan Hotel. Paper on "Automatic Telephones," by Mr. H. W. Dipple.

Manchester Association of Engineers.—Saturday, November 9th. At 6.30 p.m. At the Grand Hotel. Paper on "Workshop Measurements, with special reference to the Limit System," by Mr. W. F. Rhodes.

NOTES.

A Magnet Made of Silver.—While iron is the only metal that can be made into a really powerful magnet, the property is not peculiar to iron. Nickel and cobalt can both be magnetised, and show the familiar North and South poles, like an ordinary steel magnet. It has been discovered recently that silver can also be magnetised under certain circumstances. Some bars of exceptionally pure silver were heated to 130 deg. C., and left for some time in a strong magnetic field, in connection with some experiments on gravitational attraction, described in a paper read before the Royal Society. It was afterwards found that the silver had become weakly, but permanently, magnetised by this treatment.

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Industrial Coal Economy.—The results of the industrial coal economy campaign are becoming apparent. From all parts of the country and from all classes of steam users, the Coal Controller daily receives letters announcing improvements of plant, consequent decrease in coal consumption and appreciation of the advisory work of his department.

For the purposes of this effort, which is under the charge of the technical department of the Coal Control, the country is divided into areas and districts, each with its engineer, whose function is to visit works, to consult with and advise the management how to secure efficient working so as to cut down the coal consumption. There are 400 engineers engaged in this work. In the United Kingdom there are between 40,000 and 50,000 steam users. Of these, 6,800 cases have been reported for attention, and the process goes on at the rate of 1,400 a week.

The principal directions in which fuel economy is being effected are by the improved lagging of boilers and steam pipes, repair of defective brick work in boiler flues, attention to leaky pistons and glands, and the utilisation of exhaust steam for heating purposes, and of the hot flue gases for heating boiler feed water. The use of unnecessarily high-grade coal for steam purposes is a prolific source of waste. This to an extent which represents a large aggregate saving is being remedied by the employment of lower-grade coal, thus releasing the better qualities for other purposes.

The small steam users who are using an excessive amount of steam, and consuming an excessive amount of coal, are receiving special attention. In many cases, where it has been possible to secure the plant, substantial economies have been made by the substitution of electric motors or gas engines for small steam engines. One large establishment estimates a saving of 40 tons of coal per week by means of electrification.

The estimate and aim of the technical department is that without any general scrapping of old and installation of new plant, a saving of 5,000,000 tons of coal per annum is practicable—provided that the economy movement has the active support and co-operation of all who work steam engines, from the managing director to the fireman who feeds the boilers.

The Coal Controller has issued figures which show a further serious falling-off in the estimated output of coal during the first 36 weeks of this year compared with the output during the corresponding period of last year; the net shortage is nearly 15¼ million tons, or about 8.8 per cent. It is estimated that on account of disputes at collieries the output of nearly 435,000 tons of coal was lost. The stocks of coal at mines and in trucks on September 14th of this year were about three-quarters of a million tons less than at the corresponding date of last year.

The output has steadily improved during the last three months, partly owing to the return of miners from the Army, to the stoppage of the holiday season, and to a decline in the influenza epidemic, yet the demand for coal is greater than ever. Although the domestic rationing system is now in full operation, and the public is loyally responding to the demand for the most drastic economy in the consumption of fuel and light, the Coal Controller is faced with extra demands for many millions of tons of coal for the requirements of the advancing Allied Armies, for the Navy, and for the manufacture of munitions. Even if peace were to come quickly, there is no prospect of a solution of the coal problem other than the economical one.

Electric Arc-Welding Schools.—Three hundred men from the Ordnance Department of the United States Army will be trained as electric welders in the schools established by the electric welding section of the industrial relations group, according to an announcement made by H. A. Hornor, head of the section. These men will be used in the work of reclamation of war materials gathered from the battlefields of France. A special branch for handling electric welding problems and for training electric welders has been established. The service is free to shipbuilders, or those aiding shipbuilders, or doing important work for the Government. The schools are at Schenectady, N.Y., New York City, and Cleveland, and one is also being started in Philadelphia.—*Electrical World.*

Industrial Councils: Co-ordination Wanted.—The chemical trade, one of the first to apply the principles of the Whitley Report, is not satisfied merely to have a Joint Industrial Council. It now announces a further step in the appointment of six "special commissioners," who are to be ready "on a telegraphic summons to go at once to any place in which a question has arisen which cannot be settled by the Works Committee or the District Council." At first glance the notion of a travelling conciliation commission of employers and trade unionists looks admirable. Procrastination, as we know, has been one of the most fruitful causes of unrest in the past, and anything tending to hasten the hearing of differences should have a good influence. But there is a danger which must be plainly marked at the outset. Suppose an establishment-worker, an electrician, say, at some chemical factory raises a difficulty which cannot be settled without the intervention of the travelling Commission. Is it to be within the power of the Commission to order a change of working conditions which will create a precedent for every electrician outside the chemical trade? The point is extremely important, for it will readily be seen that whereas such a change might affect only two or three men in a chemical factory, an electrical factory might find every man in its employment presented with a grievance. This has always appeared to us to be the fatal weakness of the Whitley scheme. It provides no method of co-ordinating different trades employing the same classes of labour. Developments like this are certain to lead to trouble unless a co-ordinating body is set up. What is wanted is a Federation of Joint Industrial Councils. This body could be brought into existence at once through the more broadly constituted of the employers' federations and the corresponding labour organisations.—*The Employer.*

Science Expels "Kultur."—The Inter-Allied Conference on the future of international organisation in science, which met in London last month, unanimously adopted a number of resolutions dealing with the withdrawal of the Allied nations from existing international associations, and the substitution of new associations in their stead. The Conference declared that the traditional fellowship and co-operation of scientific men of all nationalities had been destroyed by the atrocious conduct of the Central Powers, which had broken the ordinances of civilisation and forfeited the esteem of the civilised world. Hence the Allied nations could not resume personal relations in scientific matters with the guilty nations until the latter had renounced the political methods which had led to the atrocities that had shocked the world.

On October 23rd the French Academy of Sciences confirmed the resolutions above mentioned.

Decimal Coinage and the Metric System.—The Decimal Association has reprinted a searching commentary by Mr. Harry Allcock on the findings of Lord Balfour of Burleigh's Committee with regard to the proposed introduction of metric weights and measures and decimal coinage, which was published in *Nature* of June 6th, 1918. With reference to the statement in the report to the effect that though the use of the metric system had been permitted for 20 years, it had not gained adoption, the author pointed out that it was obviously impracticable for tradespeople and manufacturers to adopt the system individually. He exposed the fallacy of the statement that the adoption of the metric system would involve changes in the dimensions of spare parts, &c., or in the equipment and working of factories, and remarked that if we did not adopt the metric system outright, we should be compelled to use both systems for ever. With regard to our export trade, Mr. Allcock pointed out that the British Dominions all wished for the change, and that if Great Britain adopted it, the United States would quickly follow the example; in order to forestall German competition, we ought to act promptly. On the subject of decimal coinage, the author emphasised the inability of our existing monetary system to cope with fluctuations in prices without great injustice to the poor in the case of low-priced articles, and he advocated book-keeping with three columns for cash entry as at present, but headed respectively, pounds, florins, and mils, to avoid the use of three figures after the decimal point. The coinage question is at present being considered by a Royal Commission.

Copies of the pamphlet can be obtained gratis from the Decimal Association.

A general meeting of the Decimal Association is to be held on Thursday next, November 7th, at 3 p.m., at the Manchester Hotel, Aldersgate Street, E.C.1., to receive the report of the Executive Committee, adopt rules, and elect members of Committee.

Variation of Resistances at High Temperatures.—Measuring the electric resistance of some metallic oxides at high temperatures in a vacuum and in a nitrogen atmosphere, Emil Podszus noticed striking differences in the two series. The investigation was not completed as Podszus had to join the army last year; however, he gave a preliminary account of his experiments in the *Verhandlungen der Deutsch, Physik. Gesellschaft* of October 30th, 1917. According to *Engineering*, the specimens were small compressed rods of the carefully purified oxides, about 1.3 mm. thick, 10 mm. long, and were heated in a small electric furnace formed by a spiral of tungsten tape, 0.2 mm. thick, suspended in a glass globe, which was evacuated to 1 mm. or 2×10^{-4} mm. of mercury or filled with nitrogen at atmospheric pressure. The globe was previously heated to 400 deg. C.; for the measurements the spiral was heated up to 2,000 deg. C. by alternating currents. The oxides examined were CaO, MgO, Al_2O_3, ThU_2, and further boron nitride BN. In all the cases the resistance decreased greatly as the temperature was raised, in the case of calcium oxide from 1,330,000 ohms at 1,510 deg., to 80,000 ohms at 1,690 deg., and in most cases the resistance was found to be much smaller (only about half) in the nitrogen atmosphere than in the vacuum. In the case of alumina there was very little difference in the two series, however, the resistance being 3,380,000 ohms at 1,550 deg. and 410,000 ohms at 1,775 deg.; we leave out the intermediate values. But the boron nitride showed much higher resistances in the nitrogen than in the vacuum, the figures being: 6,000,000 ohms at 1,620 deg., 1,300,000 ohms at 1,750 deg., 230,000 ohms at 1,930 deg. in nitrogen, and 700,000 ohms and 100,000 ohms at 1,680 deg. and 1,840 deg., respectively, in the vacuum. Dissociation of the compounds and thermionic currents would affect the resistance in addition to temperature.

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Volunteer Notes.—Royal Engineers (Vols.), London Army Troops Companies.—Headquarters: Balderton Street, Oxford Street, W. 1.

Corps Orders No. 45, by Lieut.-Col. C. B. Clay, V.D., Commanding.
Captain of the Week.—Capt. W. Darley Bentley.
Next for Duty.—Capt. E. G. Fleming.
Sunday, November 3rd.—Annual musketry course at Pirbright. Parade, Waterloo Station, 9 a.m. Drill order, with rifles and great coats. Mid-day and tea rations to be carried.
Monday, November 4th, to Saturday, November 9th.—Drills as usual.
Sunday, November 10th.—Commandant's Parade at Waterloo Station, for work at Esher, 9 a.m. Drill order and great coats. Mid-day and tea rations to be carried.

C. Higgins, *Capt.* R.E., *Adjutant.*

Chemical Technology.—According to the *Times*, a scheme has been drawn up for the post-war development, under Prof. W. A. Bone, of the Chemical Technology Department of the Imperial College of Science and Technology at South Kensington, involving an outlay estimated at £100,000 for buildings and equipment, and a cost of not less than £10,000 a year for maintenance and working expenses. It is proposed that the Department shall be organised in four principal sections. The first will be concerned with the general technology of fuels, carbonisation of coal, distillation of wood, chemistry of coal tar and its derived products, chemistry of gases and technical gas catalysis, and refractory materials used in furnace construction and the manufacture of ceramics, glass, and cements. In the second, or Chemical Engineering Section, facilities will be provided for the advanced study of the operations required in chemical manufacture, including factory economics and organisation; while the third will cover the principal applications of electricity in chemical industry. In the fourth section various groups of chemical products will be dealt with.

Fuel Economy Exhibition.—A Fuel Economy Exhibition, organised by Lady Rhondda's "Win the War" Committee, will be opened in Trafalgar Square on November 18th. The object is to show people how to economise their coal and light rations by making use of the means to hand without having recourse to expensive patent appliances. No materials will be used which cannot easily be obtained in an ordinary household. The exhibition will be open for a week, and on each day an expert will lecture on practical means of economising.—*The Times.*

Cable, Electric, D 1.—

As a supplementary bivvy-string this cable's unexcelled,
It will last you duration and a day;
As a substitute for headropes, which the Q.M. has withheld,
It is useful, for it does not break or fray.

If you're using Jordan rushes for the building of a mess,
It's invaluable for binding and for guys;
And without it, it is useless your endeavouring to dress
Lines of saddles, tents, or bivvies soldierwise.

For a ration or a forage dump that has to be enclosed
Only angle irons and cable you require;
If you want to measure distances, the Signals are disposed
To advance you quarters, halves, or miles of wire.

As a clothes-line it is matchless and for tying rolls of kit;
It's been known to clean a pipe that wouldn't light;
It has lately been discovered that a splendid use for it
Is to guide patrolling officers at night.

But for telegraphic purposes this cable is a dud—
Be advised, and never use the stuff for this;
It lies ambushed on your path and trips you sprawling in the mud,
Yet whene'er you wish to telephone—it's "dis."

[The foregoing verses appeared in the *Palestine News* for September 19th, and were forwarded to us by Mr. J. H. C. Brooking. We shall be glad to hear from the author if he sees these lines.—Eds. Elec. Rev.]

Electrical Engineers on Board Ship.—Standard rates of pay for our Mercantile Marine have been settled by the National Maritime Board. The rates of pay for electrical engineers are as follows, per month:—

	First. £	Second. £	Third. £	Fourth. £
Single-handed ships	20	—	—	—
Two-handed ships	21	18	—	—
Three-handed ships	22	18½	16½	—
Four-handed ships	23	18½	16½	16

E.T.U. Branch Treasurer Sentenced.—At Lancaster Assizes, on Friday, before Justice Baillache, Francis Furniss (37), electrician, pleaded guilty to several indictments for falsifications of accounts, forgery, and embezzlements of the books he held as treasurer of the Barrow branch of the Electrical Trades Union, between June, 1916, and June, 1918. For the defence, it was stated that Furniss had a 10 years' character as an excellent workman at Vickers's. He drew £4 5s. per week. He was sentenced to six months in the second division.

The Channel Tunnel.—Sir Arthur Fell, Chairman of the House of Commons Channel Tunnel Committee, has given notice of his intention to propose at an early date: "That in the opinion of this House the construction of the Channel Tunnel should be undertaken at the earliest moment after peace, to cement the friendship of the Allies in Western Europe, to improve their means of communication, and to promote their mutual commerce." Mr. Bonar Law will be asked to afford an early opportunity for discussion of the motion.

Metropolitan Association of Electric Tramways Managers.—A meeting of the members of this Association was held at the Municipal and County Club, 2, Whitehall Court, Whitehall, S.W., on Friday last, when there were present:—Messrs. Ullmann (East Ham), Hammond (Met. Electric), Harvey (Ilford), Murray (Walthamstow), Williams (Erith), Bruce (L.C.C.), Mason (South Met.), Mackinnon (London United), and Goodyer (Croydon). Messrs. Ullmann, Hammond, and Goodyer were re-elected chairman, vice-chairman, and hon. sec. respectively.

Electric Vehicle Progress.—Sheffield Corporation proposes contributing three guineas annually towards the expenses of the Electric Vehicle Committee of the Incorporated Municipal Electrical Association. The Port of London Authority is using an electric ambulance. Motor appliances are now used by the British Army to pump out trenches; this suggests similar work in commercial service in pumping out ditches and excavations where other forms of power are not readily available. The motor outfit is capable of pumping out 3,000 gallons per hour. The equipment comprises an Austin 2-ton truck with a separate 4½ × 6 four-cylinder motor of 32 rated H.P., mounted in a body and directly coupled to a compound-wound D.C. generator; three portable combination 200-volt electric motor and centrifugal pumps, and reels of cable by which the pumps may be set down in the trenches while the truck is some distance away. The pumps are specially designed to handle muddy water without clogging, and the wagon serves as a means of making the outfit mobile.—*Tramway and Railway World.*

Proposed Tunnel to Ireland.—On October 22nd, the Prime Minister was asked whether he could see his way to direct the Minister of Reconstruction to inquire into the possibility of constructing a tunnel to Ireland. In reply, Mr. Bonar Law stated that a Select Committee of the House of Commons had been appointed to consider the internal facilities for transport within the United Kingdom, and the inquiry suggested was covered by the terms of reference of that Committee.

Electric Pig-iron in Italy.—Electro-Metals, Ltd., of London, are putting up an extensive installation for the electric smelting of iron ore for Messrs. Ansaldo, in Italy, says *Indian Engineering.* In the first instance there are to be two plants of 4,000 H.P. each, and these will be followed by four more of the same size, bringing up the total to 20,000 H.P. The six plants together will be able to reduce 150,000 tons of ore annually. The electricity will be obtained from a three-phase, high-pressure supply through static transformers, three of which for each furnace will have a capacity of 1,200 K.V.A. each, and will be so arranged that the voltages on the secondaries can be varied between 35 and 70 volts in eight successive stages. The gas produced will escape through openings near the top of the shaft, and after being cleaned can be used for heating in the steel works. A portion of it, however, after being passed through a dust extractor and centrifugal washer, will be forced by a fan through tuyeres into the upper part of the furnace chamber.

The Metric System in Russia.—The Russian Government has decided to introduce the metric system of weights and measures. All businesses will be obliged to quote their prices according to both the old and the new systems, and the latter is to be introduced by August 21st, 1921. From January 1st, 1925, the use of the old system of weights and measures will be prohibited.

Nitrogen from the Air.—Referring to the possibility of obtaining nitrogen from the air in New Zealand, Mr. J. Orchiston, ex-chief telegraph engineer, at a meeting in Wellington, said the direct arc process, as carried on in Norway, was likely to be a success in New Zealand. In the Western Sounds of Otago there was abundance of water power waiting to be utilised, with the great advantage that Nature had so placed these powers that they could be cheaply harnessed alongside of first-class deep-water harbours. A syndicate was formed in Dunedin over a year ago for the purpose of promoting the manufacture of calcium nitrate and other electrochemical productions, but so far the Government had refused to grant the use of the water power asked for, although it was less than 1½ per cent. of the power going to waste in that region. —*Sydney Morning Herald.*

Fatality.—C. J. Ritson, aged 29, of Liverpool, died at the Liverpool Royal Infirmary, last week, as the result of being struck on the head by a falling trolley-head from a Corporation tramcar in London Road. A verdict of "Accidental death" was returned.

Lighting of Flats and Offices.—It has been brought to the notice of the Coal Mines Department by local fuel overseers that many occupiers of flats and offices appear to think that there is no need to send the usual application form to the local fuel overseer unless they use coal. To clear up the misunderstanding, it is stated that all consumers of more than 22,500 cb. ft. of gas or 120 B.T. units of electricity a year have to apply for an assessment, and the forms can be obtained from the gas or electricity undertakings if the consumer does not buy coal.

If the flat or office is part of a block where the heating is supplied by the landlord or main occupier, or if the gas or electricity is supplied by a sub-meter from the general supply to the building, the premises may be decided by the local fuel overseer to be a case for one joint assessment, and occupiers under these conditions should inquire from their landlords in the first instance.—*The Times.*

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Inquiry.—The makers of I.C. switchgear with the trade mark of "W.V." in a circle are inquired for.

Electricity in Agriculture.—According to the *Evening News*, experiments which have been carried out in Dorset, to test the practical value of electrified seeds, have resulted in an unqualified verdict in their favour. Some thousands of acres were sown last autumn and spring with wheat, oats, and barley treated by the Wolfryn electrochemical process, which consists of soaking the seed in a weak solution of water and common salt, running a small electric current through the seeds while in soak, and then slowly drying them in a kiln.

Fields were divided into sections, and the electrically treated seeds and untreated seeds were sown under identical conditions as regards ploughing, manuring, and sowing, and on the same day. The difference between the two was most apparent in the early summer. Ear, straw, and tillering were greatly superior in the treated to the untreated. Threshing trials of crops inspected by our contemporary's agricultural correspondent this summer show results as follows :—

Mr. Lovelace's farm, Piddlehinton, Dorchester, a gain of seven bushels an acre on treated Benefactor wheat over untreated, and six bushels an acre on white oats.

Mr. Foot, Bincombe Farm, Dorchester, a gain of 6½ bushels per acre.

Mr. Cake, Higher Burton, Dorchester (Archer's stiff straw barley), a gain of 16 bushels per acre.

Mr. Legg, Blasherwell, Corfe Castle (white oats), a gain of 18 bushels per acre.

Messrs. S. & H. Smith, Rollington Farm, Corfe Castle, Dorset (white Abundance oats), a gain of 19 bushels per acre.

The wheat is calculated at 63 lb. per bushel, barley at 56, and oats at 42.

Appointments Vacant.—Draughtsman for the Battersea B.C. Electricity Department; senior assistant electrical engineers (74s. + 12½ per cent.) for the North-East Coast: resident electrical engineer, Rs. 700 per month, and shift engineer, Rs. 400 per month, for the Indian Ordnance Factories Committee. See our advertisement pages to-day.

Institution and Lecture Notes. — Electrical Power Engineers' Association.—Midland Division.—A North-Western Section, comprising Shropshire and Staffordshire, and a Birmingham Section, have now been formed in this Division. Hon. Sec., North-Western Section: Mr. T. Mason, 94, Gospel Oak Road, Ocker Hill, Tipton, Staffs. Birmingham Section: Mr. W. A. Kitchin, "Soho House," Soho Avenue, Handsworth, Birmingham.

The next smoking concert in connection with the Midland Division will be held at the White Horse Hotel, Congreve Street, Birmingham, on Wednesday, the 6th inst., the chair to be taken at 6.30 p.m.

Association of Mining Electrical Engineers.—The first meeting for the session of the West of Scotland Branch was held at Glasgow, on October 18th. Mr. A. Smellie, the new president, in the course of his presidential address, said the need for trained electrical engineers was greater than ever. The work of the future must be carried on by more economical methods, and he suggested the appointment of officials at all collieries where electric plant was used whose sole duty would be to inspect such plant and educate those entrusted with it.—*Glasgow Times.*

Institution of Electrical Engineers (South Midland Centre).—On Tuesday next, at 6 p.m., at Birmingham University, the new session opens with the delivery of the address by Mr. S. T. Allen, chairman. On Wednesday, November 27th, at 7 p.m., Mr. J. H. Shaw will read a paper on "High-Pressure and High-Temperature Steam in Large Power Stations."

Illuminating Engineering Society, U.S.A.—Included in the programme of the convention of the Society to be held on October 10th was the presentation of "War-Time Lighting Economies," a treatise prepared by the Committee on War Service, and submitted to the United States Fuel Administration to serve as the basis of the Fuel Administration's propaganda for economy in lighting on the part of the public at large. Copies of the paper may be obtained upon application to the general offices of the Society, 29 W. 39th Street, New York City.

The Electrical Association of Australia.—At a meeting of the Victorian Section on July 25th, a paper was read on "The Induction Generator," by Mr. F. E. Moreton, who said there were several instances in Australia of induction generators running in parallel with synchronous generators and supplying load, the magnetising current being supplied by the synchronous machinery. A case on record where the magnetising current was supplied by the circuit itself due to capacity was somewhat different.

It occurred to the author that the system might have been very nearly resonating, or at least have had a natural frequency somewhere near that of the generator, and that the induction generator would then force the oscillations in the circuit. To find whether this was the case, and to determine some of the characteristics of an induction generator, experiments were undertaken, of which details were given in the paper. The author concluded that the induction generator at present was not suitable for power stations.

"The Proper Use of Coal" was the subject of a lecture delivered at the Central Liberal Club, Dewsbury, on October 12th, by Mr. W. B. Woodhouse, general manager and chief engineer of the Yorkshire Electric Power Co. Referring to the B. of T. Report, he said that no doubt generation at large stations would effect a large saving, but there was a difference of opinion as to the necessity for a new body to carry out the work. The Leeds Corporation, for example, considered that it should do the work in conjunction with neighbours. Other municipalities in the West Riding took the same view, and working arrangements had already been made between Sheffield, Bradford, and Rotherham, and the Yorkshire Power Co.—*Yorks. Observer.*

E.T.U. Presentation.—At a concert organised by the Birmingham District and Coventry Branches of the Electrical Trades Union, a presentation was made to Mr. J. Kinniburgh (national organiser). Mr. T. Gaynor occupied the chair, and Mr. J. W. Ball (general president), in making the presentation, referred to the progress of the Union in the Birmingham district, which was due, in a large measure, to the genius of Mr. Kinniburgh, to whom he handed a gold watch and chain for himself and a gold wristlet watch for his wife.

Women Sub-Station Operators.—The war has brought many changes in central-station practice, but few of these are more significant than the use of women as sub-station operators on the system of the Edison Electric Illuminating Co., of Boston, Mass. According to the *Electrical World* of September 21st, while as yet there are engaged only about 30 women in this work, there is every prospect that the number will be extended. Two sub-stations are now operated exclusively by women, and the results appear to be admirable in every way. The service appears to be fully as reliable as though men were in charge, emergencies have been met, and the effect upon the health of the operators has been uniformly good. The company distributes energy over an area of 700 sq. miles, and for this reason the sub-station service is of great importance. The Roslindale sub-station supplies energy for power, and commercial and street lighting, and has a rating of 3,790 kw. at 13,800 to 2,300 volts.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.

Central Station Officials.—Darwen Corporation received 94 applications for the position of electrical engineer, and these stand referred to a sub-committee.

Mr. W. Y. Anderson, A.M.I.E.E., has been appointed commercial engineer of the City of Birmingham Electric Supply Department.

Mr. J. F. Croft, works manager of the gasworks at Fenton, has been appointed manager and secretary of the Stone Gas & Electricity Co., in succession to Mr. T. W. Saville.

The Aberdeen Electricity Committee has increased the salary of Mr. Downie, chief clerk to the department, to £300, including war bonus.

Mr. D. Cowan, station superintendent at the Croydon municipal electricity works, who is retiring, has been presented by the staff and employés with a gold ring and pendant, and with a gold-mounted umbrella for his wife.

Mr. S. F. Blyth, station superintendent at the Great Yarmouth electricity works, in recognition of over 20 years' service to the undertaking, has been presented by the staff with a silver cigarette case and a vacuum flask.

Much sympathy has been expressed with Mr. J. B. Patterson, acting electrical engineer for the Lancaster Corporation, who has lost his wife and a son, aged 11 years, within two days from pneumonia following influenza.

Mr. J. W. Papworth, who for the past 11 years has held the post of burgh electrical engineer to the Stirling (N.B.) Corporation, has resigned, having accepted an appointment in the South.

General.—Sir Wm. Plender has been appointed honorary financial adviser to the Board of Trade.

It is announced that three Labour representatives, Messrs. Harry Gosling, L. W. Ogden, and James Gavin, have been appointed members of a Provisional Council to advise the Department of Commerce and Industry set up by the Board of Trade.

Major R. Grierson, R.E., who has now been moved to the H.Q., Lines of Communication, France, to do duty as Staff Officer for Electrical and Mechanical Services to the Deputy-Directory of Works (South and Central), and also to command the 356th Electrical and Mechanical Company, has suffered from a shortage of technical labour, so he is forming a school of instruction for electricians and engine drivers. He enlisted in August, 1914, as a private, and saw active service in Gallipoli, being "mentioned in dispatches" and promoted to captain.

Roll of Honour.—The Military Medal has been awarded to Inspector Norcombe and to Motorman Stevens, of the Exeter tramway staff.

Sergeant C. Self, R.E., who was with Messrs. Crompton and Co., Ltd., Chelmsford, is reported missing from the ss. *Leinster*, sunk by a submarine.

Pte. J. W. Powell, Sherwood Foresters, who has died of pneumonia while under treatment for wounds, was an electrical engineer with the Mansfield Engineering Co.

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Sergeant C. N. Smith, Devonshire Regiment, who has been killed by a shell, enlisted from the Barnstaple Corporation electric light works at the outbreak of war.

Corporal G. Blackshaw, Royal Scots, killed in action, was formerly employed by Messrs. Baxendale & Co., Ltd., Manchester.

Gunner B. P. Jenkins, Westminster Dragoons, wounded whilst serving in Palestine, was an apprentice with Messrs. Dick, Kerr & Co., Ltd., Preston.

Piper J. Richardson, of the Manitoba Regiment, one of the new V.C.'s, began his apprenticeship in 1911 as an electrical engineer with the General Electric Co. at Glasgow, and remained with them till he went to Canada with his parents.

Corporal C. R. Edwards, A.S.C., M.T., who has died of pneumonia in France, aged 24, was employed in the electrical repairs department of the Burnley Corporation tramways.

Signaller H. Pennington, King's Liverpool Regiment, who has been wounded, was employed at the Howe Bridge power station.

Trooper T. Taylor, Lancashire Hussars, killed in action, was employed by B.I. & Helsby Cables, Ltd., Prescot.

Lieutenant H. Walker, R.F.A., previously missing, now reported killed, was employed by the British Westinghouse Co., at Trafford Park.

Private G. Wade, Manchester Regiment, who has died of wounds, was with Messrs. Charles Macintosh & Co., Ltd., Manchester.

Sergeant J. Williams, Lancashire Fusiliers, awarded the Military Medal, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Private H. Bentley, Highland L.I., of Great Haywood, Staffs, who was in the accountant's department at Messrs. Siemens Bros., Ltd., Stafford, has been killed in action.

Private W. G. Earrey, East Surrey Yeomanry, lost by the sinking of the ss. *Leinster*, was on the electrical staff at Chatham Dockyard.

Captain R. B. Broster, West Riding Regiment, previously reported missing, now reported killed, was at the outbreak of the war studying electrical engineering at the Keighley Corporation generating station.

Private W. J. Hurford, Bedfordshire Regiment, killed in action, was employed by the Bristol Corporation electricity department.

At the last Barrow Town Council meeting, the Mayor moved that a vote of condolence be entered upon the minutes, and a copy sent to Ald. J. P. Smith, J.P., Chairman of the Electricity Committee, and a former Mayor of the borough, whose son, Lieutenant Basil Smith, South Lancashire Regiment, had met his death in action. Lieutenant Smith was training as an electrical engineer when he joined the Colours. He fell whilst leading his platoon in Salonica.

Obituary.—Mr. J. O. Callender.—Mr. James Ormiston Callender, whose death it was our regretful duty to announce last week, was the fourth son of the late Mr. W. O. Callender, of Bournemouth. He was born in 1863, in London, but, both by education and by family ties, he was a true Scotsman, and so remained till the close of his life. He was educated at the Glasgow Academy and in Paris, and received his technical training at the City & Guilds of London Institute, South Kensington. On its completion he joined the testing staff of the Callender's Telegraph & Bitumen Co., at Erith, and was in charge of that department for some years. During that period he made several journeys to France and Italy, returning to this country in 1886 with impaired health, which necessitated a lengthy voyage to South Africa. On his return, in 1886, he decided, under medical advice, to proceed to New Zealand, where he resided for some time at Queenstown, whose climate proved very beneficial, with the result that in the following year he took up business as a consulting engineer in Sydney, where he was one of the pioneers in the electrical industry, and a founder, and early president, of the Institution of the Electrical Engineers in that continent. During the 14 years in which he was residing in Australia he made many voyages, visiting all parts of the Australian Continent, and also China, Japan, and the United States, besides coming home on several occasions. During that time he represented the Callender Co.'s interests in Australia, and, in addition to his own consulting work, carried out several important contracts for the home firm. In 1900, the Callender's Cable & Construction Co. having been formed, and its business so largely increased, he returned to take a post at headquarters, and spent the rest of his life as one of the management of the company in London. Owing to his extensive experience of the world, he had charge of the overseas department of the company, as well as the general management of the extensive contracts which were carried out at home. In 1903 the Callender Co. acquired control of the Anchor Cable Works at Leigh, Lancashire, and from the very beginning of that connection Mr. James Callender took the keenest interest in the progress of the Anchor Works, which were entirely reorganised under his direction, and which under his personal supervision developed into one of the most important factories dealing with rubber insulation in the country. The Picardy Works, recently constructed for the manufacture of war material, was designed under his personal care and supervision. For several years past he has suffered from indifferent health. In July, 1914, he was in Carlsbad, and only reached Switzerland a few days before the declaration of war. As he was still an invalid, he suffered much during the difficult journey home in August of that year, but he regained his strength, and was most active in his work until a few months ago, when he had a breakdown which necessitated his taking a lengthy rest. His recovery was, however, anticipated by his friends, but a sudden relapse, after an operation, took place on October 18th, and he passed away in his sleep the following day at Swanage. He was an Associate of the Institution of Electrical Engineers, and a Member of Council, and represented his company on the Committee of the B.E.A.M.A.

The memory of Mr. James O. Callender will always be revered at the Anchor Works, Leigh, in the development and success of which he took quite a fatherly pride. At the hour of his funeral, last Tuesday, the works closed down for half an hour, when 900 of the workpeople and staff attended a memorial service in the works canteen, conducted by the Rev. L. S. Murdock, Vicar of the parish in which the works are situated. The service opened with the time-honoured hymn "O God, our help in ages past," followed by prayer. A second hymn, "Rock of Ages," was sung, after which a brief address was given by the Vicar, in which he referred to the personal influence the late Mr. Callender had exerted on all with whom he came in contact. Those who were present when the canteen was opened two years ago, he said, would remember the almost boyish joyfulness of Mr. Callender's demeanour on that day, when he seemed to be quite one of them. Interested as he was in all those who had taken up arms for our country, and in those from the Anchor Works who had given their lives in the great cause, he looked forward to a happier gathering when Peace was proclaimed. They at Leigh felt his loss very deeply, and mourned with those who were near and dear to him. The service was impressive. The singing was led by the Anchor Musical Society. Mr. J. Bowyer, works manager, represented the Anchor Works at the funeral. Two large wreaths, one taking the appropriate form of an anchor, were sent by the workpeople and staff.

Mr. G. Corfield.—The death occurred on October 19th of Mr. George Corfield (of Corfield & Cripwell, Balfour House, E.C.) in his 51st year.

Mr. G. V. Laycock.—Mr. Guy V. Laycock, an electrical engineer, who was in business at Huddersfield for six years, passed away on October 25th at a nursing home, aged 36 years.

Mr. M. E. Curwen.—Mr. Maskell E. Curwen, European manager of the J. G. Brill Co., died suddenly at Philadelphia on October 1st.

Mr. F. W. Heaton.—We regret to record the death of Mr. F. W. Heaton, of Manchester, in his 52nd year. Mr. Heaton, who was well known in both the electrical and the mechanical engineering industries, was managing director of Messrs. Heaton & Smith, Ltd., Salford Switch Works, Salford, and later of Heaton & Co. He was the pioneer of many present-day electrical specialities.

Mr. E. J. Docker.—Mr. E. J. Docker, head storekeeper of Messrs. Drake & Gorham, Ltd., Long Acre, W.C.2, died from influenza and pneumonia on October 22nd at the age of 35 years.

Mr. E. Bennis.—We regret to record that Mr. Edward Bennis, founder of the well-known firm of E. Bennis & Co., has passed away at the age of 81 years.

Will.—The late Col. F. J. G. Murray, a director of the Calcutta Electric Supply Corporation, Ltd., left £902,333 gross, and £894,195 net personalty.

NEW COMPANIES REGISTERED.

Howard, Rawson & Co., Ltd. (151,759).—Private company. Registered October 24th. Capital, £5,000 in £1 shares (500 deferred). To take over the business of scientific glass-blowers carried on by Howard Rawson & Co. at 21b, Pond Place, S.W.3, and to carry on the business of manufacturers of all kinds of glassware, apparatus, and appliances, &c. The subscribers (each with one share) are:—G. Howard Baker, 73, Heythrop Street, Southfields, S.W., scientific glass manufacturer; W. Pearce, 5, Delvino Road, Parsons Green, S.W., scientific glass manufacturer; J. S. Allen, 52, Clarendon Road, Lewisham, paper merchant; T. P. Parkes, 114, Wickham Road, S.W.4, laboratory furnisher. The first directors are to be appointed by the subscribers. Registered office: 10, Bush Lane, E.C.4.

British Steel Corporation, Ltd. (151,781).—Private company. Registered October 26th. Capital, £1,000,000 in £1 shares. To carry on the business of iron smelters, engineers, metallurgists, manufacturers of and dealers in iron and steel in all their branches, of castings, bars, blooms, billets, plates, sheets, and any other form, and of any product of iron and steel in combination with any other metal, coaters of any of the above by galvanising or otherwise with zinc, tin, lead, or any other metals or alloys, colliery proprietors, tinplate merchants, agents, brokers, miners, &c. The subscribers (each with one share) are:—R. V. Vassar-Smith, Charlton Park, Charlton Kings, Glos., banker; J. C. Davies, The Mount, Gowerton, Glam., ironmaster; J. R. Wright, Hendrefoilan, Sketty, Glam., ironmaster; R. Tilden Smith, 13, Upper Brook Street, London, colliery proprietor. All directors must be British subjects, and other provisions, in form approved by the Board of Trade, are inserted in the Articles with a view to excluding foreign control. Registered office: 70, Lombard Street, E.C.

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OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

George W. Green & Co., Ltd.—Debenture dated October 8th, 1918, charged on the company's undertaking and property, present and future, including uncalled capital, securing £300. Holder: G. W. Green, 12, Mortlake Road, Kew.

Rees-Roturbo Manufacturing Co., Ltd.—Satisfaction in full on October 1st, 1918, of debentures dated June 1st, 1916, securing £185,000, £100,000, and £17,000 respectively.

CITY NOTES.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

At the annual meeting, Sir J. Denison-Pender, K.C.M.G., said that the gross receipts for 1917 were £1,508,000, an increase of £287,000, due to the greatly increased traffic all over the system. The working and other expenses amounted to £552,000, an increase of £122,000, showing an increased net revenue of £165,000 for 1917. The company's holding in War Loan and National War Bonds amounts to a total of £1,668,000. The 20 years' concession granted to the company by the Spanish Government in 1897 for providing and maintaining under a subsidy arrangement, cable communication between Manila and the islands of Iloilo and Cebu (Visayas), expired in November last, when the company's stations in those islands were closed. The reason for this action was that the United States, having taken over the Philippines from Spain after the war between the two countries, soon after the concession was granted, and having subsequently laid a network of Government cables between the principal islands, considered the renewal of the concessionary arrangement unnecessary. The company's cables between Iloilo, Cebu, and Manila had since been picked up for utilisation elsewhere, after being renewed at the company's cable depot at Singapore. The company's traffic greatly expanded in the early days of the war through the Government restriction of coding facilities, and later on, when the postal delays caused by the withdrawal of shipping for war purposes made cabling more necessary than ever, an additional strain was placed upon the cables, which was accentuated by the troubles in Russia preventing the Great Northern Co. from carrying—as in pre-war days—their share of the China and Japan traffic. Nevertheless, their staff had successfully coped with this extra work, although heavy delays were unavoidable. When the war was over he might be able to go more closely into some details which would be of the greatest interest.

Replying to questions, the chairman said that he was not going to prophesy about wireless telegraphy or what it would do. He had seen the report that a message sent by cable as well as by the wireless was delivered more quickly by the wireless. It was very easy for the wireless system to send messages with an absolutely free hand, because they were cabling no traffic. The cable companies would be very glad—at least, at the present time—if the wireless system would come in and relieve them of some of their traffic. That would be a great boon to the public, both as regards commercial and private messages. The past year had been a good one, but he would like to see some reduction in delays. The companies had not raised a single cable rate. The revenue had been made under the old rate, and that was saying a good deal, because many of the Governments, both at home and in other countries, had increased their rates very materially.

Eastern Telegraph Co., Ltd.

Presiding at the annual meeting, on October 23rd, Sir John Denison-Pender said that the total revenue was £2,901,579, which is £382,296 more than the previous highest record, attained in 1916. The total working expenses were £1,262,316, or £202,373 more than for last year. The amount payable for income tax and excess profits duty was £659,581, an increase of £213,292. They were able to make the same contribution to the general reserve fund as in 1916, viz., £500,000, while maintaining the payment of a dividend and bonus on the ordinary stock at 8 per cent., free of income tax. Payments to staff and other expenses in connection with the war were £170,744, an increase of £92,310. A still further increase has taken place during the present year. The work of their staff, both at home and abroad, on land and on sea, throughout the war had been of a most strenuous nature, and they had been called upon to work long hours, sometimes under circumstances of discomfort and danger; but they had always responded with cheerfulness to the demands of the Government, with a full knowledge of the vital importance of the service due to the Empire and to the Allies.

The general reserve fund now amounted to over 2½ millions. The fund was principally required to meet the cost of renewals of cables and for additional sections to meet the ever-growing demands for extra capacity to deal with the increasing volume of traffic. They had expended for this purpose during the 17 years prior to the war on an average nearly £300,000 per annum. Although they had incurred considerable expenditure on account of repairs to cables since the war started, the conditions had been such as to prevent the carrying out of renewals or the laying of new commercial sections. At times it seemed almost impossible to get through the work, but so far they had been able to maintain satisfactory Government service; but it was not surprising if on occasions considerable delay took place in the receipt, transmission, and delivery of commercial correspondence. As soon as normal conditions again prevailed they must be prepared to incur heavy expenditure and at once proceed with the work which had been suspended during the last four years, in spite of the greatly increased cost of cable which would continue for some time. Therefore, this general reserve fund should be built up as much as possible to meet the very heavy withdrawals which must take place, they hoped, in the near future. The growth of the various companies and the increase in the work necessitated the appointment of some one to assist in the administrative work of the Eastern Co. The conditions arising from the war had naturally brought them into close touch with Government departments. The maintenance of their system and the safety of their ships had been the special care of the Admiralty, and in the course of their relations with that department he had many opportunities of realising the particular qualifications of Capt. H. W. Grant, who, when war broke out and for some time after, was in command of H.M.S. *Hampshire* in Eastern waters and the Grand Fleet, but who was ultimately called to the Admiralty War Staff at Whitehall, where for some two or three years he (the speaker) was in almost daily communication with him, with the result that in December last the board applied to the Admiralty for permission to offer this gentleman a position of managing director. Their lordships, appreciating the benefit which would be bound to result both to the Naval service and the Eastern Telegraph Co. by the latter obtaining the services of Capt. Grant, released him as soon as he could be spared from the important duties on which he was engaged, and they elected Capt. Grant a managing director in March last. The condition of affairs set up by the war was wholly unprecedented. The demands of the State for the prompt treatment of its telegrams were at times almost overwhelming, but its interests must be the first consideration. The claims of the general public through the medium of the Press during these stirring times also imposed upon them an additional burden. The formalities of censorship must affect the prompt dispatch of Press and commercial telegrams to a considerable extent. These adverse conditions, together with the difficulties of maintaining their cables, seriously reduced the promptitude of a service which in normal times was proverbial for speed and accuracy. They were doing everything that was humanly possible to carry the exceptional traffic thrown on their system through war conditions, which included the interruption of two very important systems to the East, viz., the total closing down of the Indo-European line through Germany and Russia to India, and the interruption of the Great Northern system through Russia to China and Japan. In pre-war times those two companies, although in no way under their working control and not included in the cable association under that roof, worked with them in such a manner that, when one of them foresaw delay owing to a partial temporary interruption of its service, it handed traffic over to one or both of the others if they happened to be in a more fortunate position at the time, thus ensuring regular and speedy transmission in the interests of the telegraphing public. The chairman said that the problems which would confront them on the conclusion of peace would demand a great deal of energy and concentration on the part of the whole of the staff.

Erinoid, Ltd.

Mr. A. Binnie presiding at the annual meeting said, in spite of the continual rise in cost of manufacture, the profits for the year, £34,000, showed an increase of £14,000. The industry was a new one, and a key industry upon which many other industries depended for raw material. The sales in the last six months were 35 per cent. greater than for the first six. Their only anxiety was the constant rise in the cost of raw material and working expenses. Their reserve at August 31st was nearly 50 per cent. of the share capital at that date. This had been achieved in three years. There was at present nothing to prevent a renewal of unfair competition from abroad after the war. They heard of various reconstruction programmes for preventing unemployment. A business programme would encourage new industries employing skilled labour and light labour at home instead of abroad. New industries set up here now had to face a form of taxation which, while the war lasted rendered sound finance impossible, and there was no promise of protection from unfair competition afterwards. That programme would not attract inventive ability or retain it here. If we did not regulate imports, imports would regulate the conditions of production here to the detriment of both capital and labour. A dividend of 10d. per share (16⅔ per cent.), free of tax, was declared.

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Claud Hamilton, Ltd.—According to the "Financial Times," a dividend of 7½ per cent., and a bonus of 5 per cent., on the ordinary shares are to be paid, after providing for depreciation and writing £1,000 off investments. £9,448 is carried forward.

International Light & Power Co., Ltd.—Dividend of 3 per cent., less British income tax., on the preference shares, for six months, on account of accrued arrears.—*Financial Times.*

Bruce Peebles & Co., Ltd.—Interim dividend at the rate of 7½ per cent. per annum on the preference shares for the half-year ended June.

Trafford Park Estates, Ltd.—Dividend 6 per cent.; carry forward £58,227.

Calcutta Electric Supply Corporation, Ltd.—Interim dividend at the rate of 7 per cent. per annum (3s. 6d. per share), less income tax, on the ordinary shares for the half-year.

Calcutta Tramways Co., Ltd.—Interim dividend of 2½ per cent., free of income tax, on the ordinary shares.

Babcock & Wilcox, Ltd.—Interim dividend of 6 per cent., free of tax.

Westinghouse Brake Co.—Interim dividend of 5 per cent., less tax, on the ordinary shares.

Anderson Foundry Co., Ltd.—Interim dividend 4s. 6d. per share.

Parsons Marine Steam Turbine Co., Ltd.—A final dividend of 15 per cent. is recommended, making 25 per cent. for the year, free of tax.

British Columbia Electric Railway Co., Ltd.—Five per cent. on the cumulative perpetual preference stock.

STOCKS AND SHARES.

TUESDAY EVENING.

MARKETS in the Stock Exchange remain good, the military and diplomatic developments causing great satisfaction, and encouraging a general atmosphere of buoyancy. Attention is keenly directed to after-the-war possibilities. A falling-off in subscriptions to National War Bonds is due to the expectation that the war may be over by Christmas-time. Electric lighting shares are much in favour amongst those who used to support them in days bygone. Home Railway stocks have brisked up considerably.

Marconis have been again on the rise. The parent shares went over 5, and the preference gained 7s. 6d. at 4¼. Americans advanced smartly to 33s. 6d., but Marconi Marines and Canadians follow slowly, the respective prices being 3 15/32 and 14s. 6d. respectively.

Other members of the cable group are mostly holding their prices, without much change in the quotations. Eastern Extensions and Western Telegraphs have lost ¼ apiece. Globe preference are an equal amount to the good. Orientals have run up to 3½, showing a gain of 3s. 9d.

While the Home Railway steam stocks are advancing, the Underground list is rather dull. The income bonds have eased off, and Metropolitans are heavy. 'Bus "A" shares are more buoyant, however, like most other more or less speculative issues round the markets. Anything which promises a "run for the money" is assured of a following in these pre-peace days.

County of London Electric ordinary have risen to 11¼, which is fully 25s. higher than they stood a fortnight ago. The preference have advanced £10. London Electrics are slightly harder at 1 5/16. Charing Cross, with ⅛ rise, are more satisfactorily sold than bought, and the shares in the West End companies are decidedly strong. Notting Hill preference rose ¼ to 8¾. The principal gain has been secured by Citys, which are 10s. up at 13¼. While there are no quotable changes in the other shares, prices actually are better than they look, and in some cases can't be sold well above the middle quotations. The manufacturing group is quiet, and the recent activity has died down to some extent in such shares as Edisons and those which were eagerly purchased at the beginning of October. At the same time, there has been no set-back this week, the market being firm throughout.

Amongst the foreign descriptions, the principal advances since we last wrote are shown by British Columbia electric issues. The preferred, which was rather left behind in the previous improvement, has put on 3 points, and the deferred is similarly higher. The 4½ per cent. debenture is again a point up, and the preference 1½. The Anglo-Argentine Tramways are also strong, the first and second preference gaining ½ and ⅛ respectively. For the 5 per cent. debenture stock, there are only buyers at the moment. There are some who contrast the last-named stock with Mexican Light & Power first debentures, which stand only 4 points lower than the Anglo-Argentine Tramways stock, and they argue that the latter is the cheaper, having regard to the nature of the security of both.

Mexicans as a whole are inclined to mark time after their recent jumps. Mexican Light common and preferred are both a dollar up, but the Tramways Bonds show no change. Mexico Tramway common shares have risen to 37; Monterey Fives are harder at 54½. Brazilian Tractions reacted 1 after their swift advance. A little attention is being paid again to Rio Tramway bonds, the first hardening to 90 and the second to 80. The fact of the first mortgage bonds being repayable in 1935, 17 years hence, adds attraction to the investment, because, so far as can be seen, there is little doubt as to their being repaid at due date. The San Paulo 5 per cent. debentures, now about 92, are due for redemption in 1929, which is the reason for their standing higher than the company's 5 per cent. perpetual consolidated debenture stock, quoted at 79.

London & Suburban Tractions, after dipping to half-a-crown, recovered to 3s. 6d., and the 5 per cent. cumulative preference have changed hands this week at 8s. 7½d. British Electric Traction ordinary at 45½, and the 6 per cent. participating preference at 79, are neglected, but the 5 per cent. perpetual debenture stock was bought the other day at 83½. The 4½ per cent. debenture stock last changed hands at 65¾ about a month ago. The rubber share market holds its prices, and business is fairly active, though patchy. The firmer tendency in armament shares is again noticeable, while there is also a disposition towards recovery in the iron and steel list.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Oct. 29, 1918.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	9	10	6⅜	—	£7 17 0
Charing Cross Ordinary	5	4	3⅜	+ ⅛	5 18 6
do. do. do. 4½ Pref.	4½	4½	8½	—	6 18 6
Chelsea	8	5	3⅝	—	7 16 10
City of London	8	8	13⅛	+ ½	6 0 6
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	11¼	+ ¼	6 4 3
do. do. 6 per cent. Pref.	6	6	10	+ ½	6 0 0
Kensington Ordinary	6	7	5⅛	—	6 17 7
London Electric	Nil	Nil	1⅜	—	Nil
do. do. 6 per cent. Pref.	4	5	3⅜	—	7 2 10
Metropolitan	8	4	3⅛	—	6 10 7
do. 4½ per cent. Pref.	4½	4½	8½	—	6 18 6
St. James' and Pall Mall	8	9	6¾	—	6 13 4
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	6¾	—	6 13 6
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	100	—	6 0 0
do. Def.	1½	1½	23⅜	—	6 8 6
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	16	— ⅛	*5 0 0
Eastern Tel. Ord.	8	8	161½	—	*4 19 1
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 5
do. do. Pref.	6	6	10½	+ ⅛	5 14 3
Great Northern Tel.	24	22	34	—1	6 9 5
Indo-European	13	13	58½	—	5 12 0
Marconi	15	20	5	+ ½	4 0 0
Oriental Telephone Ord.	10	10	3½	— ⅛	2 17 2
United R. Plate Tel.	8	8	7¾	—	*5 3 3
West India and Panama	6d.	1/3	1⅞	—	*3 11 6
Western Telegraph	8	8	17	— ⅛	*4 14 2
HOME RAILS.					
Central London Ord. Assented	4	4	63½	+1	6 6 0
Metropolitan		1	27	—	3 14 0
do. District	Nil	Nil	26	—	Nil
Underground Electric Ordinary	Nil	Nil	2⅞	—	Nil
do. do. "A"	Nil	Nil	7/9	+6d.	Nil
do. do. Income	6	4	87½	— ½	*4 11 5
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4½	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3⅜	+ ⅛	—
do. do. 2nd Pref.	5½	—	3⅜	+ ⅛	—
do. do. 5 Deb.	5	5	75	—	6 13 4
Brazil Tractions	—	—	56½	—1½	—
Bombay Electric Pref.	6	6	10½	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	63	+1½	7 18 8
do. do. Preferred	Nil	Nil	45½	+3	Nil
do. do. Deferred	Nil	Nil	44½	+3	Nil
do. do. Deb.	4½	4½	61½	+1	6 18 3
Mexico Trams 5 per cent. Bonds	Nil	Nil	64		Nil
do. 6 per cent. Bonds	Nil	Nil	50	—	Nil
Mexican Light Common	Nil	Nil	37½	+1	Nil
do. Pref.	Nil	Nil	50	+1	Nil
do. 1st Bonds	Nil	Nil	71	+1	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	9⅜	+ ⅛	4 0 0
British Aluminium Ord.	10	10	1⅛	—6d.	5 10 4
British Insulated Ord.	20	20	2½	—	4 9 0
British Westinghouse Pref.	7½	7½	2½	—	6 0 0
Callenders	20	25	10	—	6 5 0
do. 5 Pref.	5	5	5½	—	—
Castner-Kellner	22	20	3½	—	5 8 4
Edison-Swan, "A"	—	—	¼	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	10	1⅜	—	7 5 6
Gen. Elec. Pref.	6	6	105	—	6 2 4
do. Ord.	10	10	18	—	*5 11 1
Henley	25	25	2½	—	5 11 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	—	*5 14 3
Telegraph Con.	20	20	49	—	*4 18 0

*Dividends paid free of Income Tax.

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AN ELECTRIC WORLD GIRDLE.

By EDWARD RAYMOND-BARKER.

(*Concluded from page* 390.)

Mr. Preece says "such a cable would be capable of transmitting at the rate of 100 words per minute, working *duplex*," *i.e.*, 50 W.P.M. each way. As this is well above the fastest manual speed possible, it follows that *all* the sections are intended to be worked by *automatic* transmission; yet, when speaking of the capital outlay of £7,000,000 required for a complete new ring, he says:—"But as there is no apparent reason why the Pacific cable should not form a section of the ring the actual expenditure should not exceed £5,000,000," &c. If, however, this were to be done how could the universal working speed each way throughout the cable girdle be 50 W.P.M., seeing that on *duplex connections*, the maximum working speed on the Vancouver—Fanning cable under present conditions cannot well exceed 17 to 18 five-letter words per minute, or, say, 85 to 90 letters per minute; and this with curbed automatic sending, and with a well-known form of current amplifier receiver with siphon recorder on a local circuit. On *simplex connections* the working speed is about 105 letters, or 21 W.P.M. How then can the speed of 50 W.P.M.

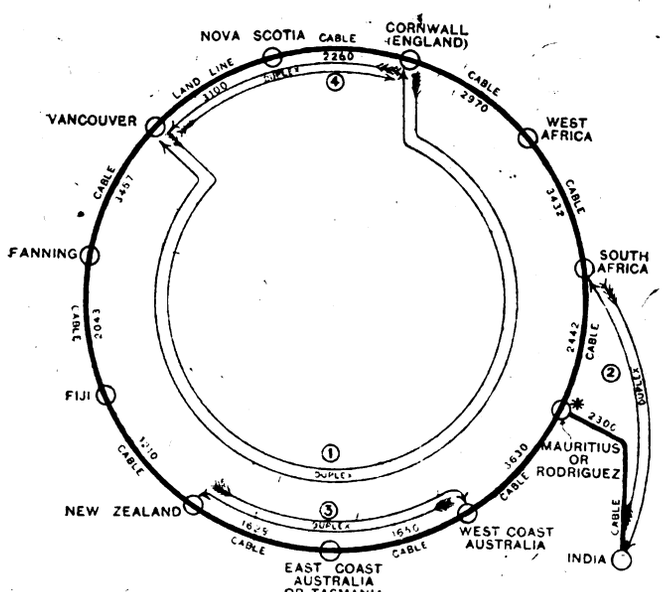

FIG. 1.

be maintained if the maximum duplex working each way on the existing Pacific cable part of the ring is no higher than 17 or 18 W.P.M.?

Mr. Preece says: "A separate cable would connect India with Mauritius," &c., which either means that it forms a permanent T-piece to the cable ring or that when India should come in it is switched on to one half, or on to the other side, of the girdle at the Mauritius station, by a special arrangement, which can scarcely be what is intended; and yet, as it is a *single* cable to India, it cannot, like the other stations, form part of the ring. Under these circumstances, how can India (according to the programme) communicate by duplex with Australia and also at the same time in the reverse direction with S. Africa? Is this a case of double duplex? If the ring system is worked on ordinary cable duplex, the duplicated duplex here inferred would be impossible. But perhaps the advocate of this world-girdle cable scheme contemplates that in cases where his T-piece cable to India is called upon to do duty in two duplex systems simultaneously, sudden transition is to be effected by some such electrical solution of the difficulty as might be found in Heurtley's diplex cable-telegraph system, duplexed, or in the cable quadruplex system of E.C.R. Marks. Here, indeed, is a case where an ordinarily-intelligent reader of the *Times* Special Supplement might reasonably object to airy generalities, and ask for more explicit statements as to the practical working conditions involved in this cable girdle. In the absence of any such illuminating explanation, the writer must conclude that Mr. Preece's complicated working routine will not in this respect, at least, fulfil his expectation.

When it is remembered that the length of the existing Vancouver-Fanning cable is 3,458 nautical miles, and that with a conductor of 600 lb. and insulation weighing 340 lb. per nautical mile, the speed of working through it is only 17 or 18 W.P.M., it will be evident that, under the usual conditions of signalling, the sections having anything like this length would require a *core* of extraordinarily large size to give 50 W.P.M. each way.

Mr. Preece does not stop to tell us whether the working of 50 W.P.M. each way is to be obtained through his long cables by specially heavy cores in conjunction with the customary siphon-recorder, or whether through cores of (say) the Vancouver-Fanning size by the use of even more extraordinarily sensitive current-amplifiers than the Heurtley hot wire, the Orling jet, or the Dixon selenium amplifier. But if we treat this very important consideration as a detail we are confronted with the not easily conceded demand on our imagination that when, for instance, Routine (1) is in progress, and Cornwall and Vancouver for 3½ hours are exchanging their respective 10,000 words in opposite directions through the literally world-wide ring of cables *viâ* Africa, Australia, and New Zealand—what time also Cornwall and Nova Scotia are composedly negotiating the exchange of *private messages* over the more direct line connecting them—all the intermediate stations round the ring are busy with English and Canadian Press news. It is only a cable telegraphist who can fully realise the difficulties introduced by the relaying work at each station in dealing with Cornwall's and Vancouver's Press news through the ring; and this is only one Routine that we are considering out of the many.

Which ever form of relaying be adopted—automatic translation, auto-tape-perforation and retransmission, or auto-retransmission, whether with Brown's drum, Muirhead's vibrating gold wire, or the "Dipper" cable relay—the amount of mental high tension in the negotiation of England's and Canada's exchange of Press news would, even if practicable, well-nigh reach snapping point, especially if delicate amplifiers be used. Was all this taken into account when Routine (1) was proposed? After many years' experience in the routine working at important cable stations, the writer is forced to the conclusion that Mr. Preece's complex cable girdle scheme and suggested routine working—with so many variations in the conditions of working throughout the 24 hours—would be impracticable. For just try to realise what is involved in the 3½ hours' *duplex* exchange of Press news between, say, Cornwall and Canada at 50 W.P.M. each way through eight translating stations, amplifiers, and automatic relays, all at concert pitch; or automatic perforators taking part, or human perforators (one hopes these will not be on the West Coast of Africa) joining in the world-wide worry over England's and Canada's Press news! A striking instance of newspaper submarine telegraphy *in excelsis*—or, rather, *in infernis*, the staffs of Mr. Preece's stations might reasonably call it.

These cables designed, constructed, laid, staffed, and maintained at the cost of the British and Dominion Governments are—so it appears—to compete at extremely low rates with the present cable systems which have been built up by private and public enterprise, and as the result of most costly individual research and labour, along the difficult road of dearly-purchased experience—experience from which the said Governments are to derive full benefit gratis.

Pros and cons regarding this debatable matter need not here exercise us; but it is only fair to the existing cable companies to call your readers' attention to the extra facilities already accorded by them—for the last six years or more—to the cabling public.

One instance of this found in the present Atlantic cable charges between Great Britain and N. America—viz., a system of deferred day-cable plain-language letters has been introduced, in which the said cable letters give precedence to the more pressing commercial *code*, or full rates, traffic,

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but are delivered after incurring some slight delay compared with next-to-*nil* delay to which *flash*, or instantaneous, service (*e.g.*, Stock Exchange traffic) is subjected. Charges for the said day-cable plain-language letters are, we understand, at the rate of 6s. for a minimum number of 20 words (or about 3½d. per word), with a charge of 1s. 3d. for every additional five words—*i.e.*, 3d. per word.

Then also there are week-end-cable plain-language letters—minimum, 30 words for 6s.; *i.e.*, 2½d. per word, with 1s. chargeable for every additional five words or less, *i.e.*, under 2½d. per word.

Again, there are deferred Press messages, for which a charge is made of 2½d. per word. Similar systems are worked in other cable companies. The writer has himself been the recipient of a week-end cable letter handed in by a soldier-son in Arabia, received over the Eastern Co.'s cables and telegraphically recorded, in Roman type, in London the same day, and delivered by post in Gloucestershire the following morning—cost, 6½d. per word.

As this question of cost per word bears directly on the low rates per word suggested by Mr. Preece for the cable girdle, it may be of interest to mention here that in the case of trans-Atlantic traffic the reduced rates referred to above are made possible by the fact that owing to the difference in time there are only a few hours of the day common to both sides, and during these hours at least 75 per cent. of the trans-Atlantic cable business is done, as is graphically shown by the print here given of the traffic chart (fig. 2). This chart was for the year 1911, and was advertised in the public Press in 1911 by the Western Union Telegraph Co.

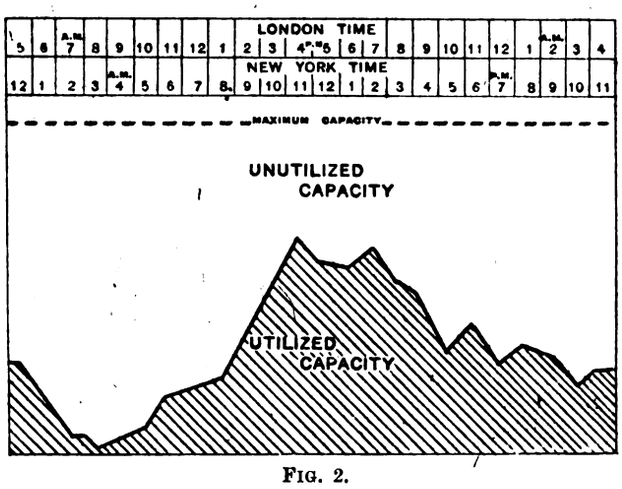

Fig. 2.

The text accompanying this chart says:—"In the interests of international business, nothing should be done to interfere in any way with the so-called *flash*, or instantaneous, service; and the lines should be kept clear to accommodate such messages during the few business hours common to both countries; but to confine the cables to this class of service would utilise only about 25 per cent. of the existing capacity of millions of property, and would place on that limited service all the capital, maintenance and operating charges. The limited time and character of the business, if best results are to be obtained, demand *direct*-cable circuits between the principal centres of the two sides of the Atlantic, as well as special circuits devoted to special business."

On this subject of the *difference of time* there would be no *business hours* common to countries separated so widely as, say, England and New Zealand; for mid-day at Greenwich is about midnight at Auckland, New Zealand.

Has it been fully considered how the difference in longitude of the various countries must affect their several interests in regard to the time most convenient for the reception and dispatch of Press news and of private message traffic? Considering that 12 hours would be devoted to Press news and testing, and the other 12 hours of the 24 to Government and private messages, the latter would be, apparently, hung up during the Press news traffic, and as the more important Government messages would, we may suppose, have the precedence, it would be a bad prospect for *private* messages—so that their senders would probably only patronise the ring route, owing to the low rate per word. Moreover, as the ring is expected to be fully occupied during the 24 hours, there would, on these occasions, be no "limited business hours" and "idle facilities" (as in the trans-Atlantic cable business) to take advantage of in order to get delayed private messages through. Consequently, it is not clear to the writer how, under the elaborate time-table of working, the several countries of the League "can be in touch with all the others at all times," or how "all their messages shall be rapidly transmitted and immediately answered."

The 3½ hours during which England is intended to send Press news round the ring to Canada and the 2 hours for private messages are really the only times during the 24 hours when these two countries can speak with each other through the *direct* circuit connecting them; and even then only supposing that their 3½ hours happen to occur in *business hours* could these stations participate in the *flash* or instantaneous messages which form so important a part of the trans-Atlantic cable traffic; therefore, they don't appear likely to get much benefit out of it.

In expecting them to keep so many exceedingly sensitive and complicated instruments in perfect order, as, in his imagination, he sees working continuously at 50 w.p.m., Mr. Preece pays a well-deserved tribute to the general expertness, ability, and patience of cable operators, but they cannot quite accomplish the impossible.

As for the frequent switchings over to conform to the routine programme, readjustments of apparatus to meet any altered electrical conditions of duplex balance, and the close attention to the times laid down in an elaborate table, it does not require much imagination to realise that the lot of the supervisor on duty, who is responsible for satisfactory working at his station, would not be a very happy one, knowing as he does that in such a chain of interdependent cable sections the failure of one relaying station affects the proper working of all others in that circuit.

With regard to *repetitions* required during Press messages by so many intermediate and simultaneously receiving stations in the ring, this circumstance alone seems likely to lead to endless confusion.

TRADE STATISTICS OF AUSTRALIA.

The following figures, showing the imports of electrical and allied goods into Australia during the twelve months ending June 30th, 1917, are taken from the recently-issued official trade statistics. The figures for 1915-16 have been given for purposes of comparison, and notes of increases or decreases have been added.

	1915-16. £	1916-17. £	Inc. or dec. £
Gas and oil engines.—			
From United Kingdom ...	84,000	46,000	– 38,000
,, United States ...	57,000	54,000	– 3,000
,, Sweden	4,000	6,000	+ 2,000
,, Other countries ...	10,000	5,000	– 5,000
Total	155,000	111,000	– 44,000
Portable and traction engines.—			
From United Kingdom ...	29,000	13,000	– 16,000
,, United States ...	28,000	32,000	+ 4,000
Total	57,000	45,000	– 12,000
Dynamo-electric machines up to 200 h.p., static transformers, coils, &c.—			
From United Kingdom ...	212,000	157,000	– 55,000
,, Italy	6,000	7,000	+ 1,000
,, Sweden	5,000	6,000	+ 1,000
,, United States ...	230,000	236,000	+ 6,000
,, Other countries ...	5,000	2,000	– 3,000
Total	458,000	408,000	– 50,000
Dynamo-electric machines over 200 h.p. and parts.—			
From United Kingdom ...	13,000	13,000	—
,, United States ...	—	4,000	+ 4,000
Total	13,000	17,000	+ 4,000
Regulating, starting, and controlling apparatus.—			
From United Kingdom ...	45,000	46,000	+ 1,000
,, United States ...	41,000	60,000	+ 19,000
,, Other countries ...	1,000	1,000	—
Total	87,000	107,000	+ 20,000

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	1915-16. £	1916-17. £	Inc. or dec. £
Electroliers, gasoliers, &c.—			
From United Kingdom ...	19,000	12,000	– 7,000
,, United States ...	9,000	6,000	– 3,000
Total	28,000	18,000	– 10,000
Electric fittings, switches, fuses and lightning arresters.—			
From United Kingdom ...	45,000	51,000	+ 6,000
,, Japan	1,000	5,000	+ 4,000
,, United States ...	24,000	33,000	+ 9,000
,, Other countries ...	3,000	—	– 3,000
Total	73,000	89,000	+ 16,000
Lamps and lampware.—			
From United Kingdom ...	51,000	45,000	– 6,000
,, Japan	8,000	14,000	+ 6,000
,, United States ...	62,000	54,000	– 8,000
,, Other countries ...	17,000	11,000	– 6,000
Total	138,000	124,000	– 14,000
Telephone switchboards and appliances.—			
From United Kingdom ...	42,000	33,000	– 9,000
,, Belgium	3,000	—	– 3,000
,, Sweden	9,000	4,000	– 5,000
,, United States ...	73,000	17,000	– 56,000
Total	127,000	54,000	– 73,000
Wire (copper).—			
From United Kingdom ...	130,000	66,000	– 64,000
,, Japan	1,000	1,000	—
,, United States ...	27,000	5,000	– 22,000
Total	158,000	72,000	– 86,000
Electric heating and cooking appliances.—			
From United Kingdom ...	4,000	8,000	+ 4,000
,, United States ...	6,000	5,000	– 1,000
Total	10,000	13,000	+ 3,000
Cable and wire (covered).—			
From United Kingdom ...	522,000	356,000	– 166,000
,, Japan	4,000	7,000	+ 3,000
,, Italy	1,000	1,000	—
,, United States ...	20,000	19,000	– 1,000
,, Other countries ...	1,000	1,000	—
Total	548,000	384,000	– 164,000
Arc lamp carbons.—			
From United Kingdom ...	3,000	2,000	– 1,000
,, Spain	7,000	4,000	– 3,000
,, Switzerland ...	2,000	3,000	+ 1,000
,, United States ...	6,000	4,000	– 2,000
,, Other countries ...	—	1,000	+ 1,000
Total	18,000	14,000	– 4,000
Accumulators or storage batteries.—			
From United Kingdom ...	42,000	66,000	+ 24,000
,, Sweden	4,000	3,000	– 1,000
,, United States ...	22,000	22,000	—
,, Other countries ...	1,000	—	– 1,000
Total	69,000	91,000	+ 22,000
Arc lamps, vacuum tubes, instruments and insulating tape.—			
From United Kingdom ...	52,000	43,000	– 9,000
,, Switzerland ...	4,000	12,000	+ 8,000
,, United States ...	16,000	30,000	+ 14,000
,, Other countries ...	2,000	1,000	– 1,000
Total	74,000	86,000	+ 12,000
Electrical appliances not included elsewhere.—			
From United Kingdom ...	146,000	126,000	– 20,000
,, Denmark	11,000	6,000	– 5,000
,, Japan	8,000	32,000	+ 24,000
,, Holland	35,000	39,000	+ 4,000
,, United States ...	74,000	104,000	+ 30,000
,, Other countries ...	4,000	4,000	—
Total	278,000	311,000	+ 33,000
Earth and rock cutting, excavating, &c., machines.—			
From United Kingdom ...	24,000	14,000	– 10,000
,, United States ...	16,000	11,000	– 5,000
,, Other countries ...	1,000	—	– 1,000
Total	41,000	25,000	– 16,000
Rotary and percussive rock drills.—			
From United Kingdom ...	7,000	3,000	– 4,000
,, United States ...	30,000	39,000	+ 9,000
,, Other countries ...	—	1,000	+ 1,000
Total	37,000	43,000	+ 6,000

	1915-16. £	1916-17. £	Inc. or dec. £
Coal-cutting machines.—			
From United States ...	6,000	7,000	+ 1,000
Machine tools.—			
From United Kingdom ...	64,000	86,000	+ 22,000
,, United States ...	76,000	87,000	+ 11,000
,, Other countries ...	3,000	2,000	– 1,000
Total	143,000	175,000	+ 32,000
Steam turbines, economisers, superheaters, &c.—			
From United Kingdom ...	95,000	65,000	– 30,000
,, United States ...	5,000	3,000	– 2,000
,, Other countries ...	1,000	—	– 1,000
Total	101,000	68,000	– 33,000
High-speed reciprocating steam engines.—			
From United Kingdom ...	10,000	9,000	– 1,000
,, United States ...	1,000	—	– 1,000
Total	11,000	9,000	– 2,000
Motive power machinery, N.E.I.—			
From United Kingdom ...	111,000	95,000	– 16,000
,, Sweden	2,000	3,000	+ 1,000
,, United States ...	60,000	66,000	+ 6,000
,, Other countries ...	—	6,000	+ 6,000
Total	173,000	170,000	– 3,000
Wire, iron, and steel.—			
From United Kingdom ...	52,000	44,000	– 8,000
,, Canada	45,000	48,000	+ 3,000
,, United States ...	408,000	228,000	– 180,000
,, Other countries ...	4,000	3,000	– 1,000
Total	509,000	323,000	– 186,000

PROFESSIONAL OFFICERS IN AUSTRALIA.

In the Commonwealth Court of Conciliation and Arbitration the President (Mr. Justice Higgins) recently delivered judgment in a case of considerable interest to professional men, not only in the Commonwealth of Australia, but generally. The plaint was lodged by the Association of Professional Officers of the Public Service and was defended by the Public Service Commissioner and the Postmaster-General. We take the following particulars from the *Post Office Electrical Engineers' Journal*.

In delivering judgment the President stated that the number of officers in the professional division of the Commonwealth Public Service was 343, of whom 286 were members of the claimant organisation. Of these totals 223 and 210 respectively were in the engineering branch of the Post Office. The professional division was divided into six classes, A to F. Youths in training constituted the F class; the main body of the officers were in the E class, only 29 per cent. being in classes A to D.

The officers in the professional division, as distinguished from the administrative, clerical, and general divisions of the public service, embraced those whose duties required special skill or technical knowledge usually acquired only in some profession or occupation different from the ordinary routine of the public service. They had to submit to defined courses of study, and to acquire considerable scientific as well as technical training.

In the electrical engineering branch especially, his Honour stated that he had been surprised to find how far the officer must advance in mathematics, physics, electricity, &c., if he was to be properly qualified for his work; but it could not be said of these men that they attained full responsible and professional status, as they nearly all acted under some direction or supervision, and acquired their experience under shelter, not in open competition. The work was constant, and there was no risk of practice and income falling off. Full professional remuneration was, therefore, not warranted.

The professor of natural philosophy in the University of Melbourne was asked to investigate and report as to "the necessary educational, scientific, and other attainments, qualifications, and responsibilities of the officers concerned, and how, comparing the functions in the several departments, to place the said persons in approximately equivalent positions."

Speaking generally, the E class consisted of men who had passed through the ordeal of training, and reached a position analogous to journeymen in a trade as distinguished from apprentices. Classes D, C, and B consisted of men who had attained more or less leadership and control of their fellow-professionals: and class A consisted of the professional heads.

His Honour said the problem was to prescribe salaries sufficient to keep up a perpetual succession of men duly qualified for service involving this exceptional education. Treating class E as the staple class, he said that he found

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dissatisfaction that severe application to science and technique did not produce an adequate reward. There had been a lack of applicants for the engineering branch. The Commissioner admitted that in the Postmaster-General's department the supply of junior assistant engineers and assistant engineers had never equalled demands, and that it had been necessary on a few occasions to go abroad for additions to the branch. He was not surprised. The Commissioner, as to the professional division, had practically adopted the same classes and salaries as for the clerical division, but added a new class at the head, although the education and training for the ordinary routine for the public service must be much lower than for professional officers. He could not regard this treatment of professional officers as being either fair or wise.

Clerical labour—the labour of the average clerk as distinguished from that of clerical officers having administrative control of others—was practically unskilled as compared with the average professional of class E. There was a tendency to make the rewards of skilled and unskilled labour too nearly equal. A perpetual flow of highly-trained men for the King's service, which involved laborious training, could not be hoped for without reasonable reward for that training.

Of the Post Office electrical engineers, responsible for the construction and maintenance of telegraphs and telephones, 223 controlled property of the public valued in 1917 at £10,000,000; the new constructions in the year before the war amounted to £1,180,000; and the annual cost of maintenance was £333,000. The number of telephone instruments had increased from 8,834 in 1901 to 52,180 in 1917. The class E engineers made inspections, prepared plans, engineering proposals, and estimates for the construction of aerial and underground lines or telephone equipment; issued detailed instructions to mechanics carrying out maintenance and other works; inspected works in progress and upon completion; certified to the conditon of the completed work; generally assisted the engineer in charge (class D) in all matters; dealt with the estimates of line inspectors and others, and with progress reports from the line foremen.

The class E engineer had to undergo a training which was equivalent to nearly three years of the four years' course in mechanical or electrical engineering in the university. The D engineer must have acquired still higher qualifications, and engineers of classes C, B, and A differed from those of the lower classes principally in the degree of responsibility and experience.

There was another consideration. The standard of qualifications required for men in the professional division was not nearly so high in 1903, when the existing scales of pay were fixed, as the standard of to-day. In the engineering branch of the Post Office, for instance, the systems of telegraphy and telephony had been revolutionised. Not only had there been an increase in the magnitude of the service, the telephone lines had been improved by the introduction of complete metallic circuits and the use of underground cables, and the telephone exchanges had been improved by the use of the common battery and automatic exchange systems. In telegraphy, the development had been in the increased speed of the transmission of messages, and in the increase of the number of messages simultaneously and automatically sent over a single telegraph line. On these grounds, therefore, he proposed to increase the minimum of the E class from £216 to £300.

The superior classes would be raised in what he regarded as due proportions. The minimum for the F class was £84, and he fixed it at £96.

Regarding increments to salaries, it was an attractive idea to leave the grant of increments to professional officers purely to the discretion of the Commissioner; but it did not work. The Commissioner and his inspector did not know how the officer carried out his daily duties, did not even understand what his duties involved. The superior officers of the professional branch did know. His Honour proposed to make the increments annual and automatic, unless the professional head of the department reported adversely in writing as to the conduct, diligence, or efficiency of the officer.

Re acting appointments, it seemed to have been a common practice to get men to perform the functions of a higher class than their own, to call them acting in the higher positions, and yet to pay them no higher remuneration, unless the period was for six months. The Commissioner suggested three months, but his Honour saw no sufficient reason for departing from his rule of one month, which he had previously laid down in relation to mechanics and linemen.

The ordinary hours of duty would be from 9 a.m. to 4.30 p.m. Monday to Friday, and on Saturday from 9 a.m. to noon; but any officer might be required to work overtime without payment for any hours after 8 a.m. and before 6 p.m. provided that 81 hours per fortnight were not exceeded.

The minimum rates of wages to be paid to employés who were members of the claimant association would be as follows:—Class F, £96 per annum; class E, £300; class D, £408; class C, £516; class B, £606; class A2, £700.

Officers in classes C, D, E, and F would be entitled to increments as follows:—£18 per annum until the salary reached £588 in class C, £498 in class D, £390 in class E, and £294 in class F.

Officers in class B might be awarded three increments of £24 each, and officers in Class A2 two increments of £100 each, at the discretion of the permanent head.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

16,696. "Electric fuse holders." Siemens Bros. Dynamo Works & J. C. Willcocks. October 14th.

16,702. "Flexible joint for cables, &c." J. Baker. October 14th.

16,704. "Incandescent electric lampholders." G. F. Colson. October 14th.

16,735. "Wireless telegraph valves." Edison Swan Electric Co. & E. E. Hiatt. October 14th.

16,736. "Lifting magnets." F. N. Pickett and A. West & Co. October 14th.

16,737. "Alternating-current motor starters." R. P. Bossom, V. Breeze and A. West & Co. October 14th.

16,739. "Manufacturing alloys of metals, and electrodes therefor." J. J. Shedlock. October 14th.

16,762. "Electrodes." H. Gerrard & E. Newbery. October 14th.

16,778. "Electric lamp lock." O. J. Reilly. October 15th.

16,784. "Electric welding apparatus." R. F. Woodburn. October 15th.

16,806. "Electric welding machines." British Thomson-Houston Co. (General Electric Co., U.S.A.) October 15th.

16,807. "Sparking plugs for ignition purposes." A. E. Heath. October 15th.

16,819. "Electric controllers." R. W. James & R. W. Stanley. October 15th.

16,850. "Apparatus for electro-magnetically controlling jigging-conveyors." C. Candlot. October 15th. (France, May 24th.)

16,911. "Electric starting motors for internal-combustion engines." C. L. Breeden, H. Lucas & H. N. Urquhart. October 16th.

16,918. "Systems of electric motor control." British Thomson-Houston Co. (General Electric Co., U.S.A.) October 16th.

16,972. "Vibrating contacts." A. B. Wood. October 17th.

16,974. "Protective devices for alternating electric current distribution systems." British Thomson-Houston Co. (General Electric Co., U.S.A.) and E. B. Wedmore. October 17th.

16,979. "Electric ignition." H. G. Solomon. October 17th.

16,982. "Spark plugs for internal-combustion engines." B. Hopps, A. M. Lodge & Lodge Sparking Plug Co. October 17th.

16,995. "Electric ignition apparatus for internal-combustion engines." G. E. Turnbull. October 17th.

16,996. "Alternating-current dynamo-electric machines." British Westinghouse Electric & Manufacturing Co. and G. H. Fletcher. October 17th.

16,999. "Thermionic amplifiers." Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) October 17th.

17,000. "Electrical discharge devices." Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) October 17th.

17,002. "Electric lamps." G. Oldham & J. Oldham. October 17th.

17,024. "Sparking plug." H. S. Cooke. October 18th.

17,038. "Portable electric lamp." A. R. Upward. October 18th.

17,053. "Electric welding machines." British Thomson-Houston Co. (General Electric Co., U.S.A.) October 18th.

17,054. "Radio telegraphy and telephony." M. Latour. October 18th. (France, October 18th, 1917.)

17,084. "Electric safety signal for motor vehicles." S. Springer & F. van den Wyngaert. October 19th.

17,120. "Automatic alarm device for vacuum tube relays." M. Latour. October 19th. (France, October 4th, 1917.)

17,122. "Stopper for containers of electric accumulators." Soc. de l'Accumulateur Tudor & Tudor Accumulator Co. October 19th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

10,772. Combined ignition and lighting and like current generators. L. J. le Pontois. July 6th, 1917. (119,254.)

13,627. Security or locking devices for electric incandescent lamps. Benjamin Electric, Ltd., & E. Fowler. September 21st, 1917. (119,270.)

13,885. Metal electrodes used in deposition and soldering by the electric arc. E. H. Jones. September 26th, 1917. (Additions to 14,468 of 1915.) (119,279.)

14,054. Watertight glands for electric cables. L. Newitt and Callender's Cable & Construction Co. September 28th, 1917. (119,293.)

14,838. Method of construction of electric furnaces of the heated-coil type. J. E. P. Kievits & Kynochs, Ltd. October 13th, 1917. (119,302.)

16,012. Electric cables. P. H. Chase. November 2nd, 1917. (111,110.)

17,525. Electric telephony. P. S. Gomez. November 27th, 1917. (119,341.)

18,168. Protective means for systems of electric distribution. British Thomson-Houston Co. (General Electric Co., U.S.A.) December 7th, 1917. (119,345.)

18,789. Electrical cut-outs. British Thomson-Houston Co. (General Electric Co., U.S.A.) December 18th, 1917. (119,354.)

1918.

36. System for amplification of small currents. British Thomson-Houston Co. (General Electric Co., U.S.A.) January 2nd, 1918. (119,365.)

404. Means for attaching mouthpieces of telephones, speaking tubes, and the like. Taylor, Tunnicliff & Co. and E. D. M. Scrivener. January 8th, 1918. (119,370.)

1,790. Insulators for supporting electric conductors. H. R. Lamb. January 31st, 1918. (119,382.)

1,805. Sparking plugs for ignition purposes. A. E. Heath. January 31st, 1918. (119,383.)

1,918. Self-starters for internal-combustion engines. Electric & Ordnance Accessories Co. & F. Wood. February 2nd, 1918. (119,384.)

2,769. Measurements or indication of alternating electric current quantities and apparatus therefor. E. Fawssett. February 16th, 1918. (119,388.)

5,109. Electric motor controllers. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) March 22nd, 1918. (119,405.)

5,181. Sparking plugs. Soc. Generale des Huiles et Fournitures Industrielles l'Oleo. October 15th, 1917. (119,407.)

7,702. Sparking plugs for internal-combustion engines. H. V. J. Joufret. January 14th, 1918. (119,419.)

10,730. Caps or holders for electrical fuses. E. G. Nicholls. June 29th, 1918. (119,431.)

11,577. Magnetic tray control for use in connection with biscuit-making machinery. A. Mason & A. E. Bowers. July 15th, 1918. (119,435.)

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THE

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THE ELECTRICAL REVIEW.

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EARTH CONNECTIONS.

REGARDED as an electrical conductor, the earth, in most localities, offers practically no appreciable resistance, no matter how far apart the electrodes may be situated. Yet it is extraordinarily hard to devise a method of utilising its conductance efficiently, owing to the difficulty experienced in making an effective connection with a mass of material of low specific conductivity. On the other hand, where high voltages or small currents are concerned, and a high resistance in the circuit is of little consequence, nothing is easier than to effect an earth connection. Thus it is that a telephone circuit can be provided with a satisfactory "earth" on occasion by simply sticking the blade of a pocket knife or a screw-driver into the ground, or a person can receive a fatal shock from a high-pressure circuit whilst standing on a stone floor and wearing leather boots; in the latter case, it is not even necessary for the circuit to be earthed at any particular point, as sufficient current may pass through the general leakage of the system, or through the condenser formed by line and earth, to produce a fatal result.

The importance of the subject is indicated by the elaborate regulations which have been made by Government Departments for the efficient earthing of all metal parts in the vicinity of electrical apparatus in workshops and mines, in order to provide an alternative path of low resistance in shunt with the body of any person who may touch them when they by chance have become "live." It should always be remembered that this "earthing" is not absolute, but is, as above-mentioned, only a shunt, and therefore that if the resistance of the earth connection is, or becomes, comparatively high, the device ceases to afford protection to the person.

It will be seen, therefore, that any kind of an earth does not give adequate protection; a really good low-resistance earth should be provided, and this is not an easy matter. Many investigations have been carried out on the subject, but the results are scattered amongst the pages of periodicals, proceedings of societies, &c., and therefore we are glad to draw attention to an important treatise, comprising some 200 pages, which was recently issued by the Bureau of Standards.* This paper embodies the results of an extended investigation of methods of earthing electrical circuits and lightning rods which has been carried out by the Bureau; the subject is treated from both the practical and the theoretical point of view, and includes an abundance of data relating to actual installations. The author lays down the rule that "for a high degree of safety to life, the resistance of the ground connection should be such that, with a current flow equal to the rated current of the nearest circuit-breaker which will operate to disconnect the equipment or circuit concerned from the source of the dangerous voltage in the event of an accident to insulation, the

* Technologic Paper No. 108: "Ground Connections for Electrical Systems." By O. S. Peters. Washington, U.S.A.: Government Printing Office. Price 30 cents.

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potential difference between ground wire and ground will not exceed 150 volts, if the ground wire or circuit is accessible."

By far the best earth connection, of course, is a water supply pipe, and where there is no likelihood of a continuous flow of current sufficient to cause electrolysis, there is no objection to its use. Where water pipes are not available, the author states that the best earth consists of pipes from 1 in. to 2 in. in diameter, driven down to a permanently moist stratum of soil; where the depth of soil is insufficient to give a reliable earth by this means, buried plates, or, preferably, long narrow strips of metal laid in trenches, may be used, but their efficiency cannot be compared with that of water pipes, which generally have a resistance of much less than one ohm, whereas a pipe driven 10 ft. deep offers an earth resistance of the order of 20 ohms. Several pipes connected in parallel are preferable to a single pipe, and, similarly, two small plates buried 10 ft. or 20 ft. apart give a better earth connection, with half the surface, than one large plate. The use of salt in large quantities, and of a bed of coke, to increase the conductance of the moisture and to enlarge the contact surface respectively, is recommended, but with the reservation that the life of the earth-plate will thereby be reduced owing to corrosion, especially when coke is used. Attention is drawn to the high potential gradient which may exist on the surface of the ground near the earth connection, particularly when a current has flowed to earth long enough to produce appreciable heating and to dry the soil to some extent: the gradient may easily be such as to give a dangerous shock to a person or an animal standing on the ground, and as the highest potential, of course, exists at the earthing conductor itself, this should be guarded, as well as the top of a driven pipe. When buried plates are used, with insulated leads attached to them, this danger is absent. The joints between the leads and earth plates or pipes are best made underground, and protected with concrete. Periodical inspection and testing of earth connections, at least once a year, is urgently necessary for safety. Not the least interesting feature of this work is a collection of some hundreds of tests of artificial earths in American towns, some of which show that an earth connection made on sound lines may yet, owing to some local condition, have a resistance of more than 2,000 ohms, whilst very many are over 100 ohms. Sand, gravel, and stones are particularly unfavourable constituents of the soil from the point of view of earthing. We strongly recommend this valuable paper to all who are called upon to make good earths.

Government and Industry.

The third of the Saddlers' Hall series of lectures arranged by the Industrial Reconstruction Council was delivered on October 30th. In our opinion, it was of greater immediate practical value than either of the preceding lectures of the series, both of which were delivered by members of the Government (the President of the Board of Trade and the Minister of Reconstruction), and covered ground which was more or less familiar. Both of these gentlemen gave us an account of many things that are proposed as the result of investigations by various Committees which have inquired into certain defined sections of activity. On the third occasion the lecturer (Mr. W. L. Hichens, chairman of Cammell, Laird & Co., Ltd.) was a man free from all Government influences officially, but by no means as free therefrom as he would desire to be as a representative of great national industries. He was, therefore, agreeably unrestrained in dealing with the subject chosen for his lecture, and, in our opinion, the importance and seriousness of what he had to say were fully appreciated by his audience. We may all have the best intentions in the world in trying to obviate causes of friction in the nation in the approaching days, but we shall be pursuing a rake's progress if we sit still and see security of industrial interests threatened with wearing away to vanishing point because Parliamentary authorities adopt policies dictated by opportunism. There are many voices in the nation at the present moment. Some of them are very loud, and what they say is very emphatically expressed; but inasmuch as "the people" can only live by what industry affords them, it is very necessary that when we are in danger of being carried along on a great wave of good feeling we should ask ourselves whither that great wave is likely to carry us. As Mr. Hichens says, it is a natural weakness of Englishmen "to drift down the stream of life without inquiring where they are going." His advice is that we should pause a moment at the veritable network of cross-roads that meets us to-day, and make up our minds where it is we want to go. Changing over from stream and cross-road similes, he very aptly likens the nation to a traveller at a railway station. He has to go somewhere, the train is waiting to be off, and, without inquiring its destination, he jumps in, and when he is settled comfortably begins to reflect, and soon hopes that there may be some "compromise junction" at which he can alight and change over before he is landed at the unknown end. But suppose it is a non-stop train, or there is no "compromise junction," or if there is, we are stranded there against our inclinations—what then? The lecturer, like many another who has the well-being of the nation at heart, has no desire to find himself in a non-stop train hurrying headlong to the destination of State Socialism. He objects to being pushed and jostled into the wrong train by a crowd of men and women in a hurry, and prefers, if he can, to travel by another route: but, to our mind, the danger of the present situation lies in the great pressure that is gathering behind us, or behind those who during the war have had to give way here, and give way there, in order to win the war. We have made many compromises during the war, and the Government has controlled us all. For a time it will continue to do so, as we feel our way along the rough and tortuous paths of Peace. But, after the transition period—what then? Not blind leaders of the blind—worse than that unless we determine our course now—blind leaders of the open-eyed! With our ripe experience of the crass absurdities, the deplorable delays, and the restrictions on initiative and enterprise, that excessive Government control has meant during these last four years, are we going to be carried irresistibly upon the flood tide to the nationalisation of a host of services and industries? If our measures for reconstruction seem likely to lead us there, we shall do well to pause, and consider our ways. The principle of Government control has been, and is, necessary up to a point under war conditions: no nation has been able to avoid it. But we have been pouring out State capital and paying State wages with a prodigal hand, and not even an idealist can imagine that we can continue along such a course with depleted resources without finding our way to bankruptcy and to universal disaster. It is suggested by some that such a view is held only by pessimists who take no account of movements of recent days in creating a harmonious atmosphere. But the man who waves a red flag on the railway track may save us from the fate that awaits us if the driver of our non-stop train wears a significant red tie, or a red ribbon in his buttonhole. If the lecturer were unsympathetically disposed towards the best interests of the masses, his warnings against excessive nationalisation might be regarded as a piece of special pleading on behalf of Capital, and he might be denounced by some sections of the community because of a supposed desire to continue the defects that accompany the existing order of society. But from his previous utterances printed in these pages it is perfectly clear that such is not the case. He holds that the State should be the arbitrator between Capital and Labour, and even goes so far as to agree with Labour that the return on capital should be decided by Government, and that the hours and wages of the worker should be similarly settled, and he has not been free from criticism from the employers' side on that account. We agree with a following speaker that the lecture, of which we give some extracts on another page, should be circulated broadcast, not only among Associations, but among the masses of workers whose

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minds are being corrupted by those who either cannot or will not see where they may be leading us by their advocacy of everything for everybody and the Government feeding us all—a popular platform appeal for the have-nots, but one which will secure "nothin' for nobody" but confusion for us all.

The Minimum Charge.

The announcement in the Press on October 31st regarding the Coal Controller's suggestion—that the quarterly minimum charge be modified into an annual charge—brings this vexed question to a definite issue. It was stated in the Press that the proposal had been arranged with the electrical undertakings, but the agreement suggested was more anticipatory than actual, since many of the leading undertakings learnt of the matter only by reading the notice in the paper, and have not, in fact, as yet determined on a line of action. The question of the minimum charge is undoubtedly a difficult one, since theoretically it is entirely justified as ensuring to the undertakings a proper return for their capital outlay in connecting the premises and their charges for keeping the supply available; while, on the other hand, the public generally are markedly dissatisfied. This dissatisfaction has been expressed by members in the House. Further, the Board of Trade has been from time to time bombarded with protests from consumers, and the discussion has for a long time been an outstanding topic in the Press. On the other hand, from the undertaking's point of view the minimum charge is the only safeguard against a consumer making the undertaking a mere matter of convenience and not paying his fair share of cost as compared with the average consumer. As a matter of fact, the Board of Trade has so far acceded to pressure as recently to make it a condition when increasing statutory charges (price per unit) under the Electric Lighting Acts, that the minimum charge should be waived. The same condition is being made, we understand, by the Board of Trade when granting relief under the Statutory Undertakings (Temporary Increase of Charges) Act. With regard to the minimum charge itself, this is included in the schedule attached to the Confirmation Acts, and is expressed in terms of units coupled with a lump sum. The number of units is 20, and the sum equals that number of units worked out at the maximum price. For 6d., 7d., and 8d. Orders, therefore, the charges would be 10s., 11s. 8d., and 13s. 4d. The fact that the minimum charge is expressed as a definite sum authorises the undertakings to charge that sum even though they are not charging their maximum price. This, however, is not invariably done, and some undertakings are charging less than the amount authorised. There are also certain undertakings which have adopted a minimum charge only since the outbreak of war, and some, of course, make no minimum charge.

The suggestion by the Coal Controller does not involve a matter of principle, although, taking it in conjunction with the attitude of the Board of Trade in revising maximum prices, the tendency is evident. The present proposal is best considered by dividing it into two parts—first, the alteration from a quarterly charge to an annual charge: and, secondly, the reduction of the total charge to £1 per annum. It is obvious that the times call for some sort of *modus vivendi*, and as the first part of the suggestion would help to get over the trouble, the undertakings might certainly do worse than arrange accordingly; in fact, some undertakings are already, and have been, allowing the alternative in the ordinary course.

As regards the reduction to £1, this is a matter in which each undertaking will have to take the responsibility of individual action. Whether, if the undertaking should refuse to grant this concession, the Board of Trade could issue a compulsory Order under D.O.R.A., is questionable, seeing that it is merely a question of a few shillings being either in the undertaking's pockets or the consumers' pockets, and the order *per se* would work just as smoothly one way as the other. There certainly does not seem to be any direct clause in the Defence of the Realm Act which would authorise such action: but, of course, it is impossible to dogmatise as to what the Government can, or cannot, do under its present very wide powers.

PARTIAL TRANSFORMATION OF DIRECT-CURRENT REDUCER SETS.

By C. L. BROWN, A.M.I.E.E., Lt. R.E.

The following describes the principle of and sets forth calculations for arriving at the most efficient combination of motor and generator for this type of rotary direct-current voltage transformer.

The advantages gained are:—(1) Higher combined efficiency, this being the most important, as will be seen later, yet in many cases the least considered; (2) cheaper initial cost, without impairing strength and stability or increasing the maintenance and depreciation charges. The whole is effected by winding the machines to give the required voltage ratio and making the necessary connections.

In many cases this type of reducer is unknown, not considered, or presumed not "worth while"; the last is totally wrong, as will be seen from the figures put forward below from actual tests; the approximate saving per annum is given.

It is only necessary here to enter into calculations, of an elementary nature, concerning the outputs of the motor and generator, a formula being worked out to meet any case: the designer can then proceed in the usual manner in accordance with ordinary D.C. machine design.

The principle, as many readers may already know, is to utilise the current which passes through the motor in parallel with the current from the generator which it is driving; this current, as far as the secondary is concerned, is supplied without any transformation losses. Fig. 1 (p. 436) will make the principle clear to those who are not familiar with this plant.

The following are simple methods for arriving at the voltages and outputs of machines; these being direct-coupled, the speeds would be the same, and chosen to suit the designer's standard frames. Let M = motor input current; G = generator output current; V = motor voltage; E = generator voltage (secondary); A = total secondary current in amperes (*i.e.*, generator current plus motor current); e = overall efficiency (this must be an assumed figure, and should, if anything, be on the low side). Given no losses:—

Motor watts = generator watts;

i.e., $M\,V = G\,E$,

$M = G\,E/V$, and $G = M\,V/E$.

Also $(M + G)\,E = E\,A$,

and as $G = M\,V/E$,

we have $(M + M\,V/E)\,E = E\,A$,

$M = E\,A/(1 + V/E)\,E = A/(1 + V/E)$.

Allowing for losses, the voltage ratio V/E would be divided by percentage overall efficiency and multiplied by 100, *i.e.*, $M = A\,(1 + e\,V/E)$, this being the only formula necessary.

The generator current is, of course, A − M, hence the actual output of each machine is solved by multiplying the respective current by the respective voltage.

Fig. 2 is a diagram of a P.T. set showing connections of shunt fields, starter, and regulator, the latter being in the generator shunt circuit; there is nothing of particular note. It will be seen that the motor and generator fields when starting are in series, and when running at full speed the contacts "C C" are short-circuited so that each field is connected to its respective side of the mid-wire.

An interesting case is here given of a 160-KW. set, the figures being for about half-load, showing a marked increase in efficiency over an ordinary motor-generator set: the efficiency *increases* over motor-generator sets are more marked in smaller sets.

Output (secondary)	80 KW. at 205 volts.
Primary volts (or line) ...	400 volts.
Secondary volts (or generator)...	205 volts.
Efficiency (overall)	91 per cent. = total secondary power/total input from line.
Speed of set	1,210 R.P.M.
Mid-wire current	390 amperes.
Windings	Both machines shunt-wound with commutation poles.

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In addition to a saving in cost of something like £125 in capital outlay for the above set, there would be a considerable annual saving, as follows :—

A well-designed motor-generator set under the above conditions would have an efficiency of about 81 per cent. : assuming that the above is required to run at a load factor of, say, 50 per cent. for 10 hours per day, six days per week, with energy at 1d. per B.O.T. unit, there would be a net saving of £140 per annum, which, at the nominal interest of 5 per cent., represents a further capital of £2,800, and higher in proportion to the load factor.

There is no difficulty in running these sets under almost any conditions ; they are satisfactory for parallel running with compound-wound generators, in which case the generator of the P.T. set should be also compound-wound, in order that the load fluctuations may be equally shared, *i.e.*, the field characteristics should be the same.

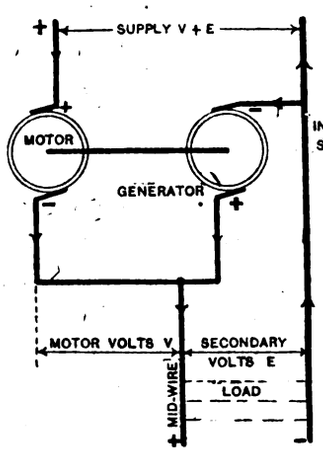

Fig. 1.

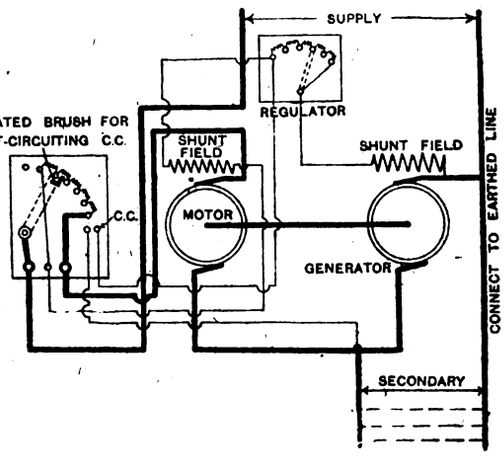

Fig. 2.

It will be noted that in the case of large voltage ratios in smaller sets up to 15-20 kw.—*i.e.*, where the motor voltage would be about six times that of the generator—not much advantage would be gained over motor-generator sets, on account of the small motor current, on which the increased efficiency depends.

These sets have been successfully used even for kinematograph work, and it would be well to note that care should be taken where the supply system is "earthed" to connect the generator side to the "earthed" line (see fig. 2), otherwise the operator would be in danger of receiving a "shock" of line voltage to "earth."

Note.—As the over-all efficiencies increase as the motor volts decrease, it will readily be seen that these sets are particularly adapted to high secondary voltages and high line voltages.

ELECTRIC TRACTION ON THE CENTRAL ARGENTINE RAILWAY.

(*Concluded from page* 413.)

The electrical equipment of the track comprised the bonding of the track rails, the erection, bonding and protection of the conductor rails, the laying of interconnecting cables across gaps in the conductor rail, and the provision of switchgear for dividing up the track into short electrical sections.

The conductor rail is of the North-Eastern Steel Co.'s high-conductivity steel, weighing 86 lb. per yard. The composition of the rail is as follows : Carbon, 0·03 per cent. : silicon, nil ; sulphur, 0·05 per cent. ; phosphorus, 0·06 per cent. ; and manganese, 0·36 per cent. The electrical resistance of the rail is 6·7 times that of copper of equal volume. The insulators are Doulton's single-shed round-porcelain type, with caps and clips of malleable cast-iron. The rail bonds are of the British Insulated and Helsby Cables' solid-head and pin types, of ·166 sq. in. area. The bond tester is of the Evershed and Vignoles type. The anchorages consist of the British Insulated and Helsby Cables' composition insulators with shackles, plates, and clamps ; and the sectioning gear is of the British Thomson-Houston Co.'s 800-volt remote-operated type.

In connection with the electrification scheme, a number of works were carried out which represent important betterments of the track. Thus the whole of the route has been fenced with wire netting. On a length of about a mile near Tigre, which was frequently flooded, the track has been raised above flood level. There are 75 level crossings on the route, and in order to prevent people and animals from straying on the line at these places, special "cattle guards" were installed. A cattle guard consists of a trench dug across the tracks parallel to the road, with brick retaining walls and concrete invert. The depth varies, the standard being about 7 ft. ; the width is 6 ft. 6 in. The track rails are carried across on wooden beams, having the upper corners chamfered off to reduce the foothold. The fences are carried up to the trench, and a footway with a locked gate is provided for the use of the maintenance gangs (fig. 15.) Other incidental improvements were the provision under every rail of four sleepers of extra length carrying the insulators, and the installation of new track fishplates.

The track rails are used throughout for the return circuit of the traction current. They weigh 85 lb. per yard, and are part 40 ft. and part 33 ft. long. The joints are bonded with two copper bonds of the ribbon type, with solid heads, giving a total cross-section of $\frac{1}{3}$ sq. in. of copper, and making the ratio of conductivities of 6 ft. of rail, including and excluding a bonded joint, about 3 to 5. To reduce the risk of loss by theft, the bonds are fixed under the fishplates. The two rails of each track are cross-connected every 100 yards with stranded copper bonds carried in wooden troughs fixed to the sleepers. Adjacent tracks are cross-bonded every 100 yards.

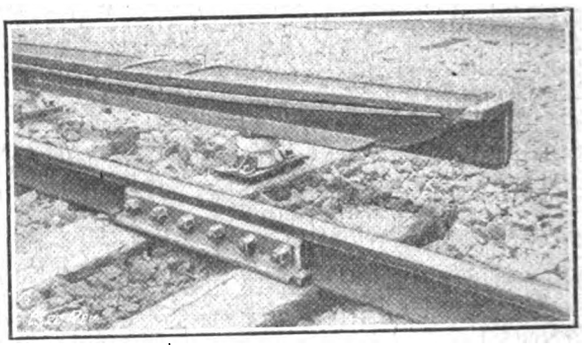

Fig. 13.—Conductor-Rail Ramp.

In the Retiro terminus the rails are used for track-circuiting with alternating current. To permit of using the same rails as a path for the traction current, impedance bonds are placed at the ends of the track-circuiting sections, these bonds consisting of heavy choke coils contained

Fig. 14.—Conductor-Rail Anchor.

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in oil-filled cast-iron cases, which are placed between the sleepers. Where crossings occur, only one rail of each track is used for the traction current.

Trespassing on the railway tracks is much more prevalent in the Argentine than in this country, so that any form of conductor rail adopted must be particularly well protected against the risk of people touching it. It was felt that the common form of flat-bottomed rail with side boards attached to it was too much exposed on the top to be safely used, and it was not possible to provide a top cover or adopt the American type of under-running rail, on account of the limited space available between the structure and load gauges. The form of rail shown in fig. 11, p. 412, was ultimately selected as occupying the minimum space consistent with proper clearance, and as permitting of a very complete insulating covering. The rail was rolled without difficulty of high-conducting steel, and can be handled without any tendency to distortion. Before leaving the works, the rails were dipped in hot bitumastic solution to prevent rusting; when the service started up a special skate with scraping edges was fixed to the collector shoe gear on a coach which was hauled up and down by a steam locomotive till the contact surface of the rail was clean; hand scrapers were also used.

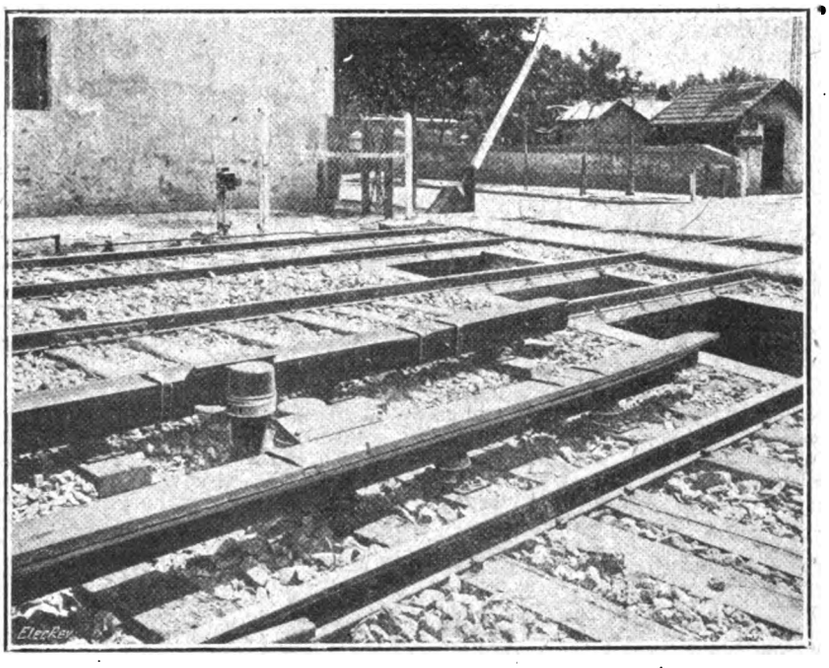

Fig. 15.—Level Crossing with Cattle Guard.

The fishplates are single and are applied to the back of the rail, the bolt heads being countersunk to leave a free passage for the toe of the skate. Two bonds with solid plug heads are fixed under the fishplate, giving a cross section of ·33 sq. in. of copper at each joint.

Where gaps occur the rails finish off with cast-steel ramps 5 ft. long, shaped to guide the skate into position without jarring (fig. 13).

The rails and ramps are covered with a protection of creosoted wood boards, built up in the shops, and fixed in position on the ground by hammering over the ends of steel strips to embrace the edges of the top table and foot of the rail. The protection has proved very efficient, no cases of fatal injury from shock having occurred up to the present, though barefooted boys have been seen to run about over the rail and men have used it as a barrow track.

The rail is carried on malleable iron castings cemented into porcelain insulators, which stand on the ends of specially long sleepers, and are fixed to them by malleable iron clips. The insulation of the rail is very good, the usual weekly figure for leakage from the 50 miles erected being between 1·0 and 1·5 amperes.

To prevent creepage every length of conductor rail is anchored, and no length exceeds ½ mile. The anchors used on long lengths consist of insulated links attached to a plate either fixed in a block of concrete or fastened down to a sleeper (fig. 14).

When a conductor rail continuity cable crosses under the track, it is carried in a cast-iron trough bolted to an old sleeper. At cattle guards the cables are carried in iron troughs supported by old rails.

All positive cables finish in terminal pillars (fig. 15), consisting of cast-iron bends into which a fibre sleeve is slipped, the cable being threaded through and the core being sweated into a gunmetal cap resting on a porcelain insulator fitted into the top of the bend. The cap has bolted to it a terminal plate with sockets for stranded bonds which make connection with the conductor rail. The cap and terminal are surrounded by a pot-ware cover, which prevents a person walking past from coming accidentally in contact with live metal.

The conductor rail is so divided into sections by switches mounted in signal cabins, that the signalman can quickly isolate any faulty section, leaving the rest of the system unaffected. The sections are also so arranged that in case of, say, a derailment at one place, any route which would be available for steam-propelled trains is also available for the electric trains. Provision is made for paralleling the "up" and "down" conductor rails, in order to make full use of their combined conductance. A view of a cabin sectioning board is given in fig. 16. The sectioning switches are normally of the 1,000-ampere quick-break knife type;

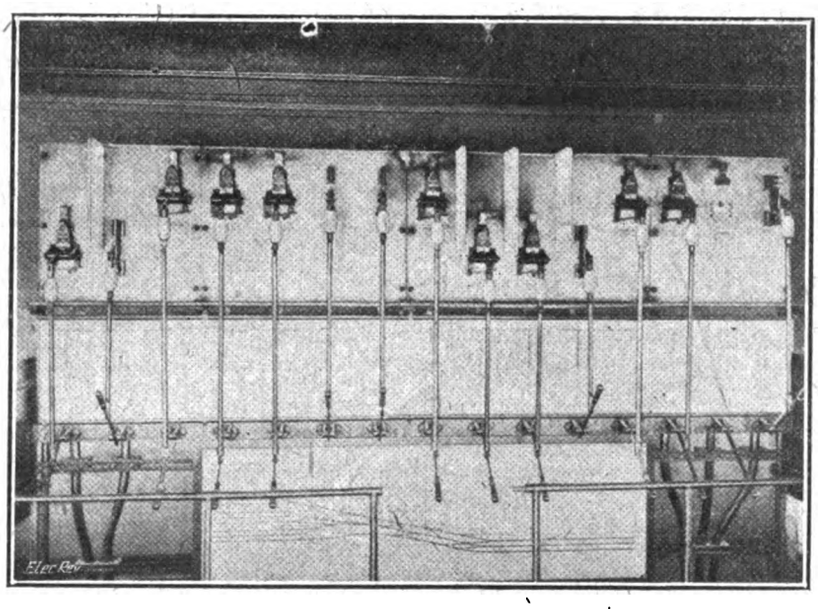

Fig. 16.—Sectioning Board in Signal Cabin.

interconnecting switches and those feeding the tracks in Retiro terminus are automatic circuit-breakers. Emergency switches are provided at the crossovers at wayside stations, to allow of trains discharging passengers and setting back to the other line when a fault occurs beyond the platform in a section containing several stations. Sidings and the platform lines at Retiro are controlled by switches mounted in cast-iron boxes, with a danger signal showing when the switch is closed.

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In the first 12 months the mileages run were :—Motor coach miles, 1,782,000 ; trailer coach miles, 1,353,000.

The total number of times the supply to the conductor rail was interrupted was :—Under one minute, 66 ; over one minute, 42.

The total number of trains run was 41,706, and the total amount by which all trains were late arriving at the termini was 817 minutes. The percentage of trains arriving late was 0·213 per cent., of which 0·129 per cent. were over five minutes late. These figures include delays to trains caused by late running of other trains.

As may be judged from these figures, the initial difficulties and maintenance troubles have been few and of minor importance, and the whole system is giving results commensurate with the care devoted to the design, manufacture, and erection of the plant.

AN OSCILLOGRAPHIC STUDY OF A HOWLER SET.*

By LINDLEY PYLE.

THE need of a simple device yielding sustained high-frequency oscillations of the order of 1,000 cycles per second led the author to an oscillographic study of the performance of the so-called "howler" apparatus, the action of which is illustrated by the shrill note emitted when the receiver of a telephone circuit is presented to the mouthpiece of the transmitter.

A telephone transmitter, T (fig. 1), capable of continuous operation at one-half ampere under an applied potential difference of 12 volts, was placed in series with eight fresh dry cells and a fixed non-inductive resistance, r, of one ohm, the resulting current traversing the primary of a small induction coil whose vibrator was closed and blocked from action. An ammeter, A, and key, k, were usually included in the circuit. A head-type telephone receiver, R, of 1,000 ohms resistance was connected to the secondary of the induction coil, the resistance of the secondary being 1,000 ohms. When the mouth-piece of the transmitter was brought close to the diaphragm of the receiver, a musical note was emitted

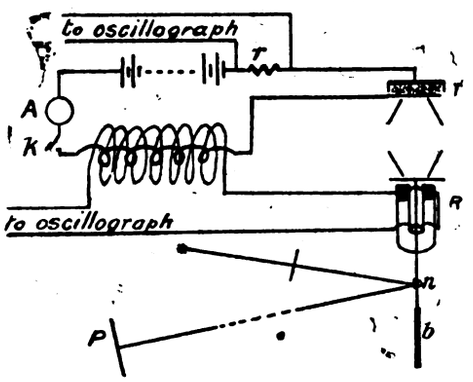

FIG. 1.

by the latter upon closing the key k or upon tapping the instrument if k were already closed. The pitch of the note is dependent upon the nearness of the mutually excited diaphragms, upon the resistance of the receiver circuit, and upon the way in which the receiver happens to be connected initially to the secondary terminals. In order to study the motion of the receiver diaphragm, use was made of the device termed by D. C. Miller, the "phonodeik," as described in his book on "The Science of Musical Sounds." A piece of thin silk thread was attached by sealing wax to the centre of the rear face of the diaphragm, the other end being led out through a hole in the rear of the receiver case. The thread was then wrapped around a fine needle mounted to rotate freely with its axis parallel to the face of the diaphragm (see n, fig. 1). The thread was then tied to a rubber band, b, which in turn was attached to a fixed point. A beam of light from a pin-hole impinged upon a minute mirror attached to the needle and was focused upon a photographic plate, v, which could be moved rapidly across the beam of light in a direction parallel to the axis of the needle. Development of the plate yielded an oscillogram of the mechanical vibrations of the diaphragm of the receiver. It was computed from observed data that the extreme displacement of the diaphragm was of the order of 0.01 millimetre. A Duddell oscillograph was used to study the variable currents in the receiver and transmitter circuits. Fig. 1 makes plain how the oscillograph was connected in circuit.

Fig. 2 is an oscillogram of the high-frequency alternating current in the receiver circuit. On the same film a simultaneous record was taken of a 57-cycle per sec. alternating current delivered by the local power house. The higher frequency was found to be 1,270 per sec. The line of zero current does not extend through the centre of the current trace. The maximum current values in one direction exceed the maximum current values in the other direction by approximately 25 per cent. of the arithmetical mean of the maxima, this being characteristic of all the receiver circuit records.

Fig. 3 is the corresponding oscillogram of the vibrations of the receiver diaphragm. The zero line corresponding to the

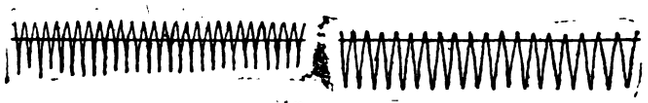

FIG. 2. FIG. 3.

position of the undisturbed diaphragm is markedly displaced from the centre of the oscillation record. In fact, the diaphragm in action swings *eight* times further *from* the attracting magnet than it swings *towards* it. This is not due to lost motion in the phonodik system, for the zero mark is in the same position after taking a record as before. Fig. 4 shows a not infrequent type of oscillation where there is a regularly alternating variation in height of one set of maxima. Fig. 5 shows the simultaneous behaviour of the receiver diaphragm.

It was thought worth while to study the variation in the primary, or transmitter, circuit. Accordingly, the Duddell instrument was connected to the terminals of the non-inductive resistance (fig. 1) in order to obtain an oscillogram showing the nature of the current traversing the transmitter.

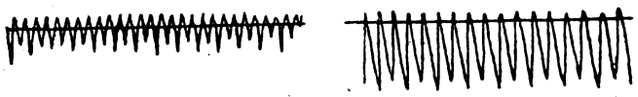

FIG. 4. FIG. 5.

Fig. 6 shows a careful copy of the very faint film record obtained. A projection lantern was used to throw an image of the film upon a sheet of white drawing paper. The lines of the image were traced in pencil and were then photographed to give the published figure. The striking feature is the wide range of fluctuation in the unidirectional current in the transmitter circuit. The current as read on a Weston direct-current ammeter was 0.50 ampere. As reckoned from the line of zero current the minimum values of the current are approximately 8 per cent. of the maximum values.

The "howler" apparatus used in these experiments will give a sustained high-frequency current of the order of 1,200 cycles per second, with no erratic variation in frequency after once set in operation. The operation has been maintained for half an hour with no personal attention whatever. The high frequency current of course departs widely from a sinusoidal form. The piercing note emitted by the diaphragm of the receiver is the only annoying feature about the device. The action continues even with as much as 80,000 ohms in the receiver circuit. The human body itself may be introduced into the receiver circuit without painful physiological effects. The effective current strength (as measured on a Rowland electrodynamometer) in the receiver circuit when no auxiliary resistance is present is about 5 milli-amperes; there is then present 2,000 ohms resistance and considerable inductance. For effective operation it is necessary to keep the primary circuit of low resistance in order that variations in the resistance of the carbon granules of the transmitter may be a high percentage of the total resistance of the circuit. Trial should be made to determine how the terminals of the secondary should be connected to the receiver. The oscillations will be set up with greater ease in one case than when the terminals are reversed. When the transmitter circuit is closed the sound wave thrown from the excited receiver diaphragm against the transmitter diaphragm may be such as to decelerate the motion of the latter rather than accelerate it. The device should be useful as a generator of high-frequency currents where sinusoidal currents are not demanded.

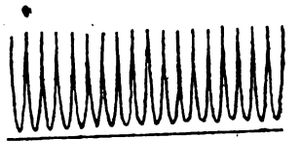

FIG. 6.

* Reprinted from *Washington University Studies*, Vol. 6, Scientific Series No. 1, 1918.

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NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Record Internal-Combustion Engine.

These engines, made by the Record Engineering Co., Ltd., of Eccles, Manchester, have been on the market for some years, but only recently have they come into prominent notice. The engines are designed on similar lines, and may be very well compared with the well-known high-speed self-lubricating steam engine. All the usual two-to-one gears, with their camshafts, cams, tappets, and poppet valves—as used in connection with the ordinary four-stroke cycle engine—have been eliminated. Consequently, this engine simply consists of the usual pistons with rings, and generally speaking, one simple piston valve for every two cylinders, this piston valve being driven by means of an eccentric formed with or fixed directly on to the crankshaft. This constitutes the whole of the valve mechanism, and as this valve only controls the distribution of the gaseous fuel to the pump cylinders, it is only subject to a few pounds pressure per square inch, never to the heat of fire, and consequent carbonisation, &c., of the working cylinders.

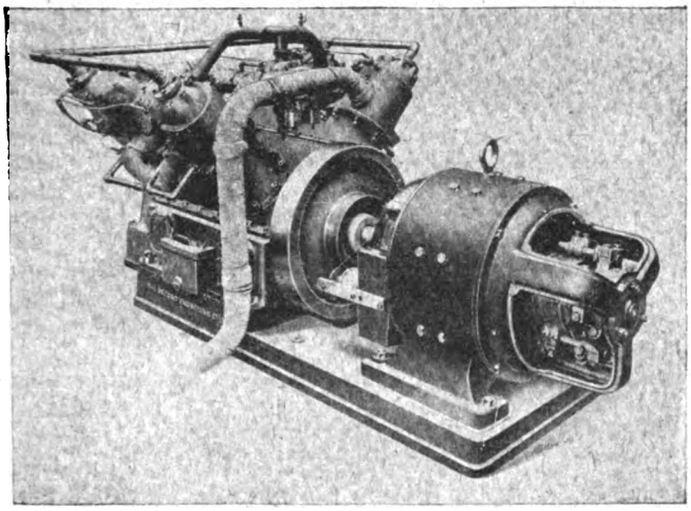


Fig. 1.—"Record" 50-b.h.p. Engine.

It will readily be seen that these engines, being of such simple construction, should be capable of maintaining their efficiency over very long periods. They are easy to overhaul and repair, and can be placed in the hands of unskilled labour for supervision. Attendants who have had long experience in the running of steam engines will find they closely approach the plant they have been accustomed to. It is, therefore, the type of engine which will appeal particularly to marine engineers.

In the "Record" engine, many causes of trouble are removed by the crank case being used only as a reservoir for lubricating oil as in the ordinary 4-cycle engine; in reality it works under more favourable conditions owing to the fact that the lubricating oil is not splashed directly on to the inside of the working pistons.

The company recently completed a six-days' endurance test on paraffin, on a 50-b.h.p. engine which was on order for a Government department, and one of the conditions under which the order was placed was that it should run continuously, at full load, on paraffin, without any attention or adjustment whatsoever. The conditions were accepted by the company, and the trial was carried out under the direct supervision of five Government departments which were interested.

During the whole of the trial, the engine received no attention except the usual filling up of fuel tanks and the addition of lubricating oil. No plugs were changed, and when afterwards dismantled, the engine showed no appreciable wear and the cylinders were practically free from deposit. The result of this test shows that a 2-stroke engine can be designed and built to give equal results in economy, efficiency, and endurance, to a 4-stroke engine, with the added advantage of great simplicity. The engine recently tested was of the "V" type, four-cylinder design, with two cranks giving four impulses per revolution, making the turning very even, and owing to the absence of valves and valve gear, the engine runs silently under all conditions of load, and absolutely free from vibration.

Fig. 1 shows the 50-b.h.p. engine referred to, whilst fig. 2 illustrates the standard 5-kw. petrol generating set with radiator system of cooling.

Generally speaking, the engines are substantially designed as regards the working parts, and ample provision is made for wear, while large doors are provided in the crank case to enable adjustments to be made without dismantling. It will also be seen from the illustrations that the cylinder heads are made loose, consequently both piston tops and combustion chambers can be cleaned without dismantling the parts.

The London office of the company is: Donnington House, Norfolk Street, Strand, W.C. 2.

Electrical Starting Apparatus for Petrol Motors.

Mr. Harry Lucas and Mr. C. L. Breeden, of Joseph Lucas, Ltd., Birmingham, have recently taken out patents in respect of two forms of electrically-actuated pinion and toothed-ring meshing arrangements which are worthy of notice. The first arrangement comprises a means of imposing on the pinion a magnetic force adapted to restrain rotation in the pinion during the meshing operation, the necessary magnetic force being obtained by a magnetic pole piece adjacent to the pinion teeth and a winding for its excitation. From the accompanying diagrammatic sectional side and end views, figs. 3 and 4, it will be seen that the end cover of the motor is made of magnetic material and provided with a pole piece B situated over the driving pinion, the extension of the pole piece being connected to a core carrying an exciting coil E. The inner surface of the forward end of the pole piece is made to a tooth-like configuration, similar to that of the driving pinion C, the two being closely set to, but not touching, one another. The circuit for the magnetic flux starting from the core is across the pole piece radially through both sets of teeth and back along the screwed shaft of the pinion and end cover. Due to the concentration of the flux on the teeth, any tendency of the pinion to rotate with the shaft when the latter is started is resisted, and rotation of the shaft results in a screwing of the pinion into mesh with the driven toothed ring G. It is pointed out that the resistance to rotation is not in the nature of a positive lock, and consequently when the pinion meshes it can rotate against the action of the magnetic flux. After proper meshing of the pinion, the current through the coil is cut off and a full current passed to the motor, enabling the full turning effort to be exerted. Suitable provision is made in the coil circuit so that after the

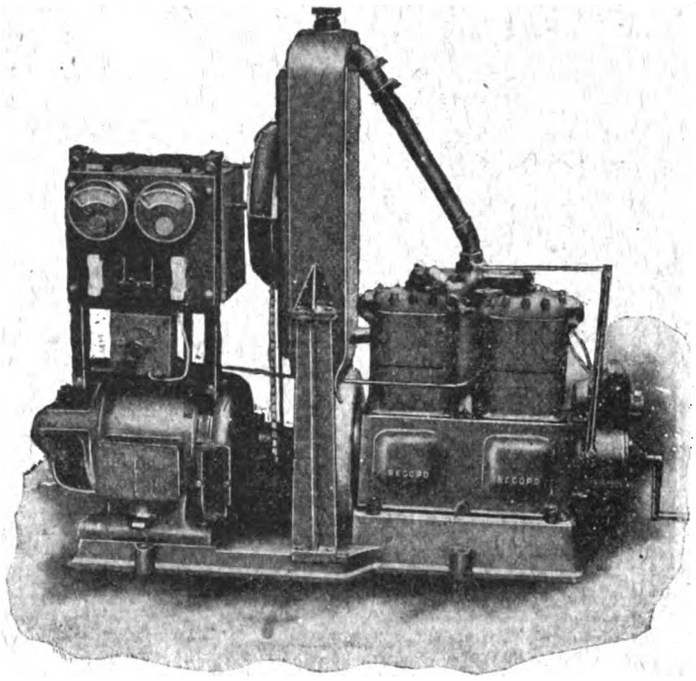
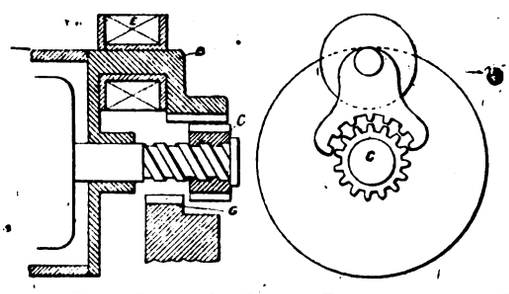


Fig. 2.—Standard 5-kw. "Record" Petrol-Electric Set.



Figs. 3 and 4.—Pinion Restraining Arrangement for Electric Starters.

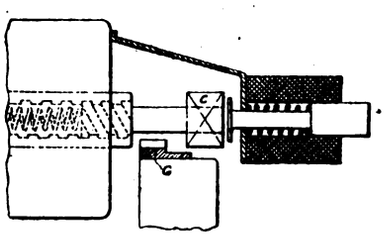


Fig. 5.—Solenoid-controlled Pinion of Electric Starter.

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engine has been started the coil does not come into action during the disengagement of the pinion; the latter is therefore free to come away from the toothed ring without restraint. It is claimed that by this arrangement the meshing operation can be effected with a slow rotation of the motor, the full power not being exerted until meshing is complete.

The second Lucas arrangement, shown diagramatically in fig. 5 comprises the combination of a pinion screw connected with the armature shaft, and a solenoid adapted to produce axial movement of the pinion relative to the shaft. The armature shaft proper is hollow and screwed internally; an externally-screwed shaft carrying the driving pinion C engages the same, the angle of the screw being such that the pinion can be moved axially by an endwise pressure. In conjunction with the pinion is a co-axially-arranged plunger of a solenoid carried on a bracket mounted on one end of the motor casing. On closing the starting switch the solenoid is excited, and its plunger causes the pinion to traverse along the armature shaft, the latter being concurrently slowly rotated. When the pinion becomes meshed with the teeth G on the engine flywheel, a further switch operation puts the solenoid out of action and passes full current to the motor. The switch control arrangement is such that the solenoid remains out of action and does not interfere with the return of the pinion by the flywheel teeth after the engine has been started. Further, the solenoid does not again come into action during the opening of the switch, so that the pinion is unaffected after the engine has been started. The solenoid plunger is returned by a spring when the solenoid is de-energised, while a spring may, as shown, be arranged in the hollow armature shaft as a buffer.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Economy in the Use of Electric Lamps.

In view of the great attention that is being paid to economy in the use of coal, and the emphasis this places on the use of the most efficient lamps, it is interesting to review the present relative economy and cost of electric lamps in the 200—250-volt range as compared to the 100—130-volt range.

It will be recalled that years ago the 200—250-volt-pressure was adopted for electric light and power distribution in Great Britain without regard to the resultant loss in lamp efficiency and increased cost of electric lamps. The following tables show the present status of electric-lamp efficiency in the high and low-voltage ranges and the difference in cost. Table I shows the conditions for the United States and Table II the conditions for Great Britain. The relative greater percentage-gain in efficiency for U.S.A. in 100-volt over 200-volt lamps is due to the greater attention paid to advancing the efficiency of 100-volt lamps in the United States.

On the average, the adoption of the higher voltage, 200—250 volts, sacrifices 10 per cent. in lamp efficiency and electric lighting service, as compared to the 100—125-volt service.

TABLE I.—Electric Lamp Comparison for the United States.

Size of lamp (watts).	Vacuum type. 25.	50.	100.	Gas-filled type. 200.	300.	400.	500.	750.	1,000.
Light output (lumens), 110 volts	230	476	1,010	2,920	4,850	6,150	8,050	12,800	18,000
Light output (lumens), 220 volts	190	422	900	2,520	4,100	5,850	7,400	11,500	16,100
Extra light output in favour of 110-volt lamp	21%	13%	12%	16%	18%	5%	9%	11%	12%
List price of lamp, 110-volt	$0·30	$0·30	$0·70	$2·20	$3·25	$4·30	$4·70	$6·50	$7·50
ditto 220-volt	0·35	0·35	0·85	2·40	3·90	5·10	5·60	7·70	9·00
Difference in list price in favour of 110-volt lamp	14·3%	14·3%	17·6%	8·3%	16·6%	15·7%	16%	15·6%	16·7%

TABLE II.—Electric Lamp Comparison for Great Britain.

Size of lamps (watts).	Vacuum type. 30.	60.	100.	Half-watt type. 200.	300.	500.	1,000.	1,500.
Light output (lumens), 110-volt	255	535	930	2,800	4,600	8,500	18,000	28,000
ditto 220-volt	229	515	905	2,500	4,200	7,900	16,500	26,000
Extra light output in favour of 110-volt lamp	11%	4%	3%	12%	10%	16%	9%	8%
List price of 110-volt lamp	3/-	3/-	6/-	20/-	25/-	30/-	40/-	50/-
ditto 220-volt lamp	3/6	3/6	6/-	20/-	30/-	30/-	40/-	50/-
Difference in list price in favour of 110-volt lamp	14·3%	14·3%	nil	nil	16·6%	nil	nil	nil

F. W. Willcox.

London, E.C., *October 14th*, 1918.

Work Without Pay.

The letter of "District Engineer," appearing in your issue of the 1st inst., will meet with the approval of all who have knowledge of the amount of work involved in carrying out the duties attached to the appointment of district engineer under the B.O.T. coal economy scheme. It is to be hoped, however, that chief engineers so appointed will not forget that in consequence of the additional work voluntarily undertaken by them in this connection, it has been necessary to allocate more of their regular duties and responsibilities to members of their staffs, and that for this and other reasons, they will view with greater sympathy than many appear to intend doing the request recently made by the Council of the E.P.E.A. for more adequate remuneration of their technical staff members. From personal knowledge I am able to state that it is the intention of more than one chief engineer to treat the request of the E.P.E.A. with contempt, and, in one case, the request was characterised as being "absolutely ridiculous" by a chief engineer who, since the commencement of the war, has had his salary increased by at least 60 per cent.

Technical Assistant.

November 2nd, 1918.

Referring to the anonymous letter subscribed "District Engineer" in your current issue, I am of opinion that the person responsible for it should furnish his name; as, in view of the distinct understanding between the Coal Mines Department and district engineers, and the uniformly courteous and sympathetic way in which the heads of the Department have met their "voluntary" assistants, an indication of dissatisfaction of this nature, which I feel quite sure is almost unique amongst the 400, casts an unmerited slur on the majority.

E. Holcombe Hewlett,
Borough Electrical Engineer.

Mansfield, *November 2nd*, 1918.

Although in complete agreement with the views of "District Engineer," I would respectfully point out to him that he knew on what terms his services were to be rendered. In this time of national stress some give their lives, some their services, some see what their country can give them; unfortunately, we see this latter spirit all round us. Do not let us, as a body, foster this.

District Engineer, No. 2.

November 5th, 1918.

Empire Water-Power Developments.

As one who has been employed on E.H.T. and hydro-electric schemes in responsible positions in South Africa, Western India and Afghanistan, I have met far cleverer electrical engineers of my own nationality than any that Germany sent abroad, and have great pleasure in endorsing "British Engineer's" statement.

Hydro-Electric.

November 2nd, 1918.

"Fraternity"—or Tyranny?

We have read with amazement the controversy in the pages of the Electrical Review between the E.T.U. and E.P.E.A., and we think it detrimental to the interests of both societies.

Would it not be more beneficial for these two societies to have a better understanding and work more in harmony one with the other?

The more bitter feeling that exists the better will the interest of those in higher authority be served; and as the writers of this letter are one a member of the E.T.U. and the other of the E.P.E.A., we feel sure that some arrangement and a satisfactory settlement could be brought about, and we suggest, seeing that unity is strength, the sooner the better for the benefit of all that a meeting of the two societies should take place, when all petty squabbles could be settled. We feel sure that these bitter feelings and controversies are not appreciated by members of either society, and we hope that in the near future the E.T.U. and E.P.E.A. will work hand in hand for the betterment of the employés of electrical undertakings.

Unity.

October 29th, 1918.

Training Disabled Men.—A report submitted to the Leeds Education Committee, on the courses of training established at the Leeds Central Technical School for disabled soldiers and sailors, shows that there are classes of 30 students in electrical work, ten in kinema operating, three in Morse telegraphy, nine in mechanical engineering, and four in oxy-acetylene welding. The courses are full-time day courses, occupying about 30 hours per week. They are conducted under the auspices of the various trade advisory Committees under the Ministries of Pensions and Labour. In addition to the special courses for disabled fighters, such men are admitted to courses in engineering (fitting, turning, a machine operating) not specially organised for them. Two mon is allowed to become proficient in oxy-acetylene welding, three months for kinema operating, telegraphy, and mechan engineering.

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WAR ITEMS.

Soldiers' Letters.—Staff-Sergeant, R.E., writing "In the Field," under date October 27th, says:—"Again I wish to thank you for the inestimable privilege of receiving your weekly publication, which, especially in the 'wilds' here, is much appreciated."

The Demobilisation of Machinery.—A member of the House of Commons, on Tuesday, asked the Minister of Reconstruction what was going to be done in the way of demobilising the vast quantity of Government machinery—agricultural and other.

American Exporters Discuss Peace Trade.—The American Manufacturers' Export Association held a dinner in New York a few days ago to discuss post-war problems.

Trading with the Enemy.—The "London Gazette" for November 1st contains further lists of bodies and persons in the following countries with whom trading is prohibited:—Uruguay; Brazil; Chile; Guatemala; Honduras; Mexico; Morocco; Netherlands; Netherlands East Indies; Panama; Peru; Spain; Sweden; and Venezuela.

Post-War Trade Policy.—The final report of Lord Balfour of Burleigh's Committee on Industrial Policy After the War was discussed at the quarterly meeting of the Association of Chambers of Commerce. Resolutions were passed that it is essential for the purpose of making preparations for post-war industries that an immediate pronouncement should be made by the Government concerning the question of trade within the Empire with Allied countries, neutrals, and enemies; that the suggested prohibition for twelve months on the importation of goods of enemy origin is not sufficient, and should be much extended, and that the conditions should be extremely drastic.

It was decided to ask the President of the Board of Trade to receive a deputation to urge upon him that steps should be taken without delay to introduce legislation to prevent or restrict after the war the dumping of foreign goods into the United Kingdom at a lower invoice price than would be charged in the home market of the producing country; that such legislation should be framed on the principle of similar legislation which has been in operation in Canada for some years, and should provide, at least, for an additional Customs duty equal to the difference between the invoice price for export and the fair home market value.—*Morning Post.*

Reconstruction.—As a first step towards co-ordinating or pooling the efforts of the several organisations which for some time past have been engaged in reconstruction propaganda, the Industrial Reconstruction Council and the Reconstruction Society have formed a joint committee, and planned a national campaign on the lines of their recent work.

According to the *Times*, the National Alliance of Employers and Employed has lately made considerable progress with its movement for bringing employers and employed together. The labour organiser has held successful meetings of delegates from trades and labour councils in the Midlands, including Stafford, Wolverhampton, Dudley, Wellington, Cannock, and Shrewsbury. Lieut.-General Sir Edward Bethune and Mr. Harry Dubery, on Thursday last week, completed the formation of a joint committee of employers and employed in Liverpool, and on the same day Mr. W. A. Appleton and Mr. T. Ernest Jackson addressed a sympathetic audience comprising 300 delegates of the allied engineering trades at Keighley. Similar conferences are being held at Leeds, Doncaster, and other important industrial centres.

The A.E.G. to pay 14 per cent. Dividend.—The directors of the A.E.G. of Berlin estimate that the company will be able to pay 14 per cent. for 1917-18, as compared with 12 per cent. in the preceding year.

Without Permission.—At Salford, on Friday, the London Electric Wire Co. and Frederick Smith, Ltd., wire manufacturers, and Mr. A. J. Hanson, the works manager, were summoned for breaches of the priority order of the Ministry of Munitions. Sir Wm. Cobbett, for the prosecution, said the defendants used lead in the making of conveniences for workpeople, without the necessary permission of the Ministry of Munitions. It was quite possible that the permit would have been granted, if application had been made, but it was done without permission. For the defendants, it was stated that the work was necessary, and that they knew nothing of the extra lead being used. They were engaged on important Government work. The Stipendiary held that the law had been broken, and imposed a fine of £1 on each of four summonses, with £5 5s. costs.

Munition Works and Peace.—In the expectation that the war will be ended very shortly many men, particularly in the engineering trades, who left their employment to go into munition works, are now endeavouring to return to their old trades. A considerable number of men made representations during the last few days to their old firm that they felt they could now be released from Government work, and would be willing to resume their former employment. Another point to be remembered is the accumulation of stocks. It may be that contracts which are now terminating will not be so freely renewed until stocks have been somewhat depleted, and we are informed that this applies to a certain extent to the production of component parts. Instances are mentioned in which the smaller firms engaged in this work have been told that they must prepare to return, on the completion of contracts, to their private business, so that they may not be unemployed when their munition contracts are not renewed. In some directions steps are undoubtedly being taken to transform plant for the manufacture of new models and peace-time products. Possibly it is a combination of these circumstances that has led to the prevalent rumours of considerable dismissals.—*Birmingham Post.*

One result of the collapse of all our enemies except Germany is the shutting down of the manufactures of munitions of war material, enough of which is already in hand for more than a year's fierce war against all our enemies. This brings us right up against the problem of employment and the productive use of the vast quantity of machines and other appliances up to the present used exclusively for turning out war material. It is the plain duty of every patriotic man and woman whether in or temporarily out of employment to keep a steady head and a quiet tongue, in order that our country may right itself and turn from the greatest war factory in history to what it ought to be, and will be, if we all pull together, the greatest centre of industry in the world.—*Evening News.*

The Sheffield correspondent of the *Engineer*, writing on "Peace Preparations," says:—

"Next to munitions output, the chief matter of interest in this district continues to be the preparation for a return to peace conditions. One may observe it on all hands. And these plans would be a great deal more conspicuous even than they are if only labour and materials were available for building operations. When hostilities cease and the interregnum period has been lived through, there should be an enormous trade boom here, and it is for this that the leading firms are putting their works into a condition of readiness. What a transformed Sheffield the return of peace will find! If one could only close one's eyes to that awful wastage of war in precious lives, and in material and financial resources, it would have to be admitted that the last four years have done more for Sheffield's industries than would otherwise have been likely for very many decades. From one end of the eastern district to the other there is scarcely an inch of ground not already built upon, being built upon, or earmarked for building upon as soon as circumstances will allow. The open country between Sheffield and Rotherham has now been spanned by steel works. The two areas are as one, and the day is almost within sight when the remaining interstices will all be filled up with works sites. The most striking features along the road uniting the towns are the large works of Steel, Peech & Tozer, and, in the Tinsley district, the great place being completed by Vickers. What is troubling some of the smaller firms, which have been placed firmly upon their feet by war contracts, is the question of whether, and, if so how, munition-making machinery can be adapted to the manufacture of the requirements of peace. There is a feeling that this is one of those reconstruction problems which some of the Government Departments might assist the firms concerned to solve. It is not quite clear how they could actually help in the matter; but, from all accounts, a national factory, not many miles from Sheffield, has been reorganised, as to plant and machinery, so many times that the impression has been created that the department carrying out those changes might be in an excellent position to impart a few wrinkles in the adaptation of war machinery to peace purposes. There is still a good deal of talk about scrapping much of the present plant, but it is to be hoped ingenuity will come to the rescue with a better and more economical way than that."

A Manchester correspondent of the *Financial Times* writes as follows:—

In view of the probability of an early peace manufacturers throughout the country who are engaged on war contracts are concerned as to what action will be taken by the Government with regard to orders not completed. It is of interest, therefore, to point out that the "break clause" for War Office contracts says that if at any time during the currency of a contract the present war shall terminate, or there shall be, in the opinion of the Secretary of State for War, a probability of its early termination, the Secretary for War shall be entitled to require the contractor, within 14 days from the receipt of written notice to that effect, to cease manufacture under the contract, and the contractor shall after the expiration of such notice take no further steps towards the completion of the contract, except as may be directed by the Secretary for War. If he shall direct the contractor to complete, in accordance with the contract, all or any articles in course of manufacture, such articles shall be delivered at such periods as may be mutually agreed. If the contractor shall have reasonably performed all his obligations under the contract down to the date of the expiration of such notice, the Secretary for War shall, unless otherwise mutually agreed, take over all articles in course of manufacture which the contractor shall not be directed to complete at a price to be calculated on the basis of the net invoice price of the materials used, the cost of productive labour actually employed on such articles, such establishment charges as the Secretary for War may consider to be reasonable, and an allowance of 5 per cent. on the price of materials, the cost of production, and establishment charges.

In Parliament, on Monday, Mr. George Terrell asked a further question respecting war contracts and peace. He asked whether the Prime Minister was aware of the consequences which were likely to occur to manufacturers on the cessation of hostilities if there was delay in appointing a central authority empowered to wind up, settle and make prompt payments on account of war contracts; and what immediate steps he proposed to take to deal with the matter. The Chancellor of the Exchequer, who replied, said that the Government were fully aware of the possibility referred to in the question, and were taking all possible steps to deal with it.

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Westinghouse Feeds the Guns.—In connection with Manchester's Big Gun Week, the British Westinghouse Co., Ltd., Trafford Park, subscribed £100,000 to War Bonds, and the employés of the firm a further £19,752.

Post-War Priority Committee.—Further particulars respecting this Committee and its work appear in our "Notes" to-day.

Armistice and Shipping Insurance Rates.—The Board of Trade last week issued a notice to the effect that in the event of the declaration of an armistice rates of premium upon all insurances accepted on or after November 1st, 1918, would be reduced 50 per cent. in cases where the vessels concerned should sail during the continuance of such armistice.

Canadian Manufacturers and Reconstruction.—The Ottawa correspondent of the *Morning Post* says that on October 29th a conference took place there between representatives of the Dominion Government, of Canadian manufacturers, and of industrial reconstruction committees for the purpose of considering the opening of new fields to industry and the development of export trade. A commission is to be appointed to co-operate with the Government on these questions after the war.

Financial Panic in Germany.—According to a Reuter dispatch from Amsterdam (October 30th) something of a financial panic had broken out in Germany. Rumours of a moratorium, it seems, led numerous circles to draw their balances at credit institutions, and to hoard paper money. It may not be long now before we are able to see of what value will be those enormous reserves that the A.E.G. and other big electrical concerns invested in German War Loan for after-war export and other trade schemes.

Reconstruction Measures.—At the luncheon of the Federation of British Industries last week, speeches on reconstruction were delivered by several Ministers. Dr. Addison said that the first big problem was the liberation and supply of essential raw materials for the restoration of our basic industries. A programme of shipping had been arranged which aimed at bringing over as quickly and as soon as possible any raw materials of which our industries were short. The Ministry of Shipping was quite sanguine as to its ability to provide, at quite short notice, the necessary tonnage. They would free our great industries from control at the earliest possible moment. If we could have an industrial armistice during the transition period there would be an era of great prosperity for British manufacturers. The demands for machinery and for restoration were prodigious, and customers for British goods would be very numerous. The anxious time would be the transition period, and he invited the support of those present for any exceptional measures that might be proposed. They must keep their pledged word to the trade unionists. The future would require a system vastly different from that which had prevailed in the past.

Wages in Germany.—Officially collected statistics regarding the increases in wages in Germany during the war were given in the *Mitteilungen des Kriegsausschusses der deutschen Industrie* for August 17th. They include the pre-war figures and those at September, 1917, for the following industries:—

	Men's daily wages.		Women's daily wages.	
	Mar., 1914.	Sept., 1917.	Mar., 1914.	Sept., 1917.
	Mk.	Mk.	Mk.	Mk.
Engineering Trade	5.22	10.79	2.28	4.88
Electrical Industry	4.53	10.93	2.75	6.18
Iron and Metal Industry ...	5.05	11.81	2.06	5.67
Paper Industry	3.93	7.37	2.15	4.09
Foodstuffs Industry	5.70	7.51	2.10	3.72
Pottery Industry	4.45	7.07	1.67	2.87

Exemption Applications.—With the assent of the National Service Representative, the Newton Abbot Rural Tribunal has granted exemption to February 1st, unless a substitute is provided in the meantime, to S. J. H. Payne (25, Grade 1), second engineer at the Bovey Tracey Electricity Works.

West Kent Appeal Court has granted three months' exemption to S. A. Bridger (21), a conscientious objector, who is a pattern maker with Messrs. Fraser & Chalmers, electrical engineers, of Erith.

Kendal Tribunal has granted exemption until April 15th to F. Collinge and J. A. T. Barnes, electrical engineers.

Dartford Rural Tribunal has granted six months' exemption to A. Pinson (20), electric tramcar driver, of Northfleet.

At Dover, on October 30th, six months were granted to G. Hopkins (35, Grade 1), stoker at the Municipal Electricity Works, and the Corporation tramways manager (Mr. Bond) appealed for G. F. Howard (36), assistant fitter. The National Service representative objected on the ground that the trams were not being repaired. Mr. Bond said that he was doing what he could; repairs were delayed because he could not get more men. Six months were conceded.

At Watford, on October 30th, R. E. Cawdell, electrician, was given six months' exemption on the ground of being in a certified occupation.

REVIEWS.

The Year Book of Wireless Telegraphy and Telephony, 1918. London: Wireless Press, Ltd. Pp. 1,154. Illustrated. Price 6s. net.

Year by year it becomes more difficult to do justice to this annual within the space limitations of a review. The present issue, paper restrictions notwithstanding, contains 230 odd more pages than were in last year's edition, thanks to which close upon half of the volume is now devoted to the laws and regulations of various countries concerning "wireless" and its use. When peace shall raise the veil of secrecy now hiding the remarkable technical progress of the past few years, there will be a wealth of technical notes to be added to the Year Book—and the latter will become about as portable as the Post Office Directory! Already there are signs of what will have to be done. The section of Useful Data, revised and extended so excellently last year, cannot be developed further in the Year Book, hence the publishers have promised that it shall form the basis of a small separate volume soon to appear. May we suggest that in the near future the Year Book will appear in three parts, viz., a volume of laws and regulations, &c.; a volume of technical articles, records, and reviews; and a small pocket volume of "useful data"?

Turning now to a brief review of the current volume, it must be admitted that the additional space now occupied has been used to excellent advantage, and the volume shows throughout that wholesale revision which has made it so useful year by year. The brief summaries of earlier legislation and present organisation affecting wireless telegraphy in different countries, now included for the first time, enhance the interest and value of the book. The whole-hearted co-operation of leading officials all over the world has made it possible to deal with the laws and regulations in a manner uniquely complete and authoritative. The special index to this section is a valuable feature.

The special technical articles, to which we always turn with such interest, include this year a paper by Dr. J. A. Fleming on Waves in Water, Air, Earth, and Ether (an instructive thesis on fundamental facts and principles); an analytical treatment of the Energy Transmission in Wireless Telegraphy, by Dr. Balth van der Pol (Utrecht); a review of Wireless Telegraphy in the U.S.A. as affected by the war, by D. Sarnoff; a comprehensive treatment of the magnetic behaviour of iron in alternating fields of radio-frequency (Dr. McLachlan); and a spirited "looking ahead," by A. R. Burrows, concerning the "possibilities" of wireless.

The notes on devotion to duty by ships' operators and the records of life-saving at sea are as inspiring as ever, and have a special significance under present conditions. The record of wireless developments has been brought up to date as fully as is permissible during the war, and the same remark applies to the particulars of wireless patents in 1917. Mr. Shoenberg's notes on valve patents published during 1917 are both interesting and valuable. The illustrations throughout are admirable, and of exceptional interest, and hints are given here and elsewhere as to the war service rendered by wireless in general and aero equipment in particular.

Standing features of the Year Book, which need not be again discussed save to say that they have been revised as completely as possible at present, include the lists of land and ship wireless stations and call letters; the large folding map of the world showing wireless stations; the biographical notes, and the lists and directories of companies engaged in commercial development of wireless, literature of wireless telegraphy and telephony, wireless societies, and Lloyds signal stations. Once again we find practically nothing in the volume concerning wireless telephony, but we expect to find a great deal—after the war.

A Small Book on Electric Motors. By W. Perren Maycock, M.I.E.E. Pp. ix + 192; figs. 128. London: Sir Isaac Pitman & Sons, Ltd. Price 5s. net.

A few weeks ago, in an article entitled "Wanted—a Book," we pointed out that the electrical artisan was in need of a simple work explaining the characteristics and uses of A.C. motors in language that he could understand without difficulty; that he did not require instruction on the more technical aspects of the subject—he had no use for sine curves, or anything in the shape of mathematical analysis; and that we were quite sure that the want could be supplied. We did not then know that the late Mr. Maycock, whose prolific pen had done so much to smooth the path of the electrical tyro, had arrived at practically the same conclusion, and had actually written the book which is before us. The author says in his preface: "This book will be of little use to electrical engineering students, except those making their very first acquaintance with the subject, for it is entirely free from technical and mathematical complications. It will be of even less use to the electrical engineer, unless he desires a work for recommending to his non-technical clients. . . . This book is intended to transmit just so much knowledge as will be useful to those who only want to know about ordinary motors and motor control, and who do not desire to dig into technical details. And it should be within the grasp of those possessing little or no electrical information to

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start with." Thus he aims to fill the very want that we outlined; it remains to see whether he hits the mark.

The book deals with both D.C. and A.C. motors, and begins with elementary ideas regarding the uses and advantages of the electric motor, the methods of supplying it with power, cables, wiring, &c. Next, the construction of a D.C. motor is explained, showing simply the cause of rotation of the armature, and describing the main features of the complete machine. Brief explanations of the differences between shunt and series motors, the methods of controlling motors, starting resistances, controllers—including, of course, the tumbler switch controls beloved of the author—speed regulation, and the various types of motor casing constitute the remainder of the D.C. section. Alternating currents are approached by way of the choking coil and the auto-transformer, leading up to the transformer proper; here the author evidently met with serious difficulties, as might be expected, and by-passes them as far as possible by making statements as to what happens, without dwelling on the reasons why it happens. We by no means quarrel with him on this score; this course, in fact, is unavoidable if his object is to be attained. One of the earliest subjects discussed in books on dynamics is the acceleration of a body falling under the action of gravitation; but we are not acquainted with any textbook, no matter how advanced, which provides an explanation of the *cause* of gravitation, for the sufficient reason that nobody knows the cause. This fact, however, presents no obstacle to the exhaustive discussion of its effects. In the same way we are taught to calculate the flux produced in a magnetic circuit by a known excitation—but *why* ampere-turns should give rise to magnetic flux remains an unsolved mystery. Until these two phenomena—or at least the latter—are explained, we defy the physicist and the mathematician to cavil at the author's superficial treatment of his subject in this respect.

The construction of a squirrel-cage rotor presents no difficulty, but the action of the stator baffles description, and the author hastily throws out a rear-guard in the shape of a reference to one of his other works, and retreats to the subject of controls for single-phase motors. Wound rotors and their connections, the use of transformers, three-phase motors and controls, starters, &c., are dealt with in turn, and a final chapter provides more detailed explanations of matters which have been lightly passed over in the body of the book, including elementary electrical calculations. It is in this section only, five pages from the end, that we find the sine curves which, in our leaderette, we suggested should be relegated to an appendix.

Now, while we cannot say that this "small book" fully corresponds with our desideratum—for it tells little or nothing about installing motors and similar practical points—it certainly goes a very long way in that direction. Supplemented by a companion volume, or expanded in a second edition, it would probably meet the case, and we only regret that the author's premature decease prevents his completing the work on these lines. We recommend the book to all readers who are unable to dig deeply into the subject, but wish to gain an insight, be it only superficial, into the construction and working of electric motors.

DIESEL ENGINE USERS' ASSOCIATION.

Before the Association on October 24th, Mr. James Richardson, of Messrs. William Beardmore & Co., Ltd., read a paper on "The Semi-Diesel Oil Engine," of which the following is an abstract.

The advantage of high compression, which according to theory resulted in economy in fuel and a higher mean effective pressure per cylinder, was counterbalanced by an advantage of low compression in the more even turning moment and a higher mechanical efficiency.

The semi-Diesel was a variable compression engine, high compression being limited to that at which the compression alone ignited the charge, and the lower to that at which the size of the hot bulb became inconveniently large. From practical considerations there was a point above which it was inadvisable to raise the compression due to losses incurred by piston friction. On that account the mechanical efficiency of the internal combustion engine was low compared with that of the steam engine.

As regards fuel economy the semi-Diesel engine gave very satisfactory results as its cycle of operation was nearer the economical explosion cycle than that of the Diesel engine. In the matter of flexibility, it was really a constant load and constant speed engine. Flexibility could be considered under three headings: (1) constant M.E.P. with varying power and revolutions; (2) constant speed and varying M.E.P.; (3) varying speed and M.E.P.

Condition (1) need not be considered from a practical point of view. After considering the second condition in detail Mr. Richardson pointed out that even where means were provided for throttling the cooling water and scavenging air, a point was quickly reached where the heat of the bulb was insufficient to ignite the charge.

The water drip was used in order to extend the range of working to cover from overload to a small load without recourse to the blow lamp. At full load the water served to take heat from the bulb so that a low compression engine with a fairly large bulb could run at from three-quarters to full load satisfactorily. By cutting off the water, low load could be reached. The water for this purpose should be as pure as possible to prevent deposits. It had a deleterious effect on the lubrication of the internal parts, and was only a crude solution of the problem. The better solution was to vary the point of ignition of the fuel charge to correspond with the load on the engine. Gears had been designed by means of which, in conjunction with the governor, the ignition might be varied according to the amount of fuel admitted to the engine.

In the matter of scavenging the efficiency was lower in the 2-cycle engine than in the 4-cycle, the amount of air available per cylinder being limited to the volume swept by the piston. In addition to this the air drawn into the crank chamber was impregnated with lubricating oil and had a cooling effect on the working parts. Probably the greatest loss in efficiency concerned the scavenging in the cylinder; large exhaust ports, ample passages, and a minimum of restriction in the exhaust ports were a necessity. The subject of stroke to bore ratio was intimately associated with that question, and Mr. Richardson's experience suggested that the larger the stroke to bore ratio, within limits, the less the escape of scavenging air through the exhaust. Turbulence was on a par with scavenging, and had as yet received little attention. With regard to the period of injection, practical considerations determined the period for full-power running to be about 30 degrees. No standard had been fixed for fineness of spray, although this could be too fine. It was essential that the whole of the oil should be in the combustion chamber in the form of a spray before the first particle touched the hot bulb, which argued for a long throw of the fuel although this militated against flexibility.

In the matter of fuel, the outstanding difference between the Diesel and the semi-Diesel had been the small range of fuels with which the latter could cope. Recently experiments had been made in the use of heavier fuel oils more readily obtainable. At present most fuel oils ranging between .8 and .9 in specific gravity could be used. Shale oil had been most frequently used. Heavy oils required pre-heating to facilitate pumping. In that connection the semi-Diesel, being of the "solid injection" type, did not run with as clean an exhaust as the Diesel, and the amount of overhauling of parts required was greater.

As regards lubrication, this was carried out in almost a similar manner to the Diesel engine, the consumption working out at about .02 lb. per B.H.P.-hr. The engine was started by means of compressed air, a compression of from 80 to 100 lb. per square inch being necessary. The bulb, prior to starting, was made sufficiently hot to ignite the fuel, one impulse being usually enough to start the engine. The reliability of the semi-Diesel engine was of a high order in the modern types.

In conclusion, Mr. Richardson referred to the recent extension of the field of application of this engine; he foreshadowed great developments in the near future. It might be expected that the lines of development of the semi-Diesel and the Diesel engines would become more closely merged. Practical difficulties appeared to confine the semi-Diesel engine to the 2-stroke principle, and improvements in the scavenging efficiency might be expected.

Applications by non-members for invitations to attend the next meeting, at which Mr. James Richardson's paper is to be discussed, should be addressed to the Hon. Sec., Mr. Percy Still, M.I.E.E., 19, Cadogan Gardens, S.W. 3.

BUSINESS NOTES.

Patents and Alien Enemies.—An application by Messrs. Bluemel Bros., Ltd., for a licence in respect of Patent No. 26,436/07 granted to Bosch, has been granted by the Board of Trade.

I.E.E. Model General Conditions for Contracts.—Alteration to Clause 24.—We have received the following Order issued by the I.E.E. under date November 1st, 1918:—"In the case of contracts made on and after January 1st, 1919, the amounts of the instalments of the retention money specified in Clause 24 (2) will be altered from 10 per cent. and 10 per cent. to 15 per cent. and 5 per cent. respectively.

Trade Announcement.—The Record Engineering Co., Ltd., has removed its offices from Southampton Street to Donington House, Norfolk Street, Strand, W.C. 2, where all communications should be addressed.

Liquidations.—Beck Engineering Co., Ltd.—A petition for the winding-up of this company, presented by Mr. S. W. Doune, of Wimbledon, creditor, will be heard on November 12th.

Vulcanized Fibre, Ltd.—This company is winding up voluntarily, with Mr. C. Cooper, of Spring Gardens, Manchester, as liquidator; meeting of creditors, November 15th.

British High-Power Gas Engine Co., Ltd.—Meeting, December 10th, at Moorgate Hall, Finsbury Pavement, E.C., to hear an account of the winding-up from the liquidator, Mr. F. G. Palin.

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American Copper.—According to a Reuter's cable, the United States Government have decided upon a retention of the fixed price of copper at 26 cents per lb. until January 1st next. This decision is in accordance with expectations, despite demands for an advance based on higher working costs. The change in the war situation may have influenced the decision, and it is to be noted that the retention of the price is for a couple of months only. Meanwhile labour difficulties, which had impeded mining as well as smelting operations, have abated somewhat. The returns of the Phelps Dodge Corporation have been declining steadily, but some of the large producing companies like the Utah, the Chili Copper, and the Cirro de Pasco, the Porphyry producers, and the Lake companies have been showing better results. The aggregate output of the 20 leading producers shows for August an increase of roughly 5,000 tons, and for the eight months there is a notable increase on last year's figures. The position of the metal seems certainly to be easing by degrees.—*Scotsman.*

Australian Copper Situation.—August papers just to hand show that the Abercrombie Copper Mining Co. had closed down its furnaces, confining work to the breaking of ore in anticipation of a renewal of treatment in the indefinite future. The curtailment was being practised throughout the whole State. The cause was that the British Government was unable to renew the copper contract, which expired on June 30th. The contract covered the whole of the metal produced. Being unable to get the copper away, the works were partly closing down in August, when there was about two million pounds' worth of copper, the property of the British Government, in Sydney, awaiting shipment.

Australian Telephone Manufacturing Industry.—It was stated in Sydney, in August, that the Government report on the possibility of establishing the manufacture of telephone instruments and equipment in the Commonwealth had been completed.

Electric Lamp Manufacture at Chile.—It is reported that a company has been formed at Santiago for the manufacture of incandescent electric lamps, and the initial results obtained are considered satisfactory.—*Review of the River Plate.*

Bankruptcy Proceedings.—E. C. Sparkes, described as an electrical manufacturers' agent, of 118, Wardour Street, Oxford Street, W.—The first meeting of creditors was held on October 30th, at the London Bankruptcy Court. The receiving order was made on October 17th, upon the petition of Messrs. Burt, Escaré and Denelle, and accounts have been lodged showing liabilities £352 against assets "nil." Mr. J. B. Knight, Official Receiver, reported that it appeared from the debtor's statements that prior to 1915 he acted as agent for various firms, the chief being J. W. Stokes, of Arnham, Holland; S. M. Woolf & Co., of Wervechyhavers, Germany; S. Heath & Son, Birmingham; and Peyton & Peyton, Birmingham. The war completely stopped the business, and since then the debtor had dealt as principal in electrical goods, but only in a small way. In the absence of any offer the case was left in the hands of the Official Receiver to be wound up in bankruptcy. The following are the principal creditors :—

Unsecured.		Unsecured.	
A. and A. Electrical Co., Ltd.	£15	Morgan Crucible Co.	£13
Burt, Escaré & Denelle	86	Radio Electric Co.	25
Bissecher & Co.	10	Southall Lamp Co.	39
British Thomson-Houston Co.	10	Tyler Apparatus	24
Hewson Manufacturing Co., Ltd.	12	Veritys, Ltd.	10
Imperial Lamp Co.	45		

The British Metals Corporation.—In the House of Commons on Monday, in reply to questions, Mr. G. J. Wardle said that no financial assistance had been promised or would be given to this company by the Government. There was no intention to accord to the company any preferential treatment as compared with other British controlled companies having similar objects.

Book Notices.—*Brassfounding.* By Joseph G. Horner. London: Emmott & Co., Ltd. 1918. Pp. viii + 182; figs. 247. Price 5s. net.—The literature which deals with the subject of brass moulding and founding is scanty, and not of recent date. This practical treatise is offered as an attempt to deal with the leading principles and practice of an interesting trade. The substance of this book has already appeared in the *Mechanical World*, but considerable space is given to descriptions of furnaces, and new matter relating to the latter has been added. In the first chapter the origin of brass is discussed; Chapter II deals with furnaces, many types of which, as well as recent improvements and economies in working, are described. Sands and crucibles are also briefly dealt with in this chapter. Chapter III is devoted to appliances, including moulding troughs, boxes, retention sand, &c. Joints, joint boards, odd sides and plates are dealt with in Chapters IV and V, while in the sixth chapter patterns, methods of constructing them, &c., are discussed. In the seventh and last chapter examples of moulds are given. Although not a comprehensive treatise on the subject, it is one which is reasonably complete. It should be of service to apprentices and students, as well as to the pattern-maker and moulder, for whom the last two chapters were written.

"B.E.A.M.A. *Journal*." No. 4, Vol. IV. October, 1918. London: King's House, Kingsway, W.C. Price 1s. net.

"Science Abstracts." Vol. XXI, Part 9. September 30th, 1918. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"*Journal* of the Franklin Institute." Vol. 186, No. 4. October, 1918. The Institute: Philadelphia.

Messrs. Automatic and Electric Furnaces, Ltd., have sent us their "Heat Treatment Bulletin," No. 4, for October, showing the effect of tempering on water-quenched gauges, and giving precise instructions for the use of the Wild-Barfield furnace and quencher.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVII, No. 10. October, 1918. New York: The Institute. Price $1.

Patent Restoration.—Application for restoration of Patent No. 3,814, of 1912, for "Improvements in sound reproducers," has been made by Thos. A. Edison.

Electrochemical Works.—The Electric Chemical Development Co. has decided to open works at Wolverhampton.

Deed of Assignment.—S. H. Barton (Engineering Supplies Co.), 11, King Street, W. Manchester.—Claims by November 16th, to Mr. J. R. Atkins, trustee, 14, St. Ann's Square, Manchester.

Germans in Argentina.—The *Times* Buenos Ayres correspondent states that the Germans are trying to persuade neutral buyers to cancel their orders by promising to supply all requirement at pre-war prices immediately after peace is declared. The prospect of a rapidly falling market creates a tendency to listen to these counsels, and some firms almost display eagerness to secure their inclusion on the "Black List," so as to evade their present commitments.

Electrical Developments in Sicily.—The British Consul at Palermo states that at an extraordinary general meeting of the shareholders of the Società Elettrica della Sicilia Orientale, held at Milan, on August 22nd, it was decided to increase the capital of 15,000,000 lire to 32,000,000 lire (or to 40,000,000 lire by June 30th, 1919, at the discretion of the board), and to change the name of the company to Società Generale della Sicilia, with a view to extending its power stations and activities over the whole island, and especially in the Province of Palermo and in the central region of the sulphur industry.—*Board of Trade Journal.*

Our Commercial Counsellors.—Sir A. Steel Maitland, referring to the reorganisation of the Consular Service which was in hand, said that the commercial counsellors who would be attached to the Service had been selected, and were just going out.

British Manufacturers and Dominion Factories.—Under the heading "A Grievance of British Manufacturers," the writer of the *Times* City column says :—"The recent movement among British manufacturers to form connections in the Dominions for the purpose of erecting jointly-owned plants to protect their trade is not making as much progress as it would do if they were not subjected to various hindrances. When the manufacturers have applied to the Treasury for permission to invest the necessary funds, the officials, we are told, have made it plain to them, even when limited assent has been given, that requests of the kind receive a very cold reception. Another difficulty is that the Priority Department at the Ministry of Munitions has not shown much appreciation of the importance of the movement, for the Dominions have not obtained any preferential, if indeed equal, treatment over foreign buyers of plant and machinery. It is urged that neither the Treasury nor the Priority Department realise that they are handicapping British manufacturers in their competition with foreign firms by the lack of sympathy and help which they reveal in dealing with applications from British manufacturers. It is pointed out, for instance, that in Japan important manufacturing interests have arisen which will compete with European goods. In metal manufactures, particularly of copper, zinc, and brass, Japan is doing a most active trade in the Orient, and introducing her wares into Australia. In the chemical and textile trades she has shown exceptional enterprise. The war, of course, rendered the development of Japanese trade inevitable, but the complaint of the British manufacturers is that Government Departments should not render foreign competition more formidable for them by adopting an unsympathetic attitude towards after-war plans."

LIGHTING AND POWER NOTES.

Aberdeen.—Wages.—The T.C. has increased the wages of employés at the electricity works by 3s. 6d. per week to men and women over 18 years of age, and by 1s. 9d. per week to those under 18, from the first pay-day in October last; overtime and Sunday rates are to remain as at present, and no further revision of wages is to take place for four months from October 1st last.

Argentina.—E.L. Schemes.—A co-operative society is to be formed by the residents of Tres Arroyos (Province of Buenos Ayres) for the installation of electric light and power; the municipal authorities of Saavedra have invited tenders for the erection of an electricity generating station in the town of Pigué. The electric power station at Barrancas (Province of Santa Fé) suspended supply in September, owing to lack of fuel.—*Review of the River Plate.*

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Arklow.—Proposed E.L.—The U.D.C. has instructed Mr. Tierney, of Dublin, to prepare the necessary plans for the electric lighting of the town.

Australia.—New South Wales.—A scheme for the establishment of a wood pulping factory for paper making has been prepared by Dr. Earle Page, of Grafton (N.S.W.). The proposal provides for the installation of a hydro-electric power station, which is to utilise the water of the Clarence River at a point near Grafton.—*Tenders.*

E.L. Schemes.—The Coburg (Vic.) Council has been authorised to borrow £14,000 for the installation of an E.L. plant; the Kyogle (N.S.W.) Shire Council has applied for authority to install electricity within its area.—*Tenders.*

Batley.—Sewage Pumping.—It has been decided to substitute electricity for steam power at the sewage works.

Belfast.—Supply to Shipyards.—Four H.T. mains have been laid from East Bridge Street to Hamilton Road, and the supply of between 40,000 and 50,000 units per week to Messrs. Harland & Wolff has been commenced; the mains are nearly completed for the supply of a similar amount to Messrs. Workman and Clark. Work has been started on the new harbour generating station, and is proceeding satisfactorily.

Burnley.—After-War Extensions.—In reply to a request from the executors of G. Keighley for a supply of 650 H.P. after the war, the Electricity Committee states that it can give no definite reply until it knows what action the Government will take with reference to the after-war generation of electricity.

Chelmsford.—Price Increase.—The B. of T. has informed the T.C. that it does not propose to consider further the application of the E.S. Corporation for permission to increase the maximum charge to 9d. per unit.

Continental.—Spain.—A concession has been granted for the establishment of plant to utilise the water power of the river Najerilla, at Ventrosa (Province of Logrono), for the generation of electricity.

The Sociedad Hidroelectrica Iberica has started work on the establishment of a large hydro-electric station to utilise the power of waterfalls on the rivers Cinca and Cinqueta, in the north of Spain.

Belgium.—According to the daily Press, it was found during the work of clearing Zeebrugge harbour and works, that the Solvay electricity works were so little damaged that they could be set at work again in a fortnight.

Edinburgh.—Proposed Extensions.—At a meeting of the T.C. the Electric Supply Committee reported that the question of electricity supply had been urgently raised by the Leith Docks Commission in a representation to the Leith T.C., with regard to the increased supply required by the shipbuilding yards. A representative of the Ministry of Munitions reported that the need could be met, until the Portobello station was in operation, by the installation of a 5,000-kW. generating set, and an additional cooling tower at the Dewar Place station, and he urged that the plant should be ordered immediately. He estimated the cost of the plant at £47,000, and the mains at £23,000. The city electrical engineer considered that the cooling tower would not be necessary, and he estimated the total cost at £55,000.

Gillingham (Kent).—Electric Pumping.—The T.C. has decided to substitute electricity for steam for driving the deep water pumps, at a cost of from £150 to £200.

Halifax.—New Generating Station.—The T.C. has approved the recommendation of the Electricity Committee that the borough engineer be instructed to prepare plans, specifications, and estimates for buildings and plant in connection with the proposed power station at Copley.

London.—It is stated that the street lighting of the City cost £4,493 in the last quarter.

The fusing of some underground cables in Leicester Square on Thursday morning, last week, resulted in an explosion which blew the cover of a manhole into the air and caused a fire; the latter, however, was quickly extinguished.

Southwark.—The deficit of £8,144 on the past year's working of the B.C. electricity undertaking has been charged to the Borough Fund; the B.C. has secured the repayment of £2,179, representing income-tax paid by the electricity department during the past two years.

Lurgan.—Water Works Lighting.—The U.D.C. has resolved to proceed with the scheme for the erection of electric lighting plant at the water works, Castor Bay, Loch Neagh. Mr. Scheneld, Belfast, has been entrusted with the carrying-out of the work.

Newcastle-under-Lyne.—Price Increase.—The T.C. has applied to the L.G.B. for permission to increase the price of electricity beyond the present statutory maximum.

Rochdale.—National Electricity Supply.—The report of the B. of T. Committee on the future supply of electricity has been considered by the Electricity Committee and reported on by the borough electrical engineer; the Committee, being of the opinion that the scheme is vague and unconvincing, has recommended the T.C. to reserve its decision on the subject.

Reigate.—Mains Extensions.—The T.C. has decided to extend the electricity supply to two searchlight stations, at an estimated cost of £365.

Slough.—Questions and answers are given in last week's Parliamentary Papers with reference to the supply of electricity to the motor depôt, which is being constructed at Chippenham. Mr. Macpherson stated that the relative advantages of obtaining the electric power supply from the Slough and Datchet E.S. Co. and the installation of generating plant at the depôt at Chippenham had been most exhaustively considered, and it had been decided, for reasons of economy, to adopt the latter proposal.

Stafford.—Mains Extensions.—It has been decided to extend the electric mains from Gaol Road to the rear of Messrs. Dorman's works, St. Patrick's Street, at an estimated cost of £300.

Wages.—The T.C. has agreed to an increase of 3s. 6d. per week being paid to all men and women over 18 years of age in its employ, and 1s. 9d. per week to those under 18, such increases to date from October 1st.

Wakefield.—Prov. Order.—The R.D.C. has decided not to consent to the proposed prov. order of the Electrical Distribution of Yorkshire, Ltd., for the supply of electricity in the rural area.

Wigan.—Proposed Loan.—The B.C. has decided to apply to the L.G.B. for sanction to the borrowing of £5,000 for extensions in connection with the electricity undertaking.

Woking.—Price Increase.—The Electric Supply Co. has applied to the B. of T. for consent to increase the maximum charge for electricity to 8d. per unit.

Yarmouth (Isle of Wight).—Price Increase.—The Electric Supply Co. has increased the price of electricity to 9d. per unit.

TRAMWAY AND RAILWAY NOTES.

Accrington.—Wages.—An application of the National Transport Workers' Federation for the war wages of its members employed by the T.C. to be increased to 35s. per week to those over 18 years of age, and by half that amount to those under 18, has been forwarded to the Municipal Tramways Association, with a protest against the proposals.

Belfast.—The proposal to establish a tramway centre at Cromie Square has been referred back to the Tramways Committee for further consideration.

Continental.—France.—Railway Electrification.—The French Minister of Public Works states that the question of the conversion of the railways to electric traction, particularly on the systems of the Paris-Orleans, Paris-Lyons-Mediterranean, and the Southern Railways, is being investigated by the engineers of the Ponts et Chaussées. The inquiry is to ascertain the advantages to be expected from the electrification from the standpoint of the improvement in the means of traction, the reduction of the personnel and the economy in fuel from the proposed use of hydro-electric works. The results of the investigations will be centralised at the Ministry of Public Works, and be communicated to the engineers-in-chief entrusted with the schemes of utilisation of water power in the districts concerned, and a Committee has been appointed by the Chief Council of Public Works to draw up a plan for dealing with the railways.

Darlington.—Proposed Extensions.—The R.D.C. has decided to offer no objection to the application of the Darlington Corporation for a further extension of time for the extension of the tramways to Haughton-le-Skerne.

Coventry.—Accident.—Last week we referred to the tramway accident which resulted in the death of a passenger. It now appears that the Coroner's jury which inquired into the matter brought in a verdict, which the Coroner said amounted to one of manslaughter, against the driver of one of the cars, who will, consequently, be proceeded against.

Exeter.—Year's Working.—For the year ended March 31st last, the traffic receipts of the Corporation tramway department amounted to £20,629, an increase of £463 compared with the previous year, while the working expenses were £14,743, an increase of £1,804. After paying capital charges, the net profit was £1,516. 414,096 car-miles were run, a decrease of 18,964, and passengers carried increased by 42,662 to 5,306,362. Receipts per car-mile averaged 11·95d., against 11·17d. The energy used totalled 607,895 units, an average of 1·467 per car-mile, at a cost of 2·203d. per car-mile; last year 671,769 units were used, an average per car-mile of 1·551, at a cost of 2·327 per car-mile. The reserve fund, which the engineer states should, in his opinion, amount to at least £15,000, on account of the increased cost of renewals, stands at £6,849.

Llandudno.—Power for Railway.—The draft agreement between the U.D.C. and the Light Railway Co., in respect of a supply of electricity, has been referred by the Council to its Law and Parliamentary Committee for consideration.

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Harrow.—Collision.—By a collision, on Wednesday last week, on the down line between two express goods trains between Harrow and Pinner, traffic on both lines to Marylebone, Baker Street and the City was entirely suspended until 8 a.m., when the up line was cleared, and both up and down trains were worked over the single line.

London.—Tube Fares Increase.—Certain fares and season-ticket rates were increased on November 1st on the District and all tube railways.

Preston.—Year's Working.—The annual report of the tramway department for the year ending March 31st last, shows that the receipts were £63,498, against £57,776; expenditure, £43,492, against £36,029; gross balance, £20,005, against £21,746; interest and income-tax, £8,291, against £6,863. The contribution to the rates was £5,500, against £3,750; sinking fund, £6,100, against £5,862. The car-miles run were 1,113,517, and the passengers carried numbered 15,455,163, being an increase of 1,645,974.

Thornaby.—Proposed Purchase.—The T.C. has decided to exercise its right of purchase of that part of the Imperial Tramways Co.'s system situated within its area, and to apply to the B. of T. for approval to notice being given to the company to sell.

United States.—Accident.—An accident, resulting in the deaths of 85 passengers, while twice that number were injured, occurred on Friday last week on the Brooklyn Rapid Transit Co.'s system at Brooklyn, New York. The accident occurred on the first day of a strike of drivers, owing to the refusal of the company to reinstate some discharged employés. The train left the rails at a sharp curve and ran into the wall of a tunnel, due, it is alleged, to the inexperience of the driver, who took the curve at too great a speed.

Yorkshire.—Electricity Charges.—Dewsbury Corporation and other authorities supplying power to Yorkshire (W.D.) electric tramways have been in conference to consider an increase in the charges for electricity supplied to the company.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—A Reuter message states that owing to certain suggestions which had been made regarding Mr. Jensen, Federal Minister of Customs, in the course of the investigations of the Royal Commission concerning the Navy Department's purchase of the wireless works at Randwick, while Mr. Jensen was Minister of the Navy, Mr. Watt, acting Prime Minister, has agreed to Mr. Jensen's request that he should be relieved of the administration of the Customs Department pending the completion of the investigations.

Empire Cable Communications.—An abstract of the Minutes of Proceedings of the Imperial War Conference, which was held in July last, has been published in the form of a Blue Book (Cd. 9177, 2s. net), and contains a report of the discussion on cable communications in connection with a resolution proposed by Sir Joseph Ward. The official announcement at the time stated that the Conference passed a resolution emphasising the need for telegraphic rates to be further materially reduced, but the actual resolution went much further. It reads as follows:—"That it is in the highest interests of the Empire that the rates for telegraphic communications between the United Kingdom, Canada, Australia, South Africa, and India should be further materially reduced as soon as practicable. That in order to ensure generally the cheapest and most secure telegraphic communication between the United Kingdom, Canada, Australia, and New Zealand, it is desirable that they should co-operate in the provision of a State-owned cable across the Atlantic." The importance of the latter part of the resolution, which commits the Governments concerned to the provision of a State-owned cable across the Alantic, is obvious. Sir Joseph Ward held the view that the State should also own the land-line across Canada.

Sweden.—Telegraphic communication between Malmo and Berlin, which had been suspended since the outbreak of war, has been resumed.

The Telephone Service.—London telephone operators have been given an advance of 3s. a week. Telegraphists and counter clerks whose wages do not exceed £1 8s. a week are to have 1s. a week more. A telephone operator will now start at the age of 18 with 19s. a week and rise in ten years to £1 11s.

Turkey.—Clause 12 of the terms of the Armistice provides that the Turkish wireless telegraph and cable stations shall be controlled by the Allies, Turkish Government messages excepted.

United States.—A new high-power radio station recently opened at Annapolis, Maryland, is one of the most powerful in the world. It was erected and equipped by the U.S. Navy in ten months; under pre-war conditions it would have taken two years. Its erection cost £300,000, and it is capable of maintaining communication over a distance of at least 4,000 miles. There are four steel towers, each 650 ft. high, supporting the antennæ, which, with the ground system, required 160 miles of wire for their completion. The power installation is in duplicate. The operation of the station requires the services of 100 men, all of whom are drawn from the enlisted force of the Navy. Suitable provision has been made for the protection of the station. The completion of the station gives still another guarantee of continuous communication abroad, even in the event of any possible interruption of the cable service.

Uruguay.—A Chicago company has presented a proposal to the Postal and Telegraph Department of the Government of Uruguay, for the installation of an automatic telephone service (subterranean) in the City of Monte Video. The proposal also comprises the construction of a new Central Post and Telegraph Office for the Government, the telephone installations to occupy the basement. The cost of the building and installations is estimated at $5,000,000 (Uruguayan), which sum it is proposed to amortise out of the proceeds of the telephone working.—*Review of the River Plate.*

Wireless in the War.—Dr. Lee de Forest, the inventor of the "Audion," states that all the U.S. airplanes are fitted with the apparatus, which has made it possible for the pilot to receive a message in the air despite the noise of the engine. The U.S. signal corps in the trenches are using a similar apparatus, which, by moving a switch, may be used for telephonic work, forming a valuable means of communication between artillery and infantry without the necessity of running wires. The French alone use 1,000 a day, and, up to date, his firm has made something like 200,000 for the American Signal Corps.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdeen.—November 21st. Great North of Scotland Railway Co. Six or 12 months' supply of stores, including telegraph material. Stores Superintendent, 80, Guild Street.

Bedford.—November 13th. Two water-tube boilers, mechanical stokers, and induced-draught plant for the Corporation. See "Official Notices" October 4th.

Bradford.—November 23rd. Tramways Committee. Stores for 12 months, including lamp fittings, insulating material, &c. General Manager.

Enniskillen.—December 1st. Sligo, Leitrim & Northern Counties Railway Co. 12 months' supply of telegraph material. Mr. J. Duff, Secretary.

Walsall.—December 5th. Electricity Supply Department. One 500-kw. rotary converter equipment. See "Official Notices" to-day.

Warrington.—November 19th. Electricity & Tramways Committee. Underfeed mechanical stokers. Mr. F. V. L. Mathias, Borough Electrical and Tramways Engineer.

CLOSED.

Gillingham (Kent).—T.C.:—
Two electric motor vans for house refuse.—Edison Accumulators, Ltd., £1,068 each.

Manchester.—E.C. Annual tenders:—
A.C. meters and potential transformers.—British Westinghouse Electric and Manufacturing Co., Ltd.
Cable (extension to annual cable contracts).—C. Macintosh & Co., Ltd.; Western Electric Co., Ltd.; and Callender's Cable and Construction Co., Ltd.
Current transformers.—Ferranti, Ltd.

Redditch.—From the tenders received for the extension to the electricity works (Messrs. Handcock, Dykes & Trotter, consulting engineers), that of Messrs. C. G. Huins & Sons, at £4,195. has been accepted for the extension of engine and boiler house and that, at £3,859, for the ferro-concrete work, overhead coal bunkers, ash tunnels, &c.

Reigate.—T.C.:—
Repairs to crankshaft, &c., of Diesel engine.—Mirrlees, Bickerton & Day, £915.

Stepney.—Electricity Committee:—
220 yd. of cable.—**W. T. Henley's Telegraph Works Co., Ltd., £179** (accepted); W. T. Glover & Co., Ltd., £184.

Wolverhampton.—T.C.—
Battery for electric vehicle, £145.—Chloride Co.
Steam-pipes for turbo set, £210.—J. Spencer, Ltd.
24-in. valve for water-pipe system, £63.—Alley & McLellan, Ltd.
Turbine platform and railings, £188 + £32 for contingencies.—Messrs. Gibbons.

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FORTHCOMING EVENTS.

Physical Society of London.—Friday, November 8th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary meeting.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, November 8th. At Westgate Road, Newcastle-on-Tyne. Paper on "Electric Welding," by Mr. W. S. Abell.

Birmingham and District Electric Club.—Saturday, November 9th. At 7 p.m. At the Swan Hotel. Paper on "Automatic Telephones," by Mr. H. W. Dipple.

Manchester Association of Engineers.—Saturday, November 9th. At 6.30 p.m. At the Grand Hotel. Paper on "Workshop Measurements, with special reference to Engineering Works," by Mr. W. F. Rogers.

Institution of Electrical Engineers (Western Centre).—Monday, November 11th. At Cardiff. Presidential address by Mr. C. H. Wordingham, C.B.E.

(Scottish Centre).—Tuesday, November 12th. At 7.30 p.m. At 207, Bath Street, Glasgow. Inaugural address by the Chairman, Mr. J. F. Nielson.

Junior Institution of Engineers.—Tuesday, November 12th. At 7.15 p.m. At the Mining Institute, Newcastle-on-Tyne. Paper on "The Design of High-speed Turbines," by Mr. M. Ward.

Friday, November 8th. At 7.30 p.m. At 39, Victoria Street, S.W. Lecturette on "Engineering in Connection with a Modern Kinema Show," by Mr. W. E. Dines.

Thursday, November 14th. At 2.30 p.m. Visit to Osram Robertson Lamp Works.

Friday, November 15th. Annual general meeting.

Industrial Reconstruction Council.—Wednesday, November 13th. At 4.30 p.m. At the Saddlers' Hall, Cheapside, E.C. Lecture entitled "A Retrospect from 1970" by Sir Arthur Steel-Maitland, Bart., M.P., Parliamentary Secretary to the Foreign Office and Board of Trade (Department of Overseas Trade).

Electro-Harmonic Society.—Friday, November 15th. At the Holborn Restaurant (Venetian Chamber). Ladies' night.

Institution of Mechanical Engineers.—Friday, November 15th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. General meeting.

NOTES.

Fuel Economy.—Mr. C. F. Spencer, the Director of National Kitchens, has ascertained through his technical advisers the average consumption of fuel in households to supply a family of five persons with a mid-day meal, and the consumption of fuel in a National Kitchen to supply the same number of people with a similar meal. The position is illustrated in the following statement of quantities used:—

Cooked at home.	Cooked at a National Kitchen.
15 lb.	5 lb.

It is estimated that in the National Kitchens throughout the country 1,000,000 portions of food are sold daily, to cook which approximately 178 tons of fuel are used. These portions represent the equivalent of meals in 80,000 households of five persons each. To cook the same quantity of food at home would require 534 tons of coal. The annual saving (excluding Sundays) is therefore 111,428 tons.

If 100,000 additional families decided to take three meals per week at a National Kitchen, the annual saving in fuel, on the above basis, would be a further saving of over 100,000 tons. It is thus clear that an enormous saving in coal would be effected if, instead of each household cooking its own meals, they were obtained at National Kitchens. In the above analysis it is assumed that households will be in a position to obtain all the coal they require. With the severe rationing now in force, this will certainly not be the case; therefore, it is essential that municipalities and other local authorities should consider seriously the establishment of National Kitchens.

An I.M.E.A. Protest.—According to *The World*, the Council of the Incorporated Municipal Electrical Association has thus circularised all Members of Parliament:—"The Council of the Incorporated Municipal Electrical Association, representing practically the whole of the electricity supply undertakings in Britain, view with grave concern the lack of uniformity of treatment at the hands of the Government Department concerned in granting permits for power station and plant extensions of large electricity supply undertakings, and respectfully request that impartiality be shown when deciding future applications for necessary extensions of electricity supply schemes. It is felt that the success of the scheme of the Board of Trade for the reorganisation of the electricity supply industry is being seriously prejudiced by the close connection between the principal staff of the Ministry of Munitions and large private electricity undertakings in the country."

Pulverised Coal.—In its endeavour to improve boiler-room efficiency, the Milwaukee Electric Railway and Light Co. has been investigating recently the possibilities of pulverised fuel. On a 468-H.P. water-tube boiler a gross efficiency of 85·22 per cent. and a net efficiency of 81 per cent. were obtained. The results of the experimental work, which was conducted at the Oneida Street plant, are given in *Power* for October 15th:—

An evaporation from and at 212° of 9·47 lb. of water per lb. of coal was obtained. The average temperature of the feed water was 157·2° F., the operating steam pressure 167 lb. gauge, and the superheat 74·9° F. The fuel used was screenings of three different varieties. The B.TH.U. in three lots of coal as received averaged 10,779 and the B.TH.U. dry 12,045. A noticeable feature was the small amount of draught required. There was, of course, no fuel bed, and the drop through the boiler when using a relatively small volume of air was practically negligible. In the combustion chamber and the first pass the vacuum was practically nil; it could not be read on a gauge calibrated to 0·01 in. In the second pass the draught was 0·0057 in. and at the uptake 0·0975 in. It was noticeable that there was no accumulation of slag on the tubes, no pulsation, and that the brickwork was not affected by the heat of combustion. The deductions made for fuel preparation are interesting. Under the drier 1,140 lb. of coal was burned. The power requirements for the pulverisers, the various conveyors, the feeders, and the fans were 449·3 KW.-hours, reducing on a basis of 3 lb. of coal per KW.-hour to 1,348 lb. of coal. The total deduction, then, was 2,488 lb. of coal, which, at $5 per ton, would amount to $6·22. As 24 tons of coal were used in the test, the fuel value for preparation reduced to 26 cents per ton.

With coal at $5 per ton it was estimated that the gross efficiency shown by the pulverised-fuel boilers would have to exceed that shown by the mechanical stoker-fired boilers by 6 per cent. to offset the coal preparation costs.

The gain in efficiency was only a part of the advantages resulting from the use of pulverised fuel. Other advantages were summarised as follows:—Continuous boiler operation at a uniform rating as well as constant efficiency. At no time is there a loss in capacity due to the clinkering of coal on grates or cleaning fires, nor are difficulties experienced from a change in the fuel as it comes from the bunker, necessitating different operating conditions at the stoker. Heavy overloads can be taken on or dropped off in an unusually brief time through the adjustment of the coal feeders and the furnace draught. From 97 to 98 per cent. of the combustible in the coal is utilised regardless of the quality of the fuel. The ash-handling costs are reduced to a minimum due to the reduced volume. When operating with pulverised fuel, the banking conditions are somewhat different from those obtained in stoker practice. By stopping the fuel supply and closing up all dampers and auxiliary air inlets, a boiler can be held up to pressure for at least ten hours. To illustrate, when running one of the preliminary tests the boilers had been shut down at 9 o'clock at night with 175 lb. steam pressure, and at 7 in the morning there was still 155 lb. pressure, and the brickwork was hot enough to ignite the coal from the burner. In stoker practice it is necessary to leave the damper slightly open to supply air and prevent gas explosions, so that much of the heat in the banking coal and from the brickwork passes up the stack rather than into the boiler.

The ease of controlling the fuel feed and draught, the ability to take on heavy overloads in a brief time, the thorough combustion of the coal, and the uniform high efficiency obtainable under normal operation make pulverised coal a satisfactory form of fuel for central station use. For operation month in and month out it is stated that pulverised fuel would show a net gain of 10 per cent. over the previous ways of operation. As to maintenance, indications were that no unusual difficulties would be encountered. One predominant factor justifying the use of pulverised fuel was the ease with which a high efficiency could be obtained and the constant nature of that efficiency. There was little doubt that with a well-equipped plant burning pulverised fuel, and having all the necessary recording and indicating instruments to guide the operator in maintaining proper conditions, a lower cost of generating steam would be possible than has heretofore been attained with any type of equipment.

Miners' Electric v. Oil-flame Lamps.—At a meeting of the Scottish Branch of the National Association of Colliery Managers at Glasgow, last month, the Branch-Secretary read a communication from Prof. Robert Laverick, of the Notts. Branch, explaining that the Safety Lamp Committee desired to include in its report some statistics upon miners' nystagmus, and would be grateful if the Scottish Branch could furnish any particulars as to the effect produced by changing from oil-flame to electric safety lamps. The Branch-President said that his experience had gone to show that the men in his colliery, although they had some few complaints regarding the electric safety lamps, preferred to use them rather than the oil safety lamp. He had had electric lamps in his colliery for two years, and not a solitary case of miners' nystagmus had been reported in that time. The electric lamp required closer supervision, but he did not think managers would grudge that, because it was compensated for by the better illumination. Other speakers expressed similar views.

Mr. Wm. Wilson (Glasgow) remarked that even with his limited experience of such lamps he certainly would never think of abandoning them for the oil-flame lamp. The great majority of the men appeared to think oil-flame lamps were more troublesome than the electric lamp, and they preferred the latter because of the pronounced superiority of its light. Mr. D. C. Gemmell said they had a mixed system of lights at his colliery, and once the electric lamps had been installed they had great difficulty in getting the miners to revert to the oil-flame lamp. He had found that the electric lamp was cheaper in maintenance than the oil-flame lamp. Mr. James Boyd (Kilsyth) suggested that the Branch-President should give them a paper on the comparative merits of oil-flame and electric lamps at some future meeting. The consensus of opinion among those present was that, so far as Scotland was concerned, the use of electric lamps had not aggravated nystagmus amongst Scottish miners.—*Iron and Coal Trades Review.*

Electrical Engineers on Board Ship.—Referring to the new scale of wages for sea-going electricians published in our last issue, the Electrical Trades Union informs us that it has been trying for a considerable period to improve the material conditions and status of men engaged as electricians and electrical engineers on board ship. As a result of a meeting with the Maritime Board some few months ago, the new rates were agreed to by that Board

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A New St. Lawrence River Dam.—Authority is to be given to the St. Lawrence River Power Co. to construct a submerged weir in the South Sault Channel of the St. Lawrence River near the entrance of the company's power canal leading to the power house at Massena, N.Y., says the *Electrical World*. The Dominion Government insisted that building the weir would interfere with navigation in the channel, in contravention of the provision of the Webster-Ashburton treaty; also that it was against public interest to permit such work to be done by private corporations, inasmuch as the control of the water level of the river would pass from international territory to the power house at Massena. It was pointed out by the United States War Department that the erection of the weir was necessary to increase the output of aluminium for war purposes, and the president of the Aluminium Co. of America said that increased production of aluminium could not be secured at any other point. He wanted the dam for war purposes during the war and to prevent interference by ice with the ordinary production after the war. The State of New York maintained that title to any structures in the St. Lawrence River should remain in the State of New York, and that while there would be no objections to grant permits for the duration of the war, the State was opposed to a permanent hindrance to navigation of the South Sault channel. It was intimated by the Dominion Government that if the commission granted the application, the Canadian Government would at once request the United States Government to guarantee that the weir would be removed upon request at any time after the war. Formal protest would also be made against the present diversion of water through the St. Lawrence River Power Co.'s power canal and against any possible future increased diversion.

Copper for German Industry.—One of the various reasons adduced in Germany for the desired return of that country's former colonial possessions lies in the deposits of copper in South-West and East Africa and New Guinea, whilst at the same time eager glances have been directed towards the mineral riches in the Belgian Congo. It seems quite a grievance to Christian Pfrank of the Oriental Seminary of the Berlin University, that with a domestic copper production of only 39,000 tons in 1912 Germany was compelled to import 200,000 tons in order to assist in meeting the total consumption, and that 85 per cent. had to be procured from the United States at the prices arbitrarily fixed by American producers. Although the copper deposits in South-West Africa had only been slightly opened up prior to the war, it is considered that they would be able, in the course of time, to meet a considerable portion of the German home demand for copper, and thus break the monopoly of the United States. The copper ore deposits in the Katanga district of the Belgian Congo are said to be enormous, and C. Pfrank states that "with such a possession we could cover our whole requirements within a not distant period, and consequently provide our important electricity industry with its thousands of workmen with an assured position for ever." This is surely an intimation of what the Belgians might have to expect if the Germans were ever permitted again to become established in Africa. It is contended finally that the Germans could only liberate themselves from paying tribute to the United States for copper by possessing their own colonies with rich copper deposits, and that therefore no peace should be agreed to without the return of German South-West Africa. It is highly probable that the Germans will reach a different conclusion before very long.

The Development of 2,500-Volt Fuses.—Mr. R. C. Cole gives an interesting *résumé*, in the *Electrical World* of September 7th, of the struggles of one enclosed fuse maker in overcoming the difficulties of the situation, and producing a safe and reliable fuse for circuits of as high a pressure as 2,500 volts. The author sets out the properties that the various component parts of the fuse should possess, and an historical survey of the early types of fuse is given. A large number of experiments were conducted to determine a method of preventing strip corrosion and breakage; to discover a heat-dissipating material embodying all of the essential characteristics required, and to determine the proper arrangement of the strips composing the fusible element. The investigators were finally fortunate in discovering a material most admirably adapted to quench the arc. Owing, however, to the fact that its behaviour under short-circuit conditions was not all that could be desired, a double-filling material scheme was determined upon, placing the material best adapted to quench the arc in the centre of the tube and using a calcium-carbonate sulphate combination at either end. New fluxes were compounded to prevent any corrosion of the strips in soldering, and a special low-melting-point alloy was devised to solder the strips to the star shaped terminals. Overload tests were made at 150 per cent. current on hot fuses, this being the most severe condition under which a fuse could be called upon to operate. The fuses were heated by a low-voltage current for a sufficient length of time to bring them up to the maximum temperature and immediately thereafter were subjected to the overload at 2,400 volts. The final fuses resulting from the experiments operated, it is stated, without the slightest exterior manifestation under extreme conditions of overload and short circuit. The amount of metal dissipated as a result of the short-circuit condition was only very little more than that under the overload condition. This is accounted for by the fact that the new filling material is capable of condensing instantaneously the metallic vapour formed upon the disruption of the link before the arc has an opportunity to extend more than three-quarters of an inch.

Electric Resistance of Porcelain and Magnesia.—All insulators fail more or less at high temperatures, and porcelain spark plugs show noticeable current leakage at 1,000 deg. C. Mr. P. H. Brace described some new experiments on the resistivity of magnesite and porcelain before the May meeting of the American Electrochemical Society. According to *Engineering*, he tried magnesite, of 94 per cent. of MgO in two forms, in test blocks of 1 in. by 0.8 in. The magnesite was either used after electrical fusion, or it was fused, then crushed to powder, moulded under heavy pressure, and baked at 1,700 deg. The test pieces were placed between nickel grids and loaded with 11 lb., layers of asbestos being applied on the outside of the grids; the specimens were heated up to 1,000 deg. C., cooled quickly, and reheated to various temperatures during the resistivity tests with continuous currents at 120 volts or alternating currents. The resistivity appeared to be a function of the time during which the current was applied; the final resistance observed was greater, several times greater frequently, than the original resistance. This change was greater with magnesite than with porcelain, and magnesite had a higher resistance than porcelain at the same temperature. The moulded magnesite gave on the whole lower resistance values than the merely fused material, possibly because the grinding had introduced small impurities. In all cases some evidence of electrolysis was obtained, the resistance first falling and then rising again on reversing the current. This was particularly noticeable in hot porcelain at 910 deg. and 990 deg. C.; porcelain, in fact, behaved like an accumulator, giving for half an hour or so a counter electromotive force of 0.7 volt.

Fined for Stealing Electricity.—Arthur Ernest Briggs (36), fitter, Moldgreen, was fined £10 at Huddersfield for stealing 16 units of electricity, of the value of 6s. 8d., the property of the Huddersfield Corporation. According to the *Yorkshire Observer*, Capt. Moore (Chief Constable) said that in June last year the accused had his electrical supply cut off for the non-payment of his bill. After a police constable had observed electric light burning in the house it was found that the accused had broken the seals, connected the fuses, and tampered with the meter. The indicator showed that 16 units had been consumed since the mechanic had disconnected the supply.

Appointments Vacant.—Shift engineer, 73s. 6d., for the Dewsbury Corporation Electricity Department; charge engineer, for the Yorkshire Electric Power Co. See our advertisement pages to-day.

Plans for Demobilisation.—The *Manchester Guardian* publishes the following:—The machinery for the demobilisation of the Forces and of war workers in civil life is very far from complete, but during the last week or two the Ministry of Labour has issued some details of its plans. This week these have been laid before the Advisory Committee (of which Sir David McCabe is chairman) which covers Manchester, Salford, Eccles, Altrincham, Stretford, Swinton, and Pendlebury, and their local bearing has been considered. The scheme, as it affects the soldier, is really an extension of the present methods of placing discharged men back in industry. Some weeks before demobilisation the soldier will be asked to fill up a form stating whether he has a definite promise, or the prospect, of reinstatement by his former employers. "This form will be sent by the Army authorities to the Employment Exchange in which area the man intends to reside, so that arrangements may be made to place him. In preparing drafts for release regard will be had to the urgency, from the national point of view, of particular trade requirements. Preference will be given to men who have a definite promise of a job. Employers, it is expected, will have an opportunity of applying for the release of individuals—especially key or pivotal men. As far as practicable, married men, or men with long Army service, will be given preference. Free unemployment insurance policies, valid for one year from the date of discharge, will be issued, though the rate of payment and the governing regulations have yet to be determined, and must form the subject of a Bill. The demobilisation of munition workers will follow much the same lines of procedure. Employers will be supplied with registration forms for distribution to their workpeople before discharge. On these the workers will state whether they have a promise of engagement, or a desire to return to their former employer. When complete, the forms will be returned to the Employment Exchange. One of the most important sides of demobilisation and reconstruction schemes will be the collection of facts about industrial prospects and conditions. Information will be gathered, and account taken, of the number of workers likely to be required by particular industries, including new trades: the number of men likely to be returned from the Forces: the number likely to be reinstated by former employers: the industries which are to be given priority: the use to which national factories, dockyards, and other war establishments are to be put: the quantities of raw material available; the work to be put in hand to meet public and industrial needs, and the housing need of each locality after the war."

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Volunteer Notes.—Royal Engineers (Vols.), London Army Troops Companies.—Headquarters: Balderton Street, Oxford Street, W. 1.

Captain of the Week.—Capt. E. G. Fleming.
Next for Duty.—Capt. W. Hynam.
Sunday, November 10th.—Commandant's Parade at Waterloo Station, for work at Esher, 9 a.m. Drill order and great coats. Mid-day and tea rations to be carried. "Demolitions."
Monday, November 11th, to Saturday, November 16th.—Drills as usual.

C. Higgins, *Capt.* R.E., *Adjutant.*

Patents and Alien Enemies.—Application has been made to the Board of Trade to avoid or suspend Patent No. 23,319/07, granted to Hartmann & Braun Akt.-Ges., for frequency meters, by Messrs. Johnson & Phillips, Ltd.

Water-power Survey in India.—Replying to Colonel Yate in the House of Commons, the Secretary of State for India said that the Government of India had decided, before constituting a Committee, to appoint an experienced engineer to report on the possibilities of promising sites as regards storage and power development. They had associated with him an electrical expert. At the same time, information would be collected regarding industrial possibilities within reach of promising sites; and the terms for the grant of concessions would be considered in consultation with local Governments.

The *Times* states that the Indian Government is considering making a systematic survey of water-power resources for the generation of electrical energy, with the object of rapid industrial development after the war.

Fatality.—The *Leeds Mercury* states that Ezekiel Pickles (50), fitter's labourer, of Barugh, has been killed through his hand coming in contact with a live wire at the works of the Smokeless Fuel Co., near Barnsley.

Institution and Lecture Notes. — Electrical Power Engineers' Association.—A meeting of the local members of the Association was held at the Grand Hotel, Bristol, on Friday evening last, under the chairmanship of Mr. A. J. Ostler (Sub-station Superintendent, Bristol Corporation Electricity Department). The following gentlemen were elected to act as a temporary Committee:—Messrs. A. J. Ostler, S. Hotchkiss, T. F. Wells, E. P. Kelly, and F. J. Elliott (hon. secretary). This Committee was entrusted with the arrangements for a mass meeting of engineers engaged in the production, transmission, distribution, and utilisation of electrical energy, to be held at Bristol this month. At that meeting it is proposed to inaugurate a Local Section of the E.P.E.A., and the Hon. Secretary, whose address is 3, Glena Avenue, Knowle, Bristol, will be pleased to receive and reply to any inquiries in connection therewith.

Liverpool Engineering Society.—The first meeting of the new session was held on Wednesday evening, when the President (Prof. J. Wemyss Anderson), delivered his inaugural address. The syllabus includes the following:—

November 20th.—A. E. Berriman, O.B.E., "Education in Relation to Industry, with Particular References to Engineering."
December 4th.—R. W. Allen, "Air Supplies to Boiler Rooms."
December 18th.—H. S. Rowe, B.Sc. (Lond.), "The Growth and Arrangement of Industrial Boiler Plants."
(Joint meeting with the Society of Chemical Industry.)
February 5th.—E. A. Atkins, "Electric and Oxy-Acetylene Welding and their Defects."
(Joint meeting with the Society of Chemical Industry.)
February 19th.—J. Purves, "Boiler Mountings."
April 16th.—John A. Davenport, "Welfare Work."

Greenock Association of Electrical Engineers.—The new session opened on October 10th with the presidential address of Mr. G. M'Donald on "Problems Confronting the Electrical Industry After the War"; last night (Thursday) a paper was to be read by Mr. G. Reid on "Electrical Thoughts." Other events in the programme for the session are:—

November 30th.—Visit to Coats's Observatory, Paisley.
January 9th, 1919.—"An Hour with Ultimate Electricity," P. C. Kerr.
January 25th.—Visit to Messrs. A. F. Craig & Co.'s Engineering Works, Paisley.
February 6th.—"Some Notes on the Cabling of Public Works," W. R. Scott.
February 22nd.—Visit to Brown & Polson's Corn Flour Works, Paisley.
March 6th.—Junior night and general meeting.

Bradford Engineering Society.—A lecture was given on Monday last by Mr. T. H. C. Homersham, of Thwaites Bros., Ltd., Bradford, on "Electric Furnaces for the Manufacture of Steel." The lecture was illustrated by lantern slides of the works of the firm.

Institution of Civil Engineers.—The opening meeting of the 100th session of the Institution was held on Tuesday, when Sir John A. F. Aspinall delivered his presidential address, after which he presented medals awarded by the Council for papers read and discussed during the past session. The president mentioned the desirability of bringing the various engineering institutions under one roof, sharing one common library, and hoped, if such a project were realised, that Westminster would become the headquarters. The address took the form of a review of British railways; Sir John explained the present situation, and indicated how and where reforms could be made. He stated that wireless telephony had been developed to such an extent that it would probably enable heavier goods trains to be hauled by the use of two locomotives, one in front and one at the rear, and both drivers and guard would control the train by wireless telephony. The railways would undoubtedly consume much electricity in the future; but electrification would be confined to suburban rather than main lines. It was a fact that wherever suburban lines had been electrified, the passenger traffic had greatly increased, due to the increased number of trains and the shorter time taken to do the journey. With regard to the proposed super-power station scheme, he said that the question which had to be settled was whether it was more economical to place the station on the coalfield or at the load centre. In other words, was it cheaper to transmit electric power from the station along long lines of copper, or to carry coal to the station along long lines of railway?

"The Electric Furnace in the Metallurgy of Iron and its Alloys" was the subject of a lecture by Mr. H. Etchells, at the Applied Science Department of Sheffield University, on Saturday evening, in connection with the Sheffield and District Section of the National Association of Industrial Chemists. The lecturer mentioned the peculiar properties of electricity as the source of energy for metallurgical purposes, and showed how the experiments of Sir William Siemens and Henri Moissan directed attention to the unexplored possibilities of electricity as a metallurgical instrument. He pointed out that in countries where coal was plentiful the development of the electrical furnace had not received such an impetus as in those countries where coal was scarce, but water power was readily available. Mr. Etchells showed that the fuel value of electricity was such that if the electric furnace was to compete on a fuel basis alone it would be quite outclassed by any process which gave a heating value directly from coal of more than, say, 7 per cent. efficiency, because, although electric power in itself was highly efficient, losses which occurred in converting the energy of coal into electricity were abnormally high. He described various types of furnaces used in steel working, showing the differences in principle of the various types. Reference was made to the new developments in electric resistance furnaces. Mr. T. F. Russell, chairman of the Sheffield and District Section of the Association, who presided, announced that the Employment Bureau in connection with the National Association of Industrial Chemists was now in full working order.

The Siemens Companies.—On Tuesday last Mr. Justice Astbury, in the Chancery Division, commenced the hearing of three actions in which Siemens Bros. & Co., Ltd., and Siemens Bros. Dynamo Works, Ltd., were concerned. The cases related to the rights of shareholders and the splitting of shares. We shall refer to the matter more fully next week.

Post-War Priority.—A Standing Council on post-war priority, to which we referred in "War Items" last week, has been appointed to assist the Cabinet Committee, and is now at work. The Council has already had before it a survey of the existing stocks of the more important raw materials, and is giving urgent consideration to the question of releasing such materials from any form of control at the earliest possible moment. It is the intention of the Council to consult the trade bodies concerned with regard to any matters affecting the industries they represent, and, by taking them into its confidence, to make the utmost possible use of their organisations in any allocation of materials which may be found to be necessary.

The personnel of the Council is not yet complete. The following are the members already nominated:—

President: Dr. Addison, M.P., Minister of Reconstruction.
Chairman: Sir Henry Birchenough.
Members: Sir Kenneth Anderson, Orient Steam Navigation Co., Ministry of Shipping; Mr. H. R. Armitage, Bradford Dyers' Association, Manchester; Mr. J. T. Brownlie, A.S.E.; Colonel Byrne, Secretary War Priorities Committee; Mr. J. Carmichael, contractor, Wandsworth, S.W.; Mr. J. H. Clapham, Board of Trade; Sir Sydney Henn, Director of Priority, Army Contracts Department; Mr. W. J. Larke, British Thomson-Houston Co., Rugby; Sir Peter McClelland, Duncan, Fox & Co., London; Sir Herbert Rowell, R. & W. Hawthorn, Leslie & Co., Newcastle; Sir David Shackleton, Secretary Ministry of Labour; Mr. Wallace Thorneycroft, Lochgelly Iron and Coal Co.; Mr. Alexander Walker, John Walker & Sons, Kilmarnock; Mr. J. Wormald, Mather & Platt, Manchester.
The joint secretaries are Mr. T. R. Gardiner, Ministry of Reconstruction, and Major G. D. Hazzledine, Board of Trade.

Communications should be addressed to the Joint Secretaries, Standing Council on Post-War Priority, 2, Queen Anne's Gate Buildings, Westminster, S.W.

Lancashire and Cheshire Wages Award.—As a result of arbitration proceedings, workers in electricity undertakings in a number of towns in Lancashire and Cheshire are to receive an advance of 3s. 6d. per week, with 1s. 9d. per week for boys and youths under 18 years. The award is made retrospective to August 10th.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—On the occasion of his retirement from the position of station superintendent at the Croydon electricity works, Mr. D. Cowan was presented with a gold ring and a gold pendant, with an umbrella for Mrs. Cowan. Mr. J. H. Parker, the assistant borough electrical engineer, made the presentation.

Mr. D. Macdougall, electrical superintendent at the Greenock Corporation electricity works, has been appointed assistant engineer at £400 per annum.

Mr. Oscar Parker, who has been filling a post at Newton Abbot (Devon), has resumed his duties at Lincoln municipal electricity works.

There were 90 applications for the position of chief engineer to the Darwen electricity works at £300 per annum.

The Gillingham (Kent) T.C. has increased the salary of the electrical engineer by £100 a year to £400, including war bonus.

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The Erith U.D.C. has accepted the resignation of Mr. J. H. Seymour, the deputy electrical engineer. Mr. Taylor, charge engineer, has also resigned. Messrs. Weston (Southall) and Kettie (Tunbridge Wells) have been appointed charge engineers, and the system of eight-hour shifts is to be re-established.

Mr. W. B. Smith, Greenock, who was recently appointed Corporation electrical engineer at Paisley, has been presented with a mahogany clock by the staff of the Greenock Corporation electricity department. Mr. F. H. Whysall made the presentation.

Stepney B.C. General Purposes, Staff, and Education Committee recommends that in lieu of the borough electrical engineer and manager's (Mr. W. C. P. Tapper) salary and war bonus of £1,080 per annum, he be paid a salary of £1,100, to be increased to £1,200 by two annual increments of £50, also that the annual sum allowed to the Town Clerk out of the funds of the undertaking in respect of services rendered by him be increased to £200.

Mr. Reginald Ayton, city electrical engineer, Winchester Corporation, was married on October 29th, at Handsworth Parish Church, to Gwendolyn Anne, only daughter of Mr. and Mrs. W. A. Bloxham, of Handsworth Wood, Birmingham.

Mr. C. J. Spencer, who, as already stated, is relinquishing his post as general manager of the Bradford tramways for a position in London, was last week presented with an illuminated address, a clock and bronzes by the employés of the department.

General.—Lieutenant John A. Miller, R.E., of Glasgow, is now in the Department of the Chief Mechanical Engineer, War Office.

Mr. H. A. Norman White, late of Messrs. Marsh Bros., Ltd., electricians, Fargate, Sheffield, having taken up a position with Messrs. Coates & Co. (Sheffield), Ltd., has been presented with a cigar case by the employés of his late firm.

Ald. G. Weeks, of Messrs. Weeks & Son, electricians, Bromley (Kent) and Beckenham, has been presented with his portrait in oils by the townspeople of Bromley, in recognition of his long public services as Mayor, Deputy-Mayor, &c.

The *Financier* states that Mr. D. B. Morison, the well-known engineer, has been appointed chairman of Richardsons, Westgarth & Co., Ltd., in succession to the late Mr. W. J. Richardson and the late Lord Furness.

Mr. R. W. Dalton, H.M. Trade Commissioner for New Zealand, who is now in London, can be seen at the Department of Overseas Trade by appointment.

Messrs. Enterprise Manufacturing Co., Ltd., announce that Messrs. Henry Ashdown and Sidney Dicks resigned their positions as directors of the company on 21st ult., and ceased their connection with it. Mr. C. H. Roberts, as heretofore, will be responsible for the management. The scope of the company's activities will be considerably extended. Messrs. Ernest Joseph and William Harvey Utz have joined the board. Mr. Barrie will continue to represent the concern for the whole of the London districts.

Roll of Honour.—Second-Lieutenant Leslie John Poynter, 20th Manchesters, "C" Company, who was killed in action on October 25th in France, joined up as a private early in 1916. Up to that time he was chief assistant to his father, the managing director of Maxim Lamp Works, Canonbury Road, N.

The *Times* states that Lieutenant Charles Westcar Sheppard, R.E., who died of pneumonia following influenza on October 29th, aged 36, was educated at Charterhouse and Westminster, and afterwards at the Crystal Palace Engineering College. He was employed on the making of tube railways, the installation of electricity in Dublin, and large building operations near Plymouth; and was subsequently for a short period with the Board of Works. His knowledge of engineering becoming known, he was lent to the R.E. for roads and railways, and was placed in charge of a line. For his work with this he was recommended for a distinction. He transferred to the R.E., and for a time was at a home station, and was then lent, on application, to the Air Ministry, where he remained till within a week of his death.

Sergeant T. H. Little, R.A.F., who has been killed at a home station, served his articles as electrical engineer with Messrs. A. & P. Steven, of Glasgow.

Private H. S. French, Royal West Kent Regiment, formerly engaged at the Northampton electric light works, is reported killed after being missing for a year.

Sapper J. Farrer, R.E., who has been killed by a lion in East Africa whilst on duty with a wireless corps, was in civil life engaged in electrical work at Windermere.

Sergeant J. W. Fawcett, Border Regiment, who has fallen in action, was on the Kendal Corporation electricity works staff.

Second-Lieutenant W. Swift, Duke of Wellington's West Riding Regiment, killed in action, was on the electrical staff at Fryston Colliery (Yorks.).

Second-Lieutenant C. Plant, Sherwood Foresters, formerly a shift engineer and assistant at the Chesterfield municipal electricity works, has fallen in action.

Private C. Smith, who has died of sickness in France, was an electrician with Messrs. Siemens Bros., of Stafford.

Four members of the Doncaster Corporation tramways staff have been killed in action:—Second-Lieutenant J. A. Lamb, Private W. Atack, Private A. Greenham, and Private J. H. West.

Private W. McCoy, R.A.M.C., who has died in a London hospital from pneumonia, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Private J. Powell, Royal Warwickshire Regiment, killed in action, was an employé of Messrs. Charles Macintosh and Co., Ltd., Manchester.

Lieutenant J. H. Waddington, R.A.F., killed on October 22nd, was an apprentice with the British Westinghouse Co., Ltd., Trafford Park.

Private W. Mounsey, King's Liverpool Regiment, killed in action, was employed as electrician at the Palace Theatre, Manchester.

The death in action is announced of Private A. J. Johnson, of the Birmingham Corporation electric supply department.

The death in hospital, in France, from pneumonia has taken place of Private R. Higham, L.N.L. Regiment, who was employed at the United Electric Car Works, Preston.

Second-Lieutenant R. N. Barr, West Riding Regiment, who has died of pneumonia, was in the accountants' department of the Leeds city tramways.

Private J. E. Smith, A.S.C., M.T., who has died from pneumonia, was employed at the Leeds Corporation electricity works.

Obituary.—Mr. Edward Bennis.—Last week we were only able to allude very briefly to the death of Mr. Edward Bennis, who passed away on October 28th. Mr. Bennis was born in Limerick in 1838. On leaving college he was apprenticed to Mr. Thomas Chandler, of Balls Mills, County Waterford, subsequently entering the service of Mr. Peter Moore Fisher, of Filton, County Cork. He afterwards started in business on his own account. It was after having acquired a competency in industry, upon which he had retired, that he resolved to re-enter business, and took an active interest in the mechanical firing of boilers. Previous to the year 1873 the firing of boilers by mechanical means was almost unknown, though two types of machine-stokers were being used on a small scale. At this stage Mr. Bennis joined Mr. Dillwyn Smith, of Philadelphia. Works were started in Liverpool, but Mr. Bennis soon came to the conclusion that the system which provided only for throwing the fuel on the fire was incomplete, and that better results were possible if an efficient furnace could be devised by which the firebars would be automatically freed from clinkers whilst the machine distributed the fuel over the fire. He invented a self-cleaning furnace which answered the requirements he had set himself to meet, and these efforts were rewarded with success. He continued to improve his machine, and ultimately established works in Bolton. A new principle of machine-firing was later introduced, in which the coal was spread over the fire, not in a continual rain, as in the older machines, but by a striker which distributed it intermittently, striking the fuel a blow, and so varying the strength of this blow that only a part of the fire was covered at any one time, allowing a short period for the part of the fire on which coal was distributed to become incandescent. The newer principle effected a complete revolution in machine-firing. Others soon followed the lead given by Mr. Bennis, and in a very short time the subject of machine-firing had aroused such attention that a competition of mechanical stoker makers was held at the Manchester Sanitary Exhibition in 1882. A medal was issued for merit on the points of smoke abatement, power, and efficiency, and this was won by Mr. Bennis. Later, at the Yorkshire Jubilee Exhibition, a gold medal was offered for the best system of machine firing, and this again was won by Mr. Bennis. At these trials very onerous terms were imposed, the conditions requiring competitors to run the exhibition from morn till night without touching the fires, and with an absolutely smokeless chimney. More recently still, a newer system has been introduced by Mr. Bennis, in conjunction with his son, in which all the advantages of forced draught, machine firing, induced draught, and self-cleaning furnace have been concentrated in one invention. Further improvements and developments followed, and in 1904, the works at Bolton being found too small, a site for a new factory was obtained at Little Hulton. Since then the buildings and plant have been extended year after year to meet the continued growth of business. All types of machine stokers are now built, including chain grates for water-tube boilers, and every description of coal-handling device—coal bunkers, pneumatic ash-handling plant, conveyors for coal, cement, and like products. Of late years Mr. Bennis and his son have devoted much attention to the mechanical firing of boilers on board ship. Some early experiments in this direction met with considerable success, but improvements since made have shown that this branch of the subject is as fully open to exploitation as the automatic firing of ordinary boilers. Its development is, however, for the time being held in suspense in consequence of the war.

Mr. S. Turner.—Mr. Sam Turner, of Bury, who died last week from pneumonia following influenza, aged 43 years, was one of the directors of Messrs. Joseph Downham, Ltd., wholesale ironmongers, &c., Bury, and head of the electrical furnishing department of the firm.

Mr. H. E. Philpot.—The death occurred on October 27th, from pneumonia, of Mr. Hubert Edward Philpot, head of

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the firm of Philpot & Co., electrical engineers, Canterbury and Ramsgate. Deceased, who was only 34 years of age, had for the past 10 years carried on the business established 50 years ago by his father, and since the age of 21 had controlled the electrical department.

Mr. C. Garnett.—At Darwen Corporation electricity works, on October 31st, a portrait was unveiled to the memory of the late electrical engineer, Mr. Charles Garnett. The inscription read:—

"Darwen Corporation.—As a token of esteem and respect to the late manager, from the Chairman, Vice-Chairman, and the Electricity and Destructor Staffs. October 31st, 1918."

NEW COMPANIES REGISTERED.

Manchester Aluminium Co., Ltd. (151,804).—Private company. Registered October 29th. Capital, £5,000 in £1 shares. To carry on the business of importers and exporters, and dealers in metal, metal scrap, ores, aluminium, brass, &c. The subscribers (each with one share) are:—J. D. Paton, Glenmuir, Leicester Road, Hale, Ches., consulting engineer; J. Ashworth, 47, Lonsdale Road, Bolton, engineer. The first directors are J. D. Paton and J. Ashworth. Registered office: 25, Market Street, Manchester.

Ferrotherm, Ltd. (151,801).—Private company. Registered October 29th. Capital, £3,000 in £1 shares. Engineers, contractors, electroplaters, electrochemists, iron founders, tube makers, &c. The subscribers (each with one share) are:—G. H. Alexander, Yeovilton Cottage, Everton, Hants, engineer; S. Wertheimer, 57-9, Long Acre, W.C.2, engineer's agent. The directors are to be appointed by the subscribers. Registered office: 57-9, Long Acre, W.C.2.

The Clyde Engineering Co., Ltd. (10,133).—Private company. Registered October 23rd. Capital, £10,000 in £1 shares. Mechanical, electric lighting, and general engineers, iron founders, shipbuilders and repairers, structural ironworkers, smiths, millwrights, iron, steel, brass, copper, and other metal manufacturers, oxy-acetylene and electric welders, and cutters of metals, &c. The subscribers (each with one share) are:—R. Wilson, 187, West George Street, Glasgow, solicitor; A. McDonald, 187, West George Street, Glasgow, law clerk. First directors are not named. Registered office: 187, West George Street, Glasgow.

CITY NOTES.

German Companies.

The Deutsche Gasgluhlicht A.G. (Auer Co.), of Berlin, which produces wire lamps as well as gas lighting appliances, reports net profits of £426,000 for 1917-18, as against £717,000 in the previous 12 months. The directors recommend the payment of a dividend of 25 per cent., being the same rate as in 1916-17.

The Deutsche Elektrizitats Werke Garbe, Lahmeyer & Co., of Aix-la-Chapelle, after setting aside £39,000 for depreciation in 1917-18, as against £37,000 in the previous year, report net profits of £78,000, as compared with £31,000 in 1916-17. It is proposed to distribute a dividend of 6 per cent., being the same rate as in 1916-17.

The Suddeutsches Telephon Apparat und Draktwerk A.G., of Nuremberg, whose share capital is held by the Felten and Guilleaume Co., records net profits of £50,000 for 1917-18, as contrasted with £27,000 in 1916-17, sums of £28,000 and £19,000 having previously been written off for depreciation.

The accounts of the *Kabelwerk Rheydt A.G., of Rheydt*, show net profits, without any provision being made for depreciation, amounting to £150,000 for 1917-18, as contrasted with £221,000 in 1916-17, when only £1,100 was written off. It is proposed to pay a dividend of 20 per cent., plus 20 per cent. bonus in War Loan, as compared with 20 per cent. in 1916-17, on a share capital of £350,000.

The report of the *Bayerische Stickstoff Werke A.G., of Munich*, states that the production of the company's own works at Trostberg and Tacherting, Bavaria, was materially less in 1917-18 than in the preceding year, owing to the inadequate allotment and supply of raw materials. The output of the Central German State Works, managed by the company, was satisfactory, but that of the Upper Silesian State Works was inconsiderable in consequence of the insufficient supply of power. War conditions hampered the extension of the Bavarian works; the new cyanamide plant was finished, but great delay took place in the completion of the power station and the carbide works. On the other hand, the enlargement of the State works was brought to a successful issue. After allocating £27,000 to depreciation, as compared with £34,000 in 1916-17, the accounts show net profits of £59,000, as against £77,000. It is intended to pay a dividend of 11 per cent., this contrasting with 14 per cent. in 1916-17.

New Issue.—*Callender's Cable & Construction Co., Ltd.*—The list opened on Monday and was to close on Wednesday in an issue of 40,000 6½ per cent cumulative preference shares of £5 each at par, and 10,000 ordinary shares of £5 each at £7 per share, to provide further working capital.

West African Telegraph Co., Ltd.—Interim dividend at the rate of 4 per cent. per annum for the half-year to June 30th.

Siemens Bros. & Co., Ltd.—Interim dividend at the rate of 10 per cent. per annum, free of tax.

Dick, Kerr & Co., Ltd.—The profits earned during the 12 months' trading to June, 1918, were £87,916, plus £36,074 brought forward, making £123,989. Out of this debenture interest and trustees' fees have been paid, and there has been reserved the sum required to provide for the premium payable on the redemption of the present debenture stock. These items absorb £10,129; 6 per cent. dividend on the preference shares absorbs £21,000; 10 per cent. is to be paid on the ordinary shares, requiring £30,000; £25,000 is put to supplement the special reserve for contingencies, and £37,860 is to be carried forward. Although the amount of excess profits levy under the Munitions of War Act has not been finally settled, the directors believe that the reserves which they have made in the accounts for extra depreciation, special taxation, &c., are sufficient, and they therefore feel justified in recommending the above dividend on the ordinary shares. All the works have been occupied during the year, although in the case of the United Electric Car Co. a considerable portion of the time has been occupied in extensions and alterations necessary to produce important work of a nature specially suited to that establishment. Messrs. B. A. Firth and G. Mure Ritchie have been appointed directors.

Drake & Gorham, Ltd.—For the year ended June 30th, 1918, after payment of all charges, including bonuses to staff, war allowances, and provision for contingencies, the net profit is £18,781, plus £2,296 brought forward. A dividend of 7½ per cent. absorbs £9,375, £5,000 is put to writing down goodwill, and £6,702 is carried forward, subject to deduction for excess profits duty, if any. The turnover constitutes a record in the history of the firm, contracts consisting mainly of national work. The business of the wholesale trade department shows an increase of about 30 per cent. on last year's figures, and covers the supply of electrical goods of all kinds to municipalities, tramway companies, and contractors. Manufacturing has for some months been in full operation at the new premises, Rockingham Works, Newington Causeway.

West India & Panama Telegraph Co., Ltd.—Interim dividends for the six months to June 30th: 6s. per share on the first preference shares, 6s. per share on the second preference shares, and 6d. per share on the ordinary shares (free of income-tax).

City of Buenos Aires Tramways Co., Ltd.—Dividend of 1s. 3d. per share (at the rate of 5 per cent. per annum), less income-tax, for the three months ended September 30th.

Calcutta Electric Supply Corporation, Ltd.—Units sold during five weeks ended August 30th 3,464,148, compared with 2,982,020 in 1917.

Anglo-Portuguese Telephone Co., Ltd.—Interim dividend of 3 per cent., less income-tax, on account of the year ending December 31st, 1918.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets have shown greater buoyancy this week than they have done since the outbreak of the war. Animation and cheerfulness have ruled in most departments, and where prices have not moved quotably, this is more frequently due to lack of stock than want of support. The end of the war is in sight, and the only question is how soon it will be before Germany breaks up in one way or another; such, at any rate, appears to be the view reflected in the markets of the Stock Exchange.

Why Home Rails should be racing up in price is not quite clear even to those most intimately concerned. The position is not intrinsically different from what it was weeks ago. But buyers have come along in force, prices have mounted merrily, and in this week's list Metropolitan Consolidated is a very strong feature. Underground Incomes have gone up to 89. Central London guaranteed assented stocks are all better. Notable strength is shown by the Scottish stocks of various kinds.

Electric Lighting shares are quietly good. County ordinary reacted 5s. to 11 after their recent big rise, but Charing Cross preference gained ¼. Urban preference are better at 2¼. There has been little slackening in the demand for shares, but the narrowness of the market, and the difficulty of buying shares, is a factor that makes perforce for quietude. If investors find they cannot buy in one market, they naturally turn to another department where greater elasticity prevails.

Securities in such companies as those which have suffered from fuel shortage are enjoying a little pre-peace consolation. Anglo-Argentine Tramways make a case in point. The first preference shares fell at one time at 2¾, whereas now they are difficult to buy at 4. The second preference have sympathetically improved. British Columbia electric issues have come up by many points in the past two or three weeks. Electric railways and tramways in various far parts of the world are being inquired for, and holders do not wish to sell. Mexicans continue good, but the only noticeable alteration this week is a rise of 1 in Mexico Tramways first bonds. Brazilian Tractions have recovered the 1½ points shed last week.

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Callender's new issue has aroused considerable interest. The company followed the example recently set by the General Electric Co. in offering preference and ordinary shares together, with the statement that in the allotment of ordinary shares preference will be given to applications for both ordinary and preference shares in the proportion of one ordinary for every four preference. The latter are offered at £5, and the ordinary at £7, that is, at par, and a premium of £2 respectively. The market prices of the existing issue stand at 5¼ and 9¼. The company is paying an underwriting commission of 2½ per cent., and an over-riding commission of ½ per cent. on the whole issue, preference and ordinary. As the subscription lists closed a day in advance of the full term it will be obvious that the company has achieved success with its offer.

Marconis come on offer fairly freely as the price approaches £5, but the shares keep steady round about 4⅞, with Americans 32s. 6d., Marconi Marines 3½, and Canadians 14s. 9d. There is not much change in cable descriptions. The Eastern group keeps very hard. West India and Panama gave way to a slight extent.

British Westinghouse ordinary are in demand at 40s., and the preference have risen 1/16 to 2 9/16. Crompton preference are a good market at 20s., at which price they can be obtained. The ordinary are 16s. 6d. Chelsea 6 per cent. preference are wanted about 91s., and South London 6 per cent. preference at 4⅜. Victoria Falls ordinary have stiffened to 20s. 6d., the preference remaining about 25s. 6d. Castner Kellners drooped to 3⅛. British Aluminiums are the turn easier. Rubber shares remain a fairly hard market, interest centring for the moment in those Middle East companies that produce coffee as well as rubber.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Nov. 5, 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6⅜	—	£7 17 0
Charing Cross Ordinary	5	4	3⅜	—	5 18 6
do. do. do. 4½ Pref.	4½	4½	3⅜	+ ⅛	6 13 4
Chelsea	8	5	3⅛	—	7 16 10
City of London	8	8	13½	—	6 0 6
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	11	— ¼	6 7 3
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	6	7	5⅛	—	6 17 7
London Electric	Nil	Nil	1⅜	—	Nil
do. do. 6 per cent. Pref.	4	5	3½	—	7 2 10
Metropolitan	8	4	3⅛	—	6 10 7
do. 4½ per cent. Pref.	4½	4½	3½	—	6 18 6
St. James' and Pall Mall	8	9	6⅞	—	6 13 4
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	6⅞	—	6 13 6
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	99xd	—	6 1 0
do. Def.	1½	1½	23⅜	—	6 8 6
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	16	—	*5 0 0
Eastern Tel. Ord.	8	8	161½	—	*4 19 1
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 5
do. do. Pref.	6	6	10½	—	5 14 8
Great Northern Tel.	24	22	84	—	6 9 5
Indo-European	18	13	57½xd	—	5 13 0
Marconi	15	20	4⅞	— ⅛	4 2 0
Oriental Telephone Ord.	10	10	3½	—	2 17 2
United R. Plate Tel.	8	8	7½xd	—	*5 5 0
West India and Panama	6d.	1/3	1/6	— 1/6	*3 13 6
Western Telegraph	8	8	17	—	*4 14 2
Home Rails.					
Central London Ord. Assented	4	4	65½	+2	6 2 2
Metropolitan		1	29⅜	+2⅜	3 17 3
do. District	Nil	Nil	26½	+ ½	Nil
Underground Electric Ordinary	Nil	Nil	8	+ ⅛	Nil
do. do. "A"	Nil	Nil	8/-	+6d.	Nil
do. do. Income	6	4	89	+1½	*4 10 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅜	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3⅜	+ ⅛	—
do. do. 2nd Pref.	5½	—	3⅜	—	—
do. do. 5 Deb.	5	5	76	+1	6 11 7
Brazil Tractions	—	—	58	+1½	—
Bombay Electric Pref.	6	6	10⅜	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	64	+1	7 16 8
do. do. Preferred	Nil	Nil	45½	—	Nil
do. do. Deferred	Nil	Nil	44½	—	Nil
do. do. Deb.	4½	4½	61½	—	6 18 3
Mexico Trams 5 per cent. Bonds	Nil	Nil	65	+1	Nil
do. 6 per cent. Bonds	Nil	Nil	50	—	Nil
Mexican Light Common	Nil	Nil	37½	—	Nil
do. Pref.	Nil	Nil	50	—	Nil
do. 1st Bonds	Nil	Nil	71	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	8⅛xd	—	4 1 4
British Aluminium Ord.	10	10	1⅝	—7½d.	5 12 4
British Insulated Ord.	20	20	2½	—	4 9 0
British Westinghouse Pref.	7½	7½	2⅜	+ ⅛	5 17 0
Callenders	20	25	9½xd	—	6 8 0
do. 5 Pref.	5	5	5⅛	—	—
Castner-Kellner	22	20	3⅛	— 1/16	5 10 4
Edison-Swan, "A"	—	—	¼	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	10	1⅜	—	7 5 6
Gen. Elec. Pref.	6	6	10⅜	—	6 2 4
do. Ord.	10	10	18	—	*5 11 1
Henley	25	25	2⅛	—	5 11 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	—	*5 14 3
Telegraph Con.	20	20	49	—	*4 18 0

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, November 6th.

CHEMICALS, &c.		Latest Price.	Fortnight's Ins. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£100	..
a Ammonia, Muriate (large crystal)	,,	£77	..
a Bisulphide of Carbon	,,	..	..
a Borax	,,	£43	..
a Copper Sulphate	,,	£62	£2 dec.
a Potash, Chlorate	per lb.	2/4	..
a ,, Perchlorate	,,	2/-	..
a Shellac	per cwt.	£17 10/-	..
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	,,	£34	..
a ,, Lump	,,	£26	..
a Soda, Chlorate	per lb.	1/1	..
a ,, Crystals	per ton	170/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c ,, Tubes (solid drawn)	,,	..	..
c ,, Wire, basis	,,	..	..
c Copper Tubes (solid drawn)	,,	1/8½ to 1/9	..
g ,, Bars (best selected)	per ton	£161	..
g ,, Sheet	,,	£161	..
g ,, Rod	,,	£161	..
d ,, (Electrolytic) Bars	,,	£137	..
d ,, ,, Sheets	,,	£161	..
d ,, ,, Wire Rods	,,	£145	..
d ,, ,, H.C. Wire	per lb.	1/5½	..
f Ebonite Rod	,,	3/-	..
f ,, Sheet	,,	2/6	..
m German Silver Wire	,,	2/6	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	2/8½	5½d. dec.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£37	..
g Lead, English Pig	,,	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	9d. to 1/6	3d. to 1/6 inc.
e ,, ,, ,, medium	,,	5/- to 10/-	1/6 to 4/- inc.
e ,, ,, ,, large	,,	12/6 to 25/- & up.	5/- to 11/- & up inc.
d Silicium Bronze Wire	per lb.	1/10	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	,,	..	..
n ,, Wire, Nos. 1 to 16	per lb.	5/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Smooth versus Undercut Commutators.—Because in many cases continuity of service in an electrolytic plant is one of the most important factors entering into the plant's success, the matter of having an adequate supply of electrical energy at all times is absolutely vital. This factor led a chemical company in the Middle West to study closely the varying conditions with both smooth and undercut commutators on its generators. It was found that although 100 per cent. service continuity and load factor could be obtained when smooth commutators were used on generators and motors, no like results could be obtained with the undercut commutators. This record was made possible by the use of an ordinary grade of domestic-made brush and by taking daily care of the commutator (says the *Electrical World*). Each morning two men sandpaper the commutators with the paper attached to a concave-shaped wood block. One man applies the block, the other holds a bunch of dry waste against the commutator directly behind the block to catch the copper dust. Each machine is thus treated for about 30 minutes. Then, without detaching any shunt wires, each brush is slipped from its holder and cleaned with sandpaper just enough to remove the particles of copper that may lodge on the wearing surface. The brush is then replaced, and the machine will operate satisfactorily for another 24 hours. In 20 years the commutators have not lost more than 1½ in. (3·8 cm.) total diameter, and they seem to be good for many years more. In fact, a half-hour's sanding barely removes the dirt, and does not even remove entirely the brown gloss from the surface. The undercutting, however, shortened continuous operating periods down to six weeks, and the machine would show distress at slight overloads. Different makes of brush and different modes of manipulation were tried, but the trouble could not be eliminated without smoothing down the commutator. The reason that the undercut commutator is not very good is thought to be that the slot gets foul with carbon and copper dust, and the tendency is to drag copper across the segments, making ideal short-circuit conditions. When an undercut commutator starts to give trouble, there is no recourse but to shut down the machine, while, on the other hand, smooth commutators under like conditions can always be brought back to good behaviour by using sandpaper without reducing the load. It is not mechanically correct to dig grooves across the wearing surface at right angles to the line of motion; it is thought that with a properly-built and operated commutator, high mica is non-existent. Soft mica, which is usually amber-coloured, is the proper kind to use, and even the hard white mica will do if first split into thin sheets about the thickness of writing paper.

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THE FUNCTIONS OF THE GOVERNMENT IN RELATION TO INDUSTRY.*

By W. L. HICHENS.

The habitual tendency of Englishmen is to drift down the stream of life without inquiring where they are going, and without any very definite ideas as to where they want to go. "We muddle through somehow," we say to each other with a smile of easy-going satisfaction, thinking the while that it is others—usually the Government—who have made the muddle, and that it is we—the men in the street—who have saved the situation.

We blame the Government because the war took us by surprise and found us wholly unprepared, and we flatter ourselves (not without reason) because we have made a glorious recovery.

And just as we were unprepared for war in 1914, so now, in 1918, we are unprepared for peace. We muddled into war, and we shall muddle into peace. Not until we find ourselves wallowing in a Serbonian bog of confusion shall we bestir ourselves, and then we shall damn the politician, and make the best of a bad job. The politician is, of course, no more to blame than we are ourselves. He doesn't lead because we refuse to be led; he pursues a policy of masterly inactivity because we decline to budge. But there are times when we must look ahead, and make up our minds what goal we mean to reach. We have arrived at a veritable network of crossroads to-day. Shall we not, then, cry a halt, and choose our way with deliberation? Or are we in such a hurry that we dare not pause?

I would like to pause to-day and inquire whither the Government proposes to lead the industries of this country, before I step into the train of post-war industrial reform. I have no desire to find myself in a non-stop train hurrying headlong to the destination of State Socialism. My fear is that we shall be "all aboard," the whistle will blow, and we shall be off before we realise whither we are bound and where we want to go.

We have become so accustomed to Government control in the everyday affairs of life during the war, we are so inured to the establishment of new departments and new Controllers, that the invasion of what were formerly regarded as the rights of the individual no longer shocks or alarms us. The list of functions which it is proposed in different quarters that the Government shall undertake in the industrial and commercial spheres has assumed truly staggering proportions. Proposals have been made to nationalise the railways, all road and water transport services, the coal mines, private armament firms, and shipbuilding firms; it has been proposed that the State shall establish super-power stations for the supply of cheap electric power; that it shall embark on an extensive housing scheme; that it shall finance or take over the key industries; that it shall convert the national factories into industrial concerns and run them for profit; that it shall nationalise the liquor trade; that it shall develop for profit selected resources of the Empire; that it shall be the sole purveyor of the prime necessities of life.

Here is a formidable list of industrial activities for the State to assume as a part of its reconstruction programme, and before committing ourselves as a nation to so ambitious a policy, it would be well to consider it carefully from all sides, since, once we have embarked upon it, it will be hard to retrace our steps. I will give some of the reasons why I think the Government should keep outside the arena of commerce and industry.

In the first place, the Government has already more than enough to do without annexing a vast new sphere of activity. Even before the war the business of Parliament was hopelessly congested, and no one will contend that in the turmoil and confusion of the next few years its duties will be lightened. If the Government and Parliament have failed lamentably to handle the business entrusted to them with any approach to efficiency, what chance is there that they will prove equal to the task of running complicated and exacting industrial undertakings? It would be the height of folly to allow the Government to embark on these new ventures while their own house is in a state of grave disorder.

The second objection to State trading is that it tends to create international complications, and increases the risk of war. Most people will agree that the international problems of the next generation will be in a great measure economic, for the war has brought out the fact that military strength is largely dependent upon economic and industrial resources. The importance, therefore, to a country of commerce and industry is likely to be more fully realised than ever before, and its promotion will be a primary object with all Governments. Each Government should therefore be in a position to consider these international problems from as broad and detached a point of view as possible, and should not be directly implicated as itself a trader. A rate war, for example, in the trans-Atlantic trade would be a far more serious matter if it were carried on by the Governments of the countries concerned than if it were instigated by private firms. Trade questions and diplomatic questions would thus become largely synonomous, to the risk of the peace of the world. Before the war the German Government was already tending to assume the functions of a bagman, and to exercise them in a manner which was both undignified and dangerous. Economic problems will probably bulk large at the peace conference, and it is to be hoped that an attempt will be made to define the limits within which State intervention in matters of foreign trade is justified.

A third objection to State trading on an extensive scale is that it creates a large army of Civil Service voters, who, in exercising the franchise, may find it difficult to forget that their material prospects can be better promoted by one candidate than another.

A fourth objection to State trading is that the organisation of a Government department must necessarily differ from that of a private business. You cannot run a public office on business lines, because the conditions of the public service and private undertakings differ *toto cælo*, and demand a different form of organisation. In business it is necessary to act promptly, to take risks, to have a free hand, to talk as little as possible. Now, a Government is handicapped in all these respects because of its responsibility to Parliament and the public. If Treasury control is relaxed, and subsequently some blunder is brought to light by the Public Accounts Committee, we are treated to a homily on the importance of a close financial supervision. It is natural to all of us that we should wish to err on the side of safety, and in the case of the Treasury over-control is safer than under-control. Hence arise many vexations, interferences, and heart-burnings. At a certain national factory it was decided to start a social club for the workers. The managers were keen, the workers took up the idea warmly, an atmosphere of enthusiasm was created. Obviously it was necessary to strike while the iron was hot; moreover an option, which had been obtained on the only suitable building, had to be exercised at once, or it lapsed in favour of another party. But the scheme involved an initial outlay of a few hundred pounds for which Treasury sanction was necessary, and the wheels of the gods grind slowly, as it is over eight months ago since all the details were worked out—but no Treasury sanction has yet been received. Therefore, officially the scheme is in a state of suspended animation, and is likely to remain so, since the game of battledore and shuttlecock is still in full swing. Unofficially—but that is another story. I do not wish to criticise the delay; it is inevitable; it is inherent in the Parliamentary system. The fact is that "State management on sound commercial lines," "A business Government," are parrot cries incapable of realisation so long as Parliamentary control remains a reality and so long as the party system continues.

I do not wish to suggest that Civil Service administration is less efficient than business management. Mistakes are made in both. The organisation of public and private services is necessarily different because they are primarily designed for different purposes; and the delays, circumlocution, and red tape which one associates with the Government service are in a great measure inevitable. The moral I would draw is that these methods are unsuitable to industry, and fore-doom it to failure.

A fifth objection to State trading is that it eliminates competition, and introduces a rigid uniformity of administration which results in stagnation. A healthy competition is the lifeblood of industry, and diversity of method is the best guarantee of progress. If Treasury sanction has to be sought before new methods can be adopted and experiments can be carried out, if the responsibility and initiative of the individual are curtailed, if all changes are hedged round with formalities, a shrewd blow will be struck at progress. And it is right that after the war the Treasury should watch all public expenditure with a jealous eye. It will be obliged to balance the rival claims of education, railways, super-power stations, housing, and a host of other things if State trading is to be the order of the day, with the result that they will all be starved. The State, again, will not dare to take the risks that private enterprise does, and must if it is to be successful. What is likely to happen if a Government not too securely seated on its Parliamentary throne is invited to undertake a transaction in its business capacity which may lead to brilliant results, or end in dismal failure? It will think of its shaky majority, it will reflect on the hostile criticisms of the Opposition and the Press, and in nine cases out of ten will play for safety. It is always easier to defend the *status quo* than to explain away a failure. The man of business knows this as well as the politician, but under stress of competition he is obliged to adopt the policy of "nothing venture nothing have," and on the whole he has ventured wisely. England's commercial greatness has been built up by the initiative and sturdy independence of the business community coupled with the skill of its craftsmen, and it is to the same characteristics that we must look for the maintenance and development of her trade.

There is one final objection to State trading. By itself entering the arena of trade the State loses the detachment and impartiality which are expected from the ultimate controlling authority. It becomes an interested party, and its decisions are at once suspect. For if the State is a large employer of labour, how can it determine the industrial disputes in which it is itself interested?

I have dealt with the question of State trading at some

*Abstract of a lecture delivered at the Industrial Reconstruction Council, London, October 30th, 1918.

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length because there are strong forces at work which appear to me to be driving us in that direction, and unless we take a firm stand now I fear that we may find ourselves driven violently down a steep place into the sea.

Having eliminated trading as one of the functions of the Government in relation to industry, I will abandon the negative method and attempt a constructive definition. I would suggest that the primary function of the Government in relation to industry is to determine the conditions under which industry shall be conducted by private individuals, firms, or corporations, and to see that those conditions are carried out. The first duty of the Government and Parliament is to secure justice as between one section of the community and another. They have to see that a bootmaker, for example, makes his boots under conditions that are fair to his workmen and to the rest of the community—not to make boots themselves.

The first duty of a Government is to secure justice to *all*, not merely to a majority, and in relation to industry its primary function is to determine the conditions under which industries shall be conducted, and to see that those conditions are carried out. Hitherto it has conspicuously failed in both respects. It has rarely had a consistent policy, and it has still more rarely seen its policy through.

To secure the confidence of both employers and employed it should be recognised as being disinterested, and if it is itself to be the largest employer of labour it will disqualify itself as the final court of appeal. To-day there are two fundamental problems which are exercising the minds of the workers—profiteering and the status of Labour. They claim—and rightly claim—that Capital shall not be unduly rewarded in relation to themselves, and that their voice shall have due weight in determining the conditions under which industry shall be carried on. The employer likewise has two bugbears—restriction of output and strikes. He sees that the material prosperity of the country depends upon the production of wealth, and that there can be no real improvement in the former except by increasing the latter. He knows that fundamentally the interests of Capital and Labour are the same; that both are necessary to the production of wealth; that both employers and employed are members of one corporate body, with distinct functions, but one common goal. Unfortunately, the common goal is obscured by the mists of controversy, the vessel is allowed to drift towards the rocks, while the members of the ship's company dispute over their respective duties and rewards.

It is obviously important that employers and employed should, in the first instance, hammer out their differences amongst themselves. But if they fail to agree, or if their agreement is against the public interest, the final decision, which should be binding on both sides, must rest with the Government elected by the whole community. There must be some outside and impartial authority to resolve the difference of the two parties, or the result will be anarchy. This—which is by far the most important function of the State in relation to industry—has never been fully recognised.

It is the Government's business to stop profiteering and to stop exorbitant wages; it is for the Government to determine in the last resort the hours and the general conditions of labour; it is for the Government to hold the scales of justice evenly between Labour and Capital when differences arise.

Assuredly it is no light task that Parliament and the Government are thus called upon to undertake in relation to industry. It involves an intimate knowledge of industrial conditions which they have never yet attained, and a degree of control which would make the bones of the members of the old *laissez faire* school turn in their graves. But it differs even more widely from the task which the State Socialists would impose on the Government. For they would endow the Government with the functions of umpire and batsman in the same game, whereas, in the view put forward, it is essential that the two should be kept separate.

The secondary functions of the Government in relation to industry are of very real importance, and they often bulk more largely in the public eye than the one which I have stressed to-day. They may be grouped, broadly, under the heading of the encouragement of industrial development. In this category come the promotion of industrial research, the development of the consular services, the thorny problem of the support of the key industries, the still more controversial problem of protection *versus* free trade. In this category may also be included the elimination or prevention of wasteful competition. For, if competition has its uses it has also its abuses. The competition among the British railway companies before the war is a case in point. No one would wish, I believe, to revert to the old conditions, or fail to recognise the great advantages and economies arising from a closer co-ordination. It is for the State to step in and insist that this co-ordination is carried out on right lines. Similarly, it has been brought home to the country that a broad and comprehensive scheme for the supply of cheap electric power through big central stations is of vital importance to industrial development. But the task of reducing the present chaos to order is beyond the powers of private enterprise without legislative assistance. It is urgently necessary that the Government should lay down the conditions under which these super-power stations may be erected, but, having done this, they should leave the actual work to be carried out by private enterprise.

These, briefly, are some of the problems which the Government is called upon to face in the interests of industrial development, and their mere enumeration conveys a striking picture of the magnitude of the task with which the Government is faced. I have made no reference at all, it may be noticed, to the question of Government control during the transitional period following upon the conclusion of peace. The reason is that I am not concerned with a temporary and wholly exceptional phase in our industrial life which we shall all wish to abridge as much as possible.

I have thought it best to concentrate upon the primary function of the Government in relation to industry, which is, I repeat, to determine the conditions under which industry shall be conducted by private enterprise, and to see that those conditions are carried out. And I have emphasised this aspect because there is a real danger, in my view, that the Government will try to turn trader and attempt to remedy its sins of omission by sins of commission, which will merely make confusion worse confounded.

RECOVERY OF CHARGES IN THE COUNTY COURT.

[FROM OUR LEGAL CONTRIBUTOR.]

A correspondent of the Electrical Review has recently propounded two questions of apparent simplicity, namely, (1) Can an electric supply company sucessfully sue in the County Court any consumer to whom the company has sent a quarterly bill for the amount of the minimum charge of 11s. 8d. for any energy he may have consumed in the quarter? and (2) Whether, in addition to such charge of 11s. 8d. per quarter, it would be legal to charge meter rent? He suggests that under the maximum prices schedule in the company's provisional order the company has the right to make charges, and draws attention to the following clause: "Where the undertakers charge any consumer by the actual amount of energy supplied to him they shall be entitled to charge him at the following rates per quarter. For any amount up to twenty units eleven shillings and eightpence, and for each unit over twenty units, sevenpence." He adds that in two County Court cases of recent date claims of this kind were decided against a supply company.

Assuming that each consumer became an assenting party to these charges when he entered into a contract for a supply, it is difficult to see how the claim of the undertakers could be resisted. There is usually a clause in every consumer's contract by which the relevant clauses of the provisional order are incorporated, and the consumer who signs the document automatically becomes bound by it. As to meter rent, that, too, is generally the subject matter of agreement; and there seems to be no reason why the meter rent should not be recovered in accordance with the terms of the contract by an action in the County Court.

It is important to note that the maximum charge above referred to does not depend upon any meter reading. It is a definite amount to which the company is to be entitled in any event. As regards the amount in addition, this depends upon the meter reading, which, generally speaking, is final and binding upon both supplier and supplied.

Possibly the County Court decisions referred to are based upon a misconception of a recent decision in the High Court to which it may be well to take this opportunity of referring. In Hendon Electric Supply Co., Ltd., *v.* Banks (87 Law Journal, p. 790), which is now reported in all the law reports, a supply company did fail to recover its charges in the County Court in circumstances which were somewhat peculiar. A consumer had agreed to the supply being ascertained by a meter provided by the company. The contract, however, incorporated the terms of 8 Cl. 57 of the schedule to the Electric Lighting (Clauses) Act, which provides as follows: "If any difference arises between any consumer and the undertakers as to whether any meter, whereby the value of the supply is ascertained (whether belonging to the consumer or to the undertakers), is or is not in proper order for correctly registering that value, or as to whether the value has been correctly registered in any case by any meter, that difference shall be determined upon the application of either party by an electric inspector or, where the local authority are the consumers, by an inspector to be appointed by the Board of Trade, and that inspector shall also order by which of the parties the costs of and incidental to the proceedings before him shall be paid, and the decision of the inspector shall be final and binding on all parties. Subject, as aforesaid, the register of the meter shall be conclusive evidence in the absence of fraud of the value of the supply."

In February, 1917, it was found that a meter fixed on the consumer's premises had recorded nothing, and it was replaced by another instrument. In point of fact, the locking pin had never been released. The plaintiff company then sought to recover in the County Court on an estimate of the energy consumed during the period when the meter was not running, the estimate being based upon the amount registered during the corresponding quarter of the previous year. The Court held that the company could not recover. Mr. Justice Lawrence, in the course of his judgment, said: "Now clause 57 of the schedule to the Electric Lighting (Clauses) Act,

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1899, provides that where a difference arises between the customer and the undertakers, as to whether any meter is in proper order for registering the value of the supply, that difference shall be determined upon the application of either party, by an electric inspector appointed by the local authority or by the Board of Trade, and that inspector shall decide by which of the parties the costs of the proceedings before him shall be paid, and the decision of the inspector shall be final and binding on all parties.

"In the present case the defendant demanded the determination of the dispute in this manner, but unfortunately no electric inspector had at that time been appointed. The County Court judge was not entitled to determine the dispute, and to assess the amount of electricity consumed. Where an Act of Parliament has, as it has here, provided a mode of determining such a dispute, no cause of action arises until the dispute is determined in the manner provided. In my opinion, the appeal must be dismissed."

There can be no doubt as to the correctness of this decision. The proper course for the company to pursue was to secure the appointment of an electric inspector, as soon as it was found that the meter was not working. He was the person to say (*a*) whether the meter was in order for correctly registering the value, and (*b*) whether the value had been correctly registered. If he arrived at the conclusion that the meter was defective he could then (it is submitted) have determined the value of the energy used. When he had made his valuation, if the consumer still refused to pay, he might have been sued for the amount in the County Court.

It came out in the course of the case that in fact there was no electric inspector in the Hendon district; but that did not affect the question. The determination of the accuracy of meters is left to electric inspectors and not to County Court judges.

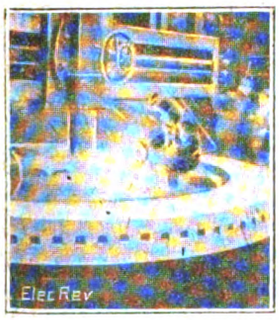
As to the general question whether an electric lighting company can sue for its lawful charges, the answer is clearly in the affirmative. If there is no question as to the accuracy of the meter, there can be no defence to the action. Charges may be recovered summarily as civil debts in a court of summary jurisdiction (see S. 40 of the Gasworks Clauses Act, 1871, incorporated with the Electric Lighting Acts) or in the County Court. (*Ib.* S. 41). The fact that such cases are rare may be partly due to the fact that undertakers are able to exercise an undoubted right to cut off the supply to anyone who refuses to pay what is due.

ELECTRIC ARC WELDING.*

By A. M. CANDY.

(*Concluded from page* 415.)

In foundries and machine shops, many applications for arc welding equipments may be found, the principal one of which is probably that of cutting risers off castings. The cross sectional area of such risers is frequently quite large, but by using a current of 600 to 800 amperes they can be removed readily. Occasionally, during the operation of machining a casting, blow-holes will be revealed which may seriously impair the strength and appearance of the casting. Without removing the piece from the machine such defects can be readily repaired by arc welding, as is illustrated by fig. 1. In this instance, a large blow-hole was discovered in



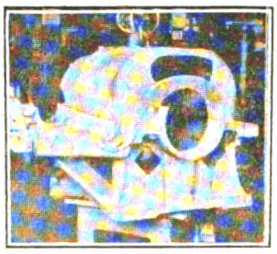


Fig. 1.—Blow Holes in Casting repaired by Arc Welding without Removing Casting from Machine.

Fig. 2.—Defective Casting Reclaimed by Arc Welding.

the hub of a cast-steel flywheel. The defect was satisfactorily repaired in 15 minutes. Fig. 2 illustrates a most interesting instance of reclaiming a defective casting through the medium of arc welding. Due to an oversight in a foundry, six cast steel frames for large mill motors were cast without the supporting members for the axle brackets. The loss involved was quite an item, and therefore it was decided to endeavour to repair the castings by the arc welding process. Supporting pieces of steel were prepared, the ends being welded to the frame and axle brackets as indicated. A very successful job resulted, which has been entirely satisfactory.

Tramway systems have many applications for arc welding, such as repairing broken motor frames, brake rigging, worn rails, and in fact all steel parts subject to wear. Fig. 3 indicates a very common example, namely, that of armature shafts which have been worn excessively. It is practicable to build new material on these shafts by the arc welding process, after which the shafts may be machined to size in the usual manner. This process is considerably less expensive than pressing out the old shaft, which must be scrapped, and pressing in a new shaft. If the armature punchings are built directly on the shaft, then the saving is very marked, because in many such instances the removal of the shaft means practically rebuilding the armature. Another interesting application is that of building material on worn track

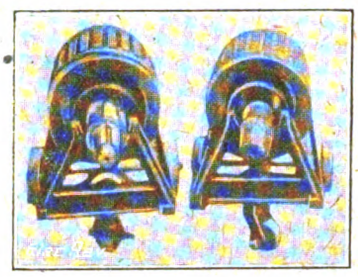


Fig. 3. Fig. 4.

Fig. 3.—Worn Armature Shafts Built up by Arc Welding.
Fig. 4.—Large Pinion Reclaimed after Wear.

frogs and crossings which are subject to severe and rapid local wear at the points, which are hammered by the wheels of passing cars. It is frequently difficult and expensive to replace such pieces of special track work in busy streets of large cities, and therefore the arc welding process is very commendable, as the worn parts can be built up and ground to shape without being removed. There are also authorities who recommend welding the fish plates or rail joints to the rails instead of the bolted or riveted construction used heretofore.

In steel mills electric arc welding can be used to advantage in many applications. For example, fig. 5 illustrates two steel mill wobblers, the ends of which have been repaired by the arc welding process; the white lines indicate the new metal deposited. It is interesting to observe that these wobblers are worth approximately $1,000 apiece, whereas the cost of repairing by the arc welding process is but $85 each.

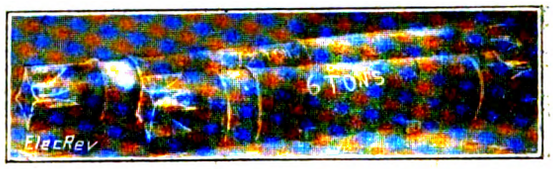


Fig. 5.—Worn Steel-mill Wobblers Repaired by Arc Welding.

These wobblers could not be saved in any other manner. Fig. 4 shows a large pinion which was reclaimed in a similar manner.

Blast furnaces, which are an adjunct to steel mills, present a very interesting application, namely, that of burning out the furnace tap holes. By using the carbon arc it is possible to burn the cold metal plugging the tap hole so that the molten metal will flow. If the hole becomes clogged with cinder or other non-conductor, it is only necessary to drive a steel bar into the hole until it makes contact with the molten metal, after which the steel bar may be melted by the carbon arc, thus releasing the molten metal. For this service special appliances are necessary. First, a carbon rod several inches in diameter and about 4 ft. long must be inserted in a suitable piece of wrought iron pipe to which a long wooden handle is secured. Second, arrangements must be made for supporting this electrode, so that the operator need not work in a position too close to the furnace for safety.

Probably the most extensive field for arc welding, however, is that of steam railway repair shops. All steam locomotives are subject to rapid deterioration, many parts requiring frequent repair or replacement. With the arc welding process such breaks may be repaired without dismantling.

The welding of flues in locomotive boilers is probably the most profitable application in steam railway shops. Prior to the introduction of the arc welding process the flues were inserted in the rear fire sheet, and the end of the tube allowed to extend beyond the sheet a sufficient distance so that it could be flanged or turned; the tube was also expanded slightly just inside of the sheet. Flues mounted in this manner will hold without severe leaking for quite a time.

* *Journal*, A.I.E.E., Vol. 38, No. 9. Abstract.

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but will gradually become sufficiently loose to necessitate repairs. Experience has demonstrated that the tubes can be welded to the flue sheet by the electric arc process. A number of the large railroads have adopted this process and are obtaining very satisfactory results.

ELECTRICAL DEVELOPMENTS FOR THE AMERICAN ARMY.

Illustrated articles in the *Electrical World* and *Power*, by Mr. Robert T. Tomlin, Staff Correspondent in France, give some idea of the electrical developments for the American Army in France. It should be understood that there is nothing of finality in what is said. Conditions change rapidly. Coupled with the conditions of uncertainty, the chief difficulty that has to be overcome is the scarcity of electrical material and equipment available for quick delivery. It should be remembered that the Americans are working in a country that has seen four years of war. Electrical equipment that was of use to the Allies early in the campaign has long since been rounded up and placed in service. The electric power demands of the American Forces at the present time in France are estimated to be from 50,000 KW. to 60,000 KW. The demands made for electricity are extremely varied. It is not a question of equipping and putting into operation one or two central stations, but rather of providing numerous segregated plants. As a general policy governing the operations of the Technical Board and the electrical division of the Services of Supply, it has been considered best, wherever possible, to make additions to existing French central stations rather than to build new ones, although a certain amount of new work has been undertaken. Another reason for making use of existing central stations, either in their present condition or enlarged, is the difficulty of securing skilled operators. Even when enlarged, such plant can be run by adding a few members to the force already on the job. The French central stations at present have little money for extensions. Such enlargements as are being made for use by the American Expeditionary Forces are being paid for by the United States. The same thing applies to transmission-line construction. Their policy is to adopt overhead construction entirely in connection with the distribution of electrical energy, of which they have already built, or have planned to build, about 132 miles. They are paying for all the lines built, and the understanding with the French Government is that they are the property of the United States. When the war is over it will be possible to recover the material put into the work, or, through some Board of Appraisal, negotiate with the French for its purchase if desired.

The situation is one which involves planning, in order that present enterprises may be adapted to after-the-war conditions. They are putting in now electric power plant and transmission systems which can readily be adapted to peace-time use. In addition to several steam-electric power stations that have been built by American labour in France, there are under consideration half-a-dozen projects for the utilisation of water power by means of the "outdoor type" of electric generating station. The design provides for the utmost simplicity in construction—merely a water-wheel and generator on substantial foundations housed under a rough shed of some sort. The idea is ultimately to make the hydro-electric plant permanent. They will be left in their rough state for the duration of the war, and will then be enclosed in a permanent masonry structure designed by French architects to meet the requirements as to exterior appearance. Hydro-electric plants of this type now under consideration are rated at from 2,000 KW. to 8,000 KW., and will operate under moderate heads. In contrast to these installations is another hydro-electric development of 9,000 KW., which has been partially completed by the French. It is probable that the American Forces will take over this work, finish it, and operate the completed plant. In so far as possible the American-built and French-built systems of electric power transmission will be interconnected. In view of present shipping conditions the Technical Board is endeavouring to procure practically all electrical equipment in France. The French equipment, built to conform to current French practice, is in many cases practically obligatory, especially in view of the fact that it must be used not only for present military needs, but also for commercial service after the war. On many details of electrical power development and transmission, French and American practices are at variance, and certain American equipment would be practically useless. The French employ almost no direct current, the almost universal preference being for 50-cycle, three-phase.

As to equipment and supplies, at the present time there is a decided shortage in transformers and the various miscellaneous supplies urgently needed in the electrical work of the American Expeditionary Forces. In the matter of insulators the shortage is still worse. Much of the clay used in the manufacture of insulators comes from England, and deliveries have fallen off considerably. Special arrangements with manufacturers, providing for coal and clay, however, are now under way. The French have succeeded in producing a glass insulator suitable for service on 35,000-volt lines. The quality of glass it is stated, is far superior to anything which has been produced on a commercial scale in the U.S. One engineer was so impressed with their quality that he said he would not hesitate to use French-made glass insulators on lines carrying voltages of 50,000 or even 60,000.

While the work is complicated by situations not met with in normal times, there are compensating advantages. The chief of these is the thorough way in which the French Ministère Armement has mobilised the central stations, controlled the supply of fuel, and regulated the distribution of energy. Not a kilowatt can be produced without the authority of the Ministère de l'Armement. On all electrical matters its word is law. It is vested with powers which greatly simplify the putting into effect of such projects as are required for the uses of the Forces. Close co-operation with the French is accomplishing two objects: it is giving the necessary help in speedily carrying out the projects immediately demanded, and it is laying the foundations for an industrial renaissence in which electric power will assume a place in France never dreamed of before the war.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

17,149. "Locking ring for locking incandescent electric lamps in lamp-holders." N. Edmondson. October 21st.

17,174. "Radio-telegraphy." L. M. Cockaday. October 31st. (U.S.A., October 17th, 1917.)

17,201. "Sparking plugs." K. Smith & J. Walker, Ltd. October 22nd.

17,222. "Clip or fastening for electrical connections." E. Pagnon. October 22nd.

17,231. "Electric accumulator boxes." A. A. Price. October 22nd.

17,242. "Attachment of telegraph wires to insulators of telegraph poles, &c., of aerial wires." W. A. Davis. October 22nd.

17,245. "High-tension continuous-current machine." A. Bolliger. October 22nd. (Switzerland, October 22nd, 1917.)

17,258. "Galvanic batteries." G. Oldham & J. Oldham. October 22nd.

17,259. "Electric signalling, &c., lamps." G. Oldham & J. Oldham. October 22nd.

17,277. "Electrical treatment of gases." L. Bradley. October 23nd. (U.S.A., June 21st, 1916.)

17,279. "Ignition of internal-combustion engines." T. F. Newman. October 23rd.

17,316. "High-speed electric, &c., locomotives." British Thomson-Houston Co. & F. W. Carter. October 23rd.

17,338. "Alkaline accumulators." A. M. Cave. October 23rd. (France, November 28th, 1917.)

17,341. "Combined turbines and electric generators, &c." Brush Electrical Engineering Co. & W. Chilton. October 23rd.

17,342. "Turbine and electrical generator plants." Brush Electrical Engineering Co. & W. Chilton. October 23rd.

17,359. "Sparking plugs for internal-combustion engines." F. A. L. Johnson. October 24th.

17,373. "Means for effecting electric synchronised control." H. Dickinson. October 24th.

17,386 "Sparking plugs for ignition purposes." A. E. Heath. October 24th.

17,395. "Utilising thermic effect of cathode rays." A. Sinding-Larsen. October 24th. (Norway, December 7th, 1917.)

17,398. "Alternating current and welding apparatus." C. J. Holslag. October 24th. (U.S.A., October 24th, 1917.)

17,404. "Electric switches." A. H. F. Perl. October 24th.

17,420. "Electric aeroplane bicycle, &c." H. M. Gloyne. October 25th.

17,429. "Ignition apparatus for internal-combustion engines." American Wheel Engine Co. October 25th. (U.S.A., November 2nd, 1917.)

17,442. "Electric make-and-break switches." Edison Swan Electric Co. and F. Shergold. October 25th.

17,454. "Producing a high vacuum." British Thomson-Houston Co (General Electric Co., U.S.A.) October 25th.

17,466. "Gas exits for galvanic batteries." G. Oldham & J. Oldham. October 25th.

17,476. "Means for gripping flexible conductors or cords of electric lamp-holders." M. J. Railing & T. Taylor. October 26th.

17,504. "Electric switches." M. D. Scott. October 26th.

17,513. "High-frequency alternators and their use as relays in wireless telephony." Soc. Française Radio-Electrique. October 26th. (France, October 26th, 1917.)

17,514. "Telephonic apparatus." M. Latour. October 26th. (France, October 3rd, 1917.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

12,284. Junction-box coupling for electric conduits. J. N. Scism. August 27th, 1917. (119,491.)

14,035. Cooling arrangements for dynamo-electric machines. H. C. E. Jacoby & Enclosed Motor Co. September 28th, 1917. (119,505.)

14,092. Electrical gyroscopes. A. H. Midgley & C. A. Vandervell and Co. September 29th, 1917. (119,511.)

14,201. Electric welding apparatus. R. F. Woodburn. October 2nd, 1917. (119,520.)

14,254. Telegraph or like signalling systems. T. B. Dixon. October 2nd, 1917. (119,524.)

14,309. Electric storage batteries or electric accumulators. Fuller Accumulator Co. & J. C. Wood. October 3rd, 1917. (119,530.)

14,399. Incandescent electric lampholders. M. H. Goldstone. October 5th, 1917. (119,539.)

14,598. Alternating-current generators. T. F. Wall. October 9th, 1917. (119,546.)

15,020. Reversing motors for planing machines and the like. G. Stirk, E. Stirk, R. Stirk & J. G. Stirk. October 17th, 1917. (119,555.)

15,214. Electric battery lamps. W. A. S. Hellyar. October 19th, 1917. (119,560.)

18,487. Electric cables. Pirelli & Co. March 26th, 1917. (114,414.)

18,847. Cradle for use in supporting electric cables and their fittings. December 19th, 1917. (119,585.)

1918.

574. Electric switches. G. O. Donovan & W. Donovan. January 10th, 1918. (119,592.)

2,648 Gas fires, electric radiators, and the like. C. Wray. February 14th, 1918. (119,604.)

3,869. Timing devices for ignition magnetos. Compagnie Générale de Magnetos. May 4th, 1917. (115,619.)

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NOTICE TO READERS.

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THE ARMISTICE.

"How are the Mighty Fallen!" At last—after fifteen hundred and more days and nights of deadly struggle—the tyrants of Prussianism have been hurled from their seats! Their strong sword has been broken in their hand; their mailed fist, battered and bleeding, carries instead a white flag suing for Peace.

An Armistice concluded in terms which will hardly permit of renewal of hostilities was signed in the early morning hours of Monday, November 11th. Before the midday hour fighting on all fronts had ceased. Thus was Peace restored to our tortured world.

The menace which has threatened Christian civilisation and the rights of all men everywhere for the greater part of a generation has been destroyed. The record of its failure through destruction is written in blood for all succeeding generations to take heed that militarism does not pay.

To destroy that menace a colossal price in lives and treasure has been paid by most of the civilised nations of the earth. In August, 1914, in fiery anger at Britain's determination to enter the war, the Kaiser, with his accustomed contemptuous scorn, asked whether we had counted the cost. Howsoever that may be, we have not shrunk from any sacrifice. The cost to the Allies has been immense, but that to the aggressor has been, and will be, larger far. Nemesis has followed the wrongdoer, and the Wrath of Heaven now pours forth mercilessly. Right and Might combined have defeated Might and Wrong. Prince Max of Baden has filled his *rôle* in the great drama. He came upon the stage to prepare the way for Peace; and as he passes out again into oblivion, words are upon his lips which will become historic:—

Germany has won a Victory over itself and its belief in the right of might.

Has the struggle been worth while? Millions of promising lives sacrificed; many millions broken in body; tens of millions distressed in mind, body, or estate. Fifteen hundred days of more than half a world wasted in the destructive arts of war. Was it all worth while? Even the very spirits of our dead will answer that it was—yes, well worth while—for the future has been saved for an entire world: fifteen hundred million lives of to-day and untold millions who will follow.

Might is for ever broken, we trust; respect for Right for ever enthroned, we pray. Torn out by the deepest roots is the cancer that threatened all existence that would not bow the knee to the Idol of World Power. The downfall of that idol having been secured, we are free to tread again the almost forgotten paths of Peace, and devote ourselves to more congenial avocations. But those paths require re-making; those avocations will be pursued in an altered atmosphere. 'Twere fatal to ignore these two essentials to-day.

The feelings of deep satisfaction that the issue brings us all is finding expression in justifiable rejoicing. The bells of St. Paul's Cathedral are ringing as we write, and from ten thousand throats there issue shout and song. Our pent-up feelings have waited for relief. Now shall we all give praise to God.

It is inevitable that the world's rejoicing should be mingled with the poignancy of grief. Chastened by sense of loss, yet not unconscious of the glory of achievement, we permit our laughter and our cheers to smother our tears and choke our deep emotion. We will reverently remember in loosening our restraint that vast army of men by whose supreme sacrifice the Victory has been won—the great company that has passed on to the heritage of the Spiritual Silence beyond. Soon our Conquering Heroes, lately so valiantly beating back the foe, will be returning, but these others hear the grand acclaim from Higher Powers. They

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have received their reward, but they brood o'er us, and we shall not forget them and the price they paid. They have died for us that we might live in greater freedom. Yet may we not say that even for them it has been worth while?

They climbed the steep ascent to Heaven,

And there are those—many of them readers of these lines—who sit alone in sorrow. The very centre of their hopes, their plans in life, four years ago, is gone. An unseen hand came forth and crumpled up the plans upon which they spent such fond affection, and left in place thereof the destiny that these should help to win the Victory. We will remember the brave, proud sorrowing ones.

What of ourselves and Peace? History alone, and that after many years of mature observation and judgment, will record how revolutionary the effects of the times have been upon the life, thought, and character of the nations. The hours are vibrant with wondrous possibilities if we go forward in the spirit of our heroes. May we prove worthy of them all, and of the grand inheritance that through these great events Providence has willed as ours.

THE KELVIN LECTURE.

On Thursday last week, at the opening meeting of the new session of the Institution of Electrical Engineers, we heard with fascinated interest the tenth Kelvin Lecture, which was delivered by Mr. Llewelyn B. Atkinson. The lecturer chose for his subject certain theorems presented to the world by Lord Kelvin—then Prof. William Thomson—in 1853, relating to the energy associated with every distribution of electricity, magnetism, or electric currents, which had lain practically dormant until now. The more we learn of the work accomplished by Lord Kelvin, and of the extraordinary range and thoroughness of his investigations in electrical science, the more we are amazed at the extent of his genius, thankful that he lived in the days when that science was practically virgin soil, and proud to claim him as one of the most eminent of our fellow-countrymen. Moreover, even if he had never engaged in electrical research, his achievements in other branches of physics would have sufficed to ensure his everlasting renown as a scientist of the first rank, a fact which intensifies our admiration of his gigantic intellect.

The original theorem demonstrated that the electrification of a conductor, the magnetisation of a substance, and the flow of an electric current, each represented a definite amount of energy of which the value could be calculated. The lecturer, with consummate ability and originality, discussed the meaning of this statement and its bearing upon practical working conditions. He examined each case exhaustively, analysed the conditions, and classified the results clearly, his remarks being illustrated by a large number of diagrams and a few simple models. Unfortunately, it was impossible in the time available for him to read the whole of the address, which, moreover, is too long and detailed for reproduction in our columns whilst the scarcity of paper under which we labour continues: but enough was imparted to achieve one object of the lecture—namely, to stimulate the investigation of electrical problems from a new point of view—and abundantly to justify the claim of the author that there are "wide fields for new designs and experiments," the cultivation of which may lead to new departures of which no one can foresee the limitations.

Listening to the author's admirably lucid and masterly exposition of a subject which in other hands might have been rendered abstruse and tedious to the last degree, we were irresistibly reminded of that other paper which Mr. Atkinson read in 1898, when he gave the outline theory of almost every type of alternating-current motor that has since been developed and brought into practical use. Probably few of our readers are acquainted with that paper—a paper which, in view of subsequent developments, was of the first importance, and should have been made available to every electrical engineer. Unfortunately, it was read before the Institution of Civil Engineers, and was, therefore, entombed in the official *Proceedings* of that body, which does not permit the Press to reprint the papers read at its meetings. Now Mr. Atkinson has again rendered a great service to the industry by directing its attention to some of the unexplored possibilities which lie before it. Amongst these are included the development of an efficient electrostatic ignition machine to take the place of the magneto, a reciprocating electric motor, and possible improvements in variable-speed motors, and in generators. As regards the first of these, we have on several occasions drawn attention to the pressing need for a direct-current generator capable of developing a very high pressure—from 50,000 to 100,000 volts—for use in connection with radiography, agriculture, the precipitation of dust, testing cables, &c., and, in view of the little progress that has so far been made in the evolution of electrostatic generators of the frictional and influence types, we agree with Mr. Atkinson that there is plenty of room for invention along these lines, to which his clear generalisations should afford great assistance. But this is only one of the many directions in which progress is possible, to which the tenth Kelvin Lecture may be expected materially to contribute, and we offer hearty congratulations to the author on his presentation of an excellent lecture, which will take its place amongst the classics of electrical literature.

Hints to New Zealand Traders.

On another page space is devoted to certain portions of the report of H.M. Trade Commissioner in New Zealand (Mr. R. W. Dalton), which deals with Great Britain's position in the machinery trade of that Dominion, and also describes certain developments bearing upon future trade in that line. The possibilities in connection with hydro-electric enterprise are especially worthy of study. It is clear that if this country is to succeed in taking a proper share of prospective business in machinery in the Dominion, no time must be lost in recovering the ground left behind during the war, and that to do this effectively a greater and better organised effort will have to be made than British manufacturers have ever before embarked on in that market.

Mr. Dalton considers that the British manufacturer, prior to establishing trading relations, fails to make sufficiently careful investigations, and he specifies the electrical machinery trade as constituting an example of this faulty method. It is of no use for an exporter supplying articles for which there is a large and scattered demand to attempt to operate on the New Zealand market exactly in the same way as one supplying goods the trade in which is small and concentrated.

Writing at a time when peace could scarcely be considered as within sight, Mr. Dalton recommended manufacturers to complete their agency arrangements, even with the mutual knowledge that actual deliveries of goods could not be contemplated. Now, however, that hostilities have ceased, this recommendation becomes of vital urgency. There are many good firms in New Zealand who are anxious to complete their agencies by adding one or two new lines; but they cannot be expected to wait indefinitely, and there are not so many of them that we can afford to have them place their services at the disposal of our competitors.

There is need, too, for British firms to be more liberal in their treatment of their representatives. American principals have for some time held a vastly better reputation in this respect than we have, and on top of this we have latterly been subjected to criticism on the score of neglect of our old agents who have remained loyal to us during the war, when business was at a standstill, and, consequently, commission was not forthcoming.

Not a few British manufacturers and traders have had the opportunity of testing the soundness of Mr. Dalton's judgment in matters of export trade generally. There is now an opportunity of consulting him about the New Zealand market, as he is on a visit to this country, and invites callers to see him (by appointment) at the Department of Overseas Trade, 73, Basinghall Street, E.C.

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Electricity-Supply Restrictions.

In our "Notes" to-day will be found the text of a new Order issued by the Ministry of Munitions with regard to the supply of electricity. A careful comparison with the terms of the Household Fuel and Lighting Order which was issued in the summer shows that the new edict is more precise and comprehensive than the former; it applies only to electricity, and forbids the making of new connections, the giving of new supplies, and the *use* of electricity for any such purposes. It, therefore, now makes the consumer himself responsible for the observance of the rule, whereas the previous Order applied only to supply undertakers and contractors. It also covers *all* uses of electricity, whilst the former dealt only with lighting and heating. Moreover, it entrusts the power of granting permits for the relaxation of the regulation to the Director of Electric Power Supply, who is thus armed with power to veto every new application for the use of electricity. While it by no means follows that permits will be unreasonably withheld, this further extension of the Director's already extremely wide powers will not be regarded without concern. That there is a certain amount of unrest in electrical circles with regard to the situation as it relates to the grants of permits for the extension of electricity works under the present *régime* is indicated by the circular of the I.M.E.A. to Members of Parliament, which was published in our last issue, and it will probably find expression in the House of Commons before very long.

The terms of the circular are rather remarkable; it will be noticed that the Association claims to represent "practically the whole of the electricity supply undertakings in Britain"! With all due respect to the Association, whose importance we fully appreciate, we cannot admit the validity of this statement. According to the Board of Trade Committee's Report, in 1916, there were 327 local authorities and 230 companies operating undertakings under statutory authority, the capital expenditure in the former case being 55 millions, and in the latter 36 millions sterling; hence the claim of the Association, even if its membership embraced the whole of the municipal undertakings, would appear to be somewhat exaggerated. Moreover, it is within our knowledge that enormous additions have been made to municipal power stations during the war—extensions which, when fully disclosed, will astonish the reader—and, in the absence of particulars, we are at a loss to know in what the "lack of uniformity of treatment" that is complained of consists. The Director has an exceedingly difficult office to fill, and his decisions must necessarily have regard to all the conditions to which the war has given rise, and which cannot be equally familiar to his critics. The fact remains, however, beyond dispute that dissatisfaction exists in certain quarters, and if it be not allayed, the success of the scheme for national electricity supply may be seriously jeopardised. It appears, therefore, that the appointment of the Board of Electricity Commissioners is a matter of extreme urgency; it will not do for the Board of Trade to delay action until its scheme has reached maturity—the situation is developing with great rapidity, and the importance of the question cannot be exaggerated. Demobilisation will shortly commence, and the change-over from the manufacture of munitions to industrial production has already begun. We therefore feel bound to urge the Board of Trade, with all the emphasis at our command, to lose not another hour in pressing forward the national scheme, and, as a first step, to set up the Board of Electricity Commissioners at once, even though it be necessary to pass a short Act of Parliament to provide it with authority for this purpose.

The importance of immediate action will be better understood when we add that it has come to our knowledge that directly hostilities came to an end a circular letter was addressed by the Ministry of Munitions to all the supply undertakings of this country, inviting them to forward particulars of any extensions of plant and mains that they might have in view, especially such as were unavoidably postponed during the war, in order that urgent requirements might be met as far as possible. The establishment of a controlling authority, or at least an advisory body, to co-ordinate all such extensions in accordance with the national interests is therefore a matter of the utmost urgency.

Provisional Orders.

In view of the prospective reorganisation of the electric supply industry, and of the fact that the bulk of such supply is given under Provisional Orders, it may be of interest to review briefly the position in this respect as it is to-day.

A supply of electricity to the public is given either by a statutory or a non-statutory undertaking. The non-statutory undertakings are practically negligible; they are small and unimportant, and would number, say, about 70 or 80.

As regards the statutory undertakings, the legal authority for these may be either a Licence, a Special Act, or a Provisional Order. The first method has long been a dead letter; no licences have been granted since 1902, and only 33 licences have been granted altogether, none of which are now in force.

As regards the undertakings working under Special Acts, these are mainly power companies or undertakings which have combined their electricity supply with gas or tramway undertakings.

The remaining class of statutory undertaking, and the procedure most favoured, is that of the "Provisional Order," and it is under such provision that the bulk of the capital invested in electricity supply has been expended.

The number of Provisional Orders in force in 1915 was 881—56 in London and 825 in other parts of the kingdom. Of the total of Provisional Orders, 425 are in the hands of local authorities and 456 in the hands of companies or private individuals. For some years past, all important areas have been already covered by Provisional Orders, so that although a good many Orders appear from year to year, these, in the main, are either for small towns or for areas where there is some prospect of industrial or other development, or for extensions of existing Orders.

The total capital expended under Provisional Orders and Acts (company and municipal) is about 91 million pounds, the bulk of this being, of course, expended under Provisional Orders.

Since the outbreak of war a good number of applications have been made for Provisional Orders, but these are at present hung up, pending legislation on the lines of the Board of Trade Electric Power Committee's Report. Among such applications are a certain number which have been formally granted, but they are rendered inoperative by the insertion of a clause leaving the date open on which the Order shall come into force. The few cases which have been completely granted have each had some special circumstances which justified their exceptional treatment.

The B. of T. Electric Power Committee's Report contains one or two points of interest with regard to Provisional Orders. It takes cognizance of the position of the non-statutory companies, and considers that these should be put on a legal basis. In order to do this at a small cost, it recommends that any new Provisional Orders authorising the supply of electricity to areas of a population of less than 5,000 should not require confirmation by Parliament.

The Report is also in favour of the procedure by way of Provisional Order being simplified, as recommended by the Sub-Committee of the Ministry of Reconstruction presided over by Sir George Murray—namely, the Acquisition of Powers Sub-Committee. This Sub-Committee was appointed to consider the question of reducing the cost and simplifying the process of obtaining Parliamentary powers. Incidentally, the Sub-Committee refers very favourably to the procedure regarding Provisional Orders as administered under the Electric Lighting Acts. But the point in this Report which is of particular interest in the present connection is the recommendation that Parliament should be willing to authorise that any Provisional Order which was unopposed might be allowed to take effect without further Legislative enactment, after having been laid before Parliament for the prescribed period.

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THE CHARACTERISTICS OF THE COMMUTATOR AMPERE-HOUR METER.

By G. W. STUBBINGS.

The commutator ampere-hour meter formed the subject of a good deal of discussion some years ago, and very varied opinions as to its performance were expressed. On the one hand, curves were published as representing the average performance of meters of this class which were so bad as to make it surprising that the meters had any sale at all. On the other hand, the advocates of this meter confidently predicted for them a hopeful future, and asserted that for small consumers the mercury-type meter would soon be considered obsolete. Neither of these extreme opinions has been justified by subsequent experience. The commutator meter is still used to a considerable extent in this country, and in suitable circumstances has given very satisfactory service. For accurate registration on small loads the commutator meter has not been found to be entirely suitable, on account of the fact that the low-load accuracy, which may be very high when the meter is new, rapidly falls off after the meter has been on circuit for some time. For these requirements the mercury-type meter still holds its own, the commutator meter finding more useful application on circuits where the minimum load is fairly high.

The theory of the commutator meter does not appear to be well understood. The writer has heard it stated that the addition of an eddy-current brake to a meter of this class completely alters the form of the speed-load characteristic. A speaker at the discussion on Messrs. Ratcliffe and Moore's paper on "Electricity Meters," read before the I.E.E. in 1911, stated that for maximum accuracy the sum of the armature and shunt resistances should be made equal to the friction moment, and condemned the practice of designing these meters with a high armature resistance. As these views are more or less misleading, it may be useful to inquire briefly, from a theoretical point of view, into the nature of the characteristics of the commutator meter.

The earliest meters of this class consisted of a small electric motor connected across the terminals of a low-resistance shunt which was placed in the circuit to be metered. As there was no eddy-current brake, when the current was switched on, the armature would commence to rotate, and would accelerate till the armature current was just strong enough to develop sufficient torque to overcome the friction. Denoting the resistance of the armature circuit by R, the resistance of the shunt by r, the total flux by B, the number of turns in the armature by N, the friction torque by f, the currents in the main, shunt, and armature respectively by C, C_s, and C_a, and equating the torque developed in the meter to the friction torque, then—

$$K\,B\,N\,C_a = f,$$

K being a constant. Equating the E.M.F.'s in the shunt and armature circuit—

$$K\,B\,N\,\omega + C_a\,R = C_s\,r,$$

ω being the angular speed of the rotor. Remembering that $C_a + C_s = C$, and eliminating C_a from these equations, we finally obtain—

$$\omega = C\,r/K\,B\,N - f(R + r)(K\,B\,N)^2.$$

If in this equation f be put equal to zero, the first term will give the speed of the meter under ideal conditions, and the percentage error of the meter will accordingly be given by the equation—

$$\epsilon = -100\,\{f(R + r)/K\,B\,N\,C\,r\}.$$

From this equation it is seen that the error is inversely proportional to the load, and the error curve of the meter, therefore, is a rectangular hyperbola. The error at any load will be proportional to the friction and inversely proportional to the flux. Increasing B will, therefore, not only decrease the speed of the meter, but will also decrease its inaccuracy. The effect of varying R and N is not so simple, as these quantities are not necessarily independent. If the weight of copper in the armature windings be constant, the resistance of these windings will then be proportional approximately to N^2. Assuming that in these circumstances f remains constant, it is easy to show that the error is a minimum when the armature resistance is equal to the sum of the resistances of the shunt, and the commutator and brushes. This result is of little practical value, as this condition would, owing to the small value of N, involve an excessive speed. Actually the limiting values of ω/C, B, and r are fixed by practical considerations, thus also fixing the value of N. The value of R will then depend mainly upon the armature weight permissible.

The above expression of the percentage error of the unbraked meter represents its initial inaccuracy only, and not necessarily its inaccuracy after prolonged service. In course of time not only will the friction increase, but the magnets will weaken, and the contact resistance of the brushes will increase. The effect of an alteration in B will be to increase the ideal speed of the meter, and as the meter has been adjusted to read correctly at the former speed, the alteration in calibration will cause an error of registration. As the speed, neglecting the error term, is inversely proportional to the flux, a small percentage change in B will make a similar percentage change in ω. The effect of an alteration in R, due to increased brush friction, will not affect the calibration of the meter, and will only affect the error term. A small percentage increase in R will therefore cause an approximately equal percentage increase in the percentage error, the magnitude of the effect being negligible. An increase of 10 per cent., for instance, in the value of R, will mean that a meter having an error of 3 per cent. will have this error increased to about 3·3 per cent. The comparatively small effect of a change in the contact resistance of the brushes in an unbraked meter is worthy of note.

The speed of the unbraked meter with permanent magnets of ordinary size is very high, and in most meters this speed is reduced by the addition of an eddy-current brake moving in the field of the driving magnet. In meters having a disk-shaped armature, the aluminium casing containing the coils serves as the brake. The effect of the brake is to reduce the speed of the armature till sufficient current flows to develop a torque equal to the sum of the friction and braking torques. Equating these torques, we have, m being a constant depending upon the shape and material of the brake—

$$K\,B\,N\,C_a = f + m\,B^2\,\omega,$$

and

$$K\,B\,N\,\omega + C_a\,R = C_s\,r.$$

Eliminating C_a from these two equations, we finally obtain—

$$\omega = \{K\,B\,N\,C\,r - f(R + r)\}/\{(K\,B\,N)^2 + m\,B^2(R + r)\}.$$

The speed of the meter has thus been reduced, the ratio of the unbraked to the braked speed being—

$$1 + m\,(R + r)/K^2\,N^2.$$

The percentage error of the meter will be—

$$-100\,\{f(R + r)/K\,B\,N\,C\,r\}.$$

This expression is the same as that obtained for the unbraked meter. The effect of adding the brake has been, therefore, merely to lower the speed, the initial accuracy of the meter remaining the same.

The ideal speed of the braked meter can be written as $K\,N\,C\,r/B\,\{K^2\,N^2 + m\,(R + r)\}$. The effect of a diminution in B, through the gradual weakening of the permanent magnets will be to alter the ideal speed of the meter, and to introduce an error of registration equal to the percentage change in B. It will also be noticed that R, the armature resistance, appears in the expression for the ideal speed. Any change in R, due to increase in brush contact resistance, will therefore alter the calibration of the meter by an amount depending upon the braking effect. The error of registration caused by such alteration of R will, therefore, be appreciable, and for this reason it is necessary in braked meters to have a fairly high armature resistance, in order that a change in the brush contact resistance will produce but a small percentage change in R. In this respect there is then a marked difference between meters of the braked and unbraked types.

It is now well known that a mercury type shunted meter will register accurately on varying loads. Since in the commutator meter the control is partly effected by the back E.M.F. of the armature, the behaviour of the meter on varying loads is worthy of investigation.

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If L_s and L_a be the coefficients of self-induction of the shunt and armature circuits respectively, we have, equating E.M.F.'s, for any conditions—

$$C_s r + L_s \cdot d C_s/dt = C_a R + L_a' \cdot d C_a/dt + K_1 \omega.$$

Substituting $(C - C_a)$ for C_s, multiplying throughout by dt, and integrating between the limits T_1 and T_2 at each of which times $C = 0$—

$$r Q = (R + r) \int_{T_1}^{T_2} C_a \, dt + K \theta,$$

where Q is the total quantity of electricity that has passed, and θ is the angle turned through by the armature. The equation of motion of the moving element can be written, I being its moment of inertia—

$$b C_a = m_1 \omega + I \cdot d \omega/dt.$$

Multiplying by dt, and integrating as before between T_1 and T_2 at each of which times the armature is at rest—

$$\int_{T_1}^{T_2} C_a \, dt = m_1 \theta/b.$$

Combining the second and fourth equations of this paragraph—

$$Q = \theta \{K_1/r + m_1 (R + r)/b r\};$$

and this equation is precisely similar to that which would be obtained on the assumption of a constant current. The commutator meter will, therefore, register accurately on varying loads.

Since the ideal speed of the unbraked meter is $C r/K B N$, by making the shunt of a material of negligible temperature coefficient, the effect of temperature on the accuracy of the meter will be very small, such effect only taking place in the error term. The speed of the braked meter, neglecting the back E.M.F. of the armature can be written as—

$$\omega = K_2 \cdot r \rho/(R + r),$$

where ρ is the volume resistivity of the material of the brake. If α be the resistance temperature coefficient of this material, β that of the armature windings, and n the ratio of armature resistance to shunt resistance, it is easy to show that the temperature coefficient of the meter is—

$$\alpha - \beta \cdot n/(n + 1).$$

As α and β usually apply to copper and aluminium respectively, and $n/(n + 1)$ is nearly equal to unity, this temperature coefficient can be made negligibly small. The effect of the back E.M.F. of the armature will be to cause an apparent increase of n. The above approximate value is thus worse than the actual value.

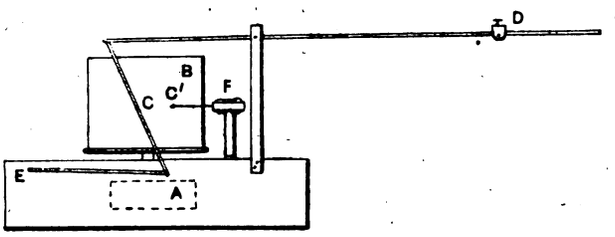
A SIMPLE CHRONOGRAPH.

By C. W. MARSHALL.

It is now generally recognised to be essential for all electricity supply undertakings to have accurate data as to the characteristics of their oil switches. Data regarding new switches can be obtained from the manufacturers, but older types must be investigated by their owners. The apparatus described has been found very serviceable, and can be thoroughly recommended as a cheap and reliable article. Practically no skill is required either to build or to operate it. Refering to the figure, A is a gramophone motor, such as can readily be purchased second-hand for a few shillings, B is a drum taken from an obsolete recording ammeter, and fitted on the gramophone record turntable; C D E is a three-element lever system. The long arm is made in sections, for convenience in transport. When testing the speed of a switch, the sliding saddle D is connected to a convenient point on the switch mechanism, and the length of the lever is adjusted so as to give a suitable travel to the recording pencil which is at C.

The drum is then set to revolve at a speed commensurate with that of the apparatus under test, and "opening" and "closing" curves of the switch can be taken as required. Experience has shown that a drum peripheral speed of 50 cm./sec. gives excellent results with the usual types of oil switch; but even a very cheap motor will drive the drum at 500 cm./sec. if necessary. A very gratifying feature of the motor is its constancy in speed over long intervals, and cyclic irregularities are quite negligible. This renders it quite unnecessary to fit any additional apparatus to mark the time-co-ordinates directly on the record except in specially important cases. In such cases the ingenious appliances described by Dr. Garrard in a recent paper to the I.E.E. could be used. Metallic paper is generally used in conjunction with a silver point, and the records obtained in this way are very satisfactory. The paper is fitted on the drum by two rubber bands, one being at the top and the other at the bottom.

The apparatus could be made more compact if spiral records were considered allowable, as the charts could be put directly on the gramophone turntable. The form



A Simple Chronograph.

described is, however, somewhat more convenient when space-time curves are being differentiated to give velocity-space curves.

The fitting shown at F is used for determining the times of action of relays, fuses, &c. The fuse, for example, is connected in series with the energising coil of the electromagnet. When the current is switched on, the pencil C' comes into contact with the revolving drum, and when the current is interrupted by the blowing of the fuse, C' leaves the paper. The length of the line is a measure of the time taken to blow the fuse. For convenience in obtaining "fusing-current" "time" curves, the height of F is variable.

PROPOSED EXTENSIONS AT STOKE-ON-TRENT.

The County Borough Council on October 30th considered Sir John Snell's report, to whom had been referred the Electricity Committee's proposal to spend £110,000 on extending the central power station. The report dealt with (1) the cause of the annual deficit in the working of the electricity department; (2) the necessity or otherwise of the proposed extension of the central power-house and of the proposed H.T. main to the Denbigh Castle; (3) the proposal to add a uniform percentage to both lighting and power rates, and whether some differentiation should be made between the two classes of supply; (4) the future position of Stoke arising from the probable action to be taken throughout the country as a result of the report of the Electric Power Supply Committee of the Board of Trade; (5) the Corporation's relations with the tramway undertaking. The position was rendered more complex by reason of the existence of five power stations and four separate distribution districts and systems. A summary of the conclusions and recommendations of the report is as follows:—

The net loss of £3,769 for the financial year ending March 31st last arose partly from the awards of the Committee on Production and of Sir George Askwith ante-dated to September 1st and October 1st, 1917, respectively, and partly from the insufficient increase added to charges made to consumers. Several months' notice had to be given of any intended increase in charges, and thus no special addition could have been made in 1917-18 to cover the wages awards. The increased charges, which from August 1st last amounted to 75 per cent. on pre-war rates, should guard against any deficit during the current year. The public must realise that coal had risen from a pre-war average of 11s. 5d. per ton to an average to-day of 24s. 8d., an increase of 116 per cent. (the actual price at the central station being over 29s. per ton), that wages had risen over 20 per cent. during the last year, and that interest on capital was seriously higher. Therefore charges to consumers should be reasonably increased to cover these costs. Instead of the uniform 75 per cent. which the Corporation had added to all consumers' accounts, lighting consumers should have been charged with 87 per cent. increase, and power consumers 72 per cent. These additions should give the same result as the uniform 75 per cent. all round. As a matter of policy, however, the latter increase should remain unaltered, at any rate, for the current year.

There were certain pre-Federation contracts in the Burslem area on which the Corporation was losing heavily. They

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ought never to have been entered into at the low prices contracted for, as it would not have been possible for the small Burslem station to have ever supplied power at ½d. The charges to consumers differed in each of the four districts to an absurd and entirely unnecessary degree, and the time had now come when the scales of charges should be made uniform. The present time afforded an excellent opportunity to prepare for such a change, and a scale of charges could be judiciously fitted to meet all cases.

There were five systems now being worked within the Borough, viz.: 3-phase, 50 cycles; 1-phase, 100 cycles; and D.C. 480, 460, and 440 volts respectively. The efficiency of distribution was 70 per cent. The sooner those distribution systems were unified the better. In the first place, certain of the single-phase sub-stations should be changed over to the 50-cycle system, and supplied from the central power-house without a double transformation. That improvement could only be carried out gradually, but when completed would save over 3,000 tons of coal per annum by shutting down the steam plant in the original Hanley station. The whole of the D.C. consumers ought gradually to be changed to the pressure of 480 volts, and the other two pressures eliminated; the necessity for that improvement was, however, not pressing. Though the several stations were not strictly comparable, the coal consumption per unit at Burslem, Hanley, Longton, and Stoke was much higher than at the central station. Had it been possible to generate all the energy at the latter station in 1917-18, instead of at five different places, there would have been a saving of at least 5,700 tons, or £5,195—although the coal cost per ton delivered was lower at the local stations than at the central station. Could that end have been attained, the total saving would have amounted to £11,400 per annum; there could be little doubt as to the correctness of that figure.

The site of the central power station was not a fortunate one for a large station; the canal water apparently could only be used through the agency of cooling towers, and the amount of make-up water was strictly limited. The station was on the top of a hill, with the boilers at the highest part of the site. All coal had to be carted at considerable cost, which, however, might be somewhat reduced by the use of electric vehicles. The design of the station did not lend itself conveniently to extension for large units, and facilities for coal storage were quite inadequate. The Corporation was not justified in incurring any expenditure other than was absolutely necessary upon a station which would certainly be outgrown in a few years' time. It was, nevertheless, essential to concentrate the generating plant; just sufficient plant should be added to the central station at the lowest possible cost. Steps should be taken at the same time to secure an adequate site elsewhere, with the best water and coaling facilities, so that after the war a station might be erected containing large units and all modern appliances. Inquiries ought to be made as to the availability of waste heat from the blast furnaces or local coke ovens, as those sources of energy ought to be utilised to the advantage of the suppliers and the public.

The total load in 1917-18 was 4,419 KW., and it was estimated there would be a new maximum load of 6,250 KW. in 1922-23. With the completion of the present 3,000-KW. extension and the addition of another 3,000 KW. the station would be able to meet the demand for another two or three years. The present boiler capacity was insufficient, and three new boilers of 25,000 lb. each should be added. No more than was absolutely necessary should be spent on extensions to buildings; it was lamentable to think that there was the old Hanley station next door, of which some use could not be made. Two new cooling towers, each of 200,000 gallons, were required. Owing to the present cost of wood, the possibility of using canal water direct or a cooling pond with sprinklers should be considered. The necessary changes at the local stations would involve a third 600-KW. converter and switchgear at each station. Some further development of the general H.T. cable system would also be required for some time to come. A proper protective system ought to be included for the H.T. cables; partial provision had already been made for that, but the then director of electric power supply postponed the proposal to complete the scheme.

The total cost of the extension and improvements (possibly reduced to £89,000) would be £102,000, the capital charges on which would be covered by the saving previously referred to, and there would be a net surplus to carry forward.

Stoke was 30 miles from any other large electrical undertaking, and it was not likely, therefore, to be included within any new and larger electrical district which might be set up. With the expansion of the future, the Corporation would be asked to undertake the supply of electricity within a radius of 10 or 15 miles from the borough. The H.T. system was of the right kind, collieries were actually within the district, and the sole difficulty was the want of ample condensing water. It would be advisable for the Corporation to be prepared with a well-considered scheme for submission to the Electricity Commissioners when that body was set up, and there was no time to be lost.

The tramways were considered as a probable consumer. The Corporation had the right to purchase the greater part of the system in 1924, and the other parts in 1932. It would be in the public interest if the Corporation would now negotiate with the company (*a*) to settle by consent the date for the purchase of the whole system; (*b*) to shut down the company's two small generating stations, and to purchase energy from the Corporation.

After considering the report, the Council decided to proceed with the expenditure of £102,000 for extending the central power station, and postponed the question of a new station on another site.

THE TRADE OF NEW ZEALAND.

The following extracts of interest to the electrical and allied trades have been taken from the recently-issued report of H.M. Trade Commissioner in New Zealand (Mr. R. W. Dalton). The full report may be obtained from the Stationery Office, price 3d. (Cd. 9175.)

Machinery Imports.—This is the first year in which the imports of machinery from the United States have exceeded those from the United Kingdom. Since 1914 the share of the United States in the total trade in this class advanced from 24.6 per cent. to 41.2 per cent., while in the same time the share of the United Kingdom has declined from 59.0 per cent. to 39.9 per cent. If one could regard the future in this trade with satisfaction the position would not be as disquieting as it seems, but, as a matter of fact, it will probably be in this line that British manufacturers will be hardest put to it to recover lost ground. Since I came to New Zealand I have referred repeatedly to the question of our position in the engineering and machinery trades, both in published reports and in confidential reports to the Board of Trade. It is, perhaps, unnecessary to cover the same ground again, but I would urge that previous suggestions made by me should be given the most careful attention. As I have frequently pointed out, our position is particularly weak in certain machinery, and in some we do practically no business at all even in normal times. In some cases the reason is that our firms have not attempted to make certain machines on a competitive basis, but in others it seems only too true that our agency systems and pioneering work are not as thoughtfully planned, or as energetically carried out, as they should be. After the war there will be a considerable opportunity here for the sale of machinery and plant, in connection both with the development of industries, whether primary or secondary, and with the execution of public works which are admitted to be urgently necessary. It is not safe to imagine that because this is a British Dominion our trade here must necessarily be safe. American firms have not only secured some of their most valuable trade since the war in British Dominions, but, apparently, they have also designed and organised to do so. I hope that firms and associations at home will realise this, and will take steps to see that, as soon as the war is over, if not before, expert investigations are made and plans laid to go more energetically into this branch of trade in New Zealand.

The imports of *electrical machinery* from the United States increased from £60,701 in 1914 to £113,615 in 1917, while those from the United Kingdom decreased from £392,168 to £305,249. I have reported at length to the Department of Overseas Trade on the subject of the development of the electrical trade in New Zealand and the competition of the United States. The question is also referred to in my last annual report. Japan has increased her trade in *insulated cable and wire* from £8,853 in 1916 (the first year in which Japan supplied this market) to £10,052 in 1917. I am told that the wire supplied from Japan is not at all satisfactory.

Hydro-Electric Developments.—The development of roads and railways will call for urgent attention, but it seems likely that the chief part of the public works programme of the Government will be the utilisation of water powers for the production of electric energy. This matter was referred to at some length in my last annual report, and it is one to which firms at home should give the closest attention. The hydro-electric works at Lake Coleridge have been so successful that not only is the Government convinced by its success of the practicability of developing other schemes, but the general public is prepared to press the authorities (and is already pressing them) to proceed with the large programme which has been drawn up. The programme provides for a series of schemes designed to supply the whole of the North Island with hydro-electric power from three sources eventually to be linked together. The Chief Electrical Engineer to the Government, in a report on the possible development of hydro-electric schemes in the North Island, suggested the utilisation of waters of the Mangahao River, the Waikato River, and Lake Waikaremoana, the first to supply the south-east and south-west, the second the centre and north-west, and the third the north-east of the North Island. It was suggested that the first two should be proceeded with at the earliest possible moment, and that the third should be deferred until railway communication in the Hawkes Bay and Poverty Bay districts had been improved. Considerable pressure is being put on the Government to proceed with all these schemes at once. Whether the Government decides to proceed with all three schemes together or not, it seems certain that the first two will be undertaken as soon as possible. It would seem, moreover, that New Zealand is cer-

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tain to witness an era of hydro-electric development on a large scale. I cannot too strongly urge upon firms at home the desirability of watching this development closely, in order that they may get a reasonable share of the work which will be offering. It is believed here fairly widely that foreign firms have practically a monopoly of experience in high-tension water-power schemes. Foreign firms, too, are well represented, and have been able to consolidate their position in the market during the war. Consequently, if British firms are to obtain a reasonable share of the business which will undoubtedly offer, it will be necessary to show considerable activity.

So far as the Lake Coleridge scheme is concerned, it may safely be said that the development of the use of energy in the district covered is only limited by the inadequacy of the available supply. The Christchurch district is convinced of the value of electricity for all purposes, and the Government has found it necessary to limit new installations until the water-power works can be extended. It is anticipated that the scheme will give rise to considerable development of industries which are helped, or are made possible, by the availability of electric power. It is also proposed to utilise electric energy extensively for agricultural and dairying purposes, and a beginning in this direction has already been made. The Christchurch City Council is most enthusiastic in its advocacy of the use of electric power, and is giving every facility (subject to the limitation of supply) for new installations and for the development of new uses; it is also giving special service to encourage the use of electric vehicles for transportation and delivery purposes. The Government engineers (Mr. Evan Parry and Mr. Laurence Birks) are giving every possible assistance throughout the district to new industries depending on electricity, and are closely watching and encouraging distributing enterprises which have been initiated or are proposed. The total installed capacity of the Lake Coleridge works is now 8,000 H.P., but an additional unit is on order having a capacity of 4,000 H.P.

The following extract from the Public Works Statement presented to Parliament in the middle of 1917 will give an indication of the development of the Lake Coleridge scheme:—

> The financial results of the year's operations may be considered satisfactory, and a balance of £7,865 was carried to the net revenue account. The prospects for the present year are promising, and there is every indication at present that the undertaking will earn sufficient to meet interest charges and depreciation as well as working expenses.
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> During the year the feeder lines have been extended from Belfast to Kaiapoi, but owing to the lack of material and other considerations extensions in other directions have had to be postponed. Urgent requests have been received from Akaroa, Southbridge, Leeston, Timaru, and other municipalities and districts on the route of the transmission line from Christchurch to Timaru, but it has been impossible to comply with these requests. The demand for power threatens to exceed the capacity of the present machinery, and, having regard to the difficulty of obtaining delivery of machinery and plant on order to cope with the demand, the Department has declined for the present to enter into fresh contracts of any magnitude. A request has also been addressed to the Christchurch City Council and other local authorities taking a supply from the Department to exercise restraint in making new contracts.
>
> In order to tide over the difficulty of shortage of plant, and to enable the Department to place the whole of the machinery in Lake Coleridge in service, a contract is being negotiated with the Christchurch Tramway Board and with the Christchurch City Council for the use of their steam plant for stand-by purposes.

Apart from the schemes definitely proposed, other districts in New Zealand are pressing for works to meet their needs. Amongst these the Southland district, largely through the activities of the Southland League, hopes to proceed with its own scheme to meet urgent needs pending the inauguration of a Government scheme. Powers are being sought for this purpose, and if these powers are given a steam plant will be installed to serve the greater part of the southern district of the South Island.

THE DYNAMICAL THEORY OF ELECTRIC ENGINES.

The tenth Kelvin Lecture was delivered before the Institution of Electrical Engineers on November 7th by Mr. Llewelyn B. Atkinson, M.I.E.E., who said that the prodigious growth of electrical science and its applications made it difficult for the younger generation of electrical engineers to realise what Kelvin was or what he did for electrical science between the years 1845 and 1895; in his own experience there were many of the present generation of electrical engineers who were quite ignorant of some of the scientific truths which Lord Kelvin presented to the world. He therefore purposed to concentrate attention upon one of such truths, and its results, which he thought was and had been overlooked and ignored.

In 1853 Lord Kelvin, then Professor William Thomson, read a paper before the Glasgow Philosophical Society on the "Mechanical Values of Distributions of Electricity, Magnetism, and Galvanism," in which he, for the first time, enunciated the principle that every distribution of electricity, magnetism, or electric currents had a definite energy value which was calculable, and he gave expressions for some of these values. This paper of Kelvin's was the first definite statement giving the method of calculating the energy related to electrical and magnetic conditions.

The original paper was divided into three heads. The first dealt with electrostatically charged bodies. He said:—"The mechanical value of any electrification of a conductor has a perfectly definite character or may be calculated by means of formulæ demonstrated in this communication. The simplest case is that of a single conductor insulated at a distance from other conductors, or with only uninsulated conducting matter in its neighbourhood. In this case the mechanical value of the electrification of the conductor is equal to half the square of the quantity of electricity multiplied by the capacity of the conductor."

Later on he gave the general case of a system of electrified conductors and showed that the general expression for the energy W was

$$W = \Sigma (Q V),$$

where Q was the quantity of electricity on each conductor and V the potential of the charge.

The paper then passed on to the case of the mechanical value of magnetism. By a very subtle process of reasoning Kelvin arrived at the result that if W was the total energy in a given volume of magnetic material, R the magnetic force, and k the permeability, every element of volume contained energy proportionate to the square of the magnetic force and to the permeability, and the total energy W was

$$W = \frac{1}{8\pi} \iiint dx\,dy\,dz\,(k)\,R^2.$$

The part of the paper dealing with the energy of electric currents was ultimately expanded in Nichol's Cyclopædia, from which the following is taken:—

"Hence it is concluded that the mechanical value of a current of given strength in a linear conductor of any form is determined by calculating the amount of work against electro-dynamic forces required to double it upon itself, while a current of constant strength is sustained in it. The mathematical problem thus presented leads to an expression for the required mechanical value consisting of two factors, of which one is determined according to the form and dimensions of the line of the conductor in any case, irrespectively of its section, and the other is the square of the strength of the current. The mechanical value of a current in a closed circuit, determined on these principles, may be calculated by means of the following simple formula, not hitherto published,

$$\frac{1}{8\pi} \iiint R^2\,dx\,dy\,dz,$$

where R denotes the resultant electro magnetic force at any point $(x\ y\ z)$.

"This expression is very useful in the dynamical theory of magnetic electric machines and electromagnetic engines."

Referring to the last paragraph, Mr. Atkinson said it was curious that neither Lord Kelvin nor any other writer had, in fact, developed the theory of generators and motors on the basis he then proposed, and it was the purpose of this lecture to show how a general theory and classification of electric engines arose from the principles Kelvin enunciated. The history of science and engineering showed many instances of the advantages arising from viewing a subject from a new standpoint. There was, in fact, a tendency at all times for the standpoint to crystallise, and accordingly for progress more or less to stop; a new standpoint might form a starting-point for new results, and it might be that to look on some problem with the eye of one of the founders of electric and magnetic science might form such a new starting-point.

The paper cannot be abstracted with advantage. In his "conclusion" the author said:—

"We may briefly review what ground has been covered. It has been shown that starting from the Kelvin original discovery and statement of the energy relations of the electrical and electro-magnetic quantities of any electric system, we may classify electric engines by the changes taking place in the energy put into such systems or taken out, electrically or mechanically. We have seen that we can then arrive at the ideal or possible efficiency of electric engines of various types. . . . The general types and cycles of electric engines have been classified and considered and their efficiencies set forth. And thus those words of Kelvin quoted at the beginning where he says the expression for the energy of an electromagnetic system may be very useful in the theory of electric engines have been justified. But the author hopes that this lecture may have some further use. The author has spoken of the advantage of a new view point, in stimulating thought and invention. It took something like 2,000 years to come from the original steam jet engine of Hero to the Parsons turbine. It may be that some of the early and simple types of electromotor may be revived in a much shorter time if the principles and reasons of their inefficiency are grasped. There is every reason why rotating machinery should be driven through belts or gears from rotating electric motors, there is no good reason why the brake air pumps on an electric train should not be driven by direct reciprocating motors.* We have considered that next to defeating the German armies the production in our own country of a magneto for petrol engine ignition has been the most remarkable achievement of the war. The possibility is that one tithe

* To realise some of the cycles described requires the solution of some questions, notably the putting of a coil out of circuit at the moment the current is zero. Some form of electrical non-return valve of higher efficiency than the aluminium valve has to be contrived.

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of the energy devoted to this reproduction might have developed an influence electrostatic generator for the purpose, of much simpler and cheaper construction. In any case, the use of electrostatic generators for some purposes would rapidly follow were they constructed of reasonable efficiency and moderate compactness. The younger members of this institution may well look into some of these questions, there are wide fields for new designs and experiments, and it is possible that the thought of the energy aspect which Kelvin put before us will prove to be fruitful of new departures. It is because the author thinks this aspect has been overlooked that he has ventured to go over ground that may have been already traversed by some of his hearers, but which was never apart from the thoughts and ideas of the great discoverer of whom we remind ourselves to-night."

THE FUTURE OF ELECTRIC RAILWAY OPERATION.

The following are a few remarks dealing with the future of electric railway operation, which we abstract from Sir John A. F. Aspinall's presidential address to the Institution of Civil Engineers on Tuesday, November 5th:—

So much was going to be done in the future by electrical operation that Sir John was led to mention that it had been his lot to take a somewhat active part in certain phases of the Government Electric Power Supply Inquiry and to come into contact with many of those who were interested in the supply of cheap electricity for industrial use, and that had led to the conclusion that there was a very strong desire on the part of all who were likely to be large consumers to see that the views expressed by the Electric Power Supply Committee as to the creation of suitable power stations in well-selected districts were carried out, though there were various objectors to the details of the methods proposed. The leading idea was, however, one of co-operation in any well-devised scheme, and a recognition of the prospective advantages of at last having some central authority, possessing both knowledge and power, to deal with that great electrical question of power supply.

One of the most serious questions which any new body of electricity commissioners would have to decide was whether it was better to put the generating station in the midst of the coalfields or in the midst of the industries which it was desired to supply with power. Was it cheaper to convey the coal for generation by a long line of railway, or to convey electricity by a long line of copper?

Those would be nice questions involving the balancing of all-round costs, and would vary much in different districts.

The demand for electrical energy by the railways would be far in excess of that for any other industry, and it was open to doubt whether it was wise to divorce the control of generating stations for railway supplies from the management of those who were responsible for the operation of the traffic, and the same question arose when some of the great municipal supplies for tramway working as distinguished from lighting were considered. The movement of traffic of all kinds required the instant command of power, and knowledge of the requirements was not likely to be appreciated by those who had never come in contact with traffic problems. The super-power station was a modern necessity, and the question of that control required much discussion and thought.

There had been at least three Government departments which had considered that they had interests in connection with electrical matters, and their diversity of view had most frequently led to delay, and their decisions had often been guided by conservatism, and, sometimes, want of knowledge.

Electrical progress was so rapid that it could not prosper without a due recognition of the necessity for accepting changes of method, and the vigorous youth of the industry connected with it was such as to require the continuous assistance of broad-minded men whose one desire should be to assist in advancement.

It was not only in the manufacturing districts that electricity would be required, as we could now see that its use was extending to agriculture. That being so, it might be that the distribution of energy in agricultural areas would not only assist the farmer in working the light railways which he mentioned elsewhere in his address, but the very fact of electricity being thus used would facilitate its distribution along roads in the country where, if he would, the farmer could make use of it for the stimulation of his cornfields.

Had it not been for the war, he believed a very great extension of the use of electric power would have taken place in railway working, whereas no great additions to electrical plant—where they had not been initiated before the commencement of hostilities—had been possible during the last four years.

The three chief additions to our electrical mileage which had been opened recently were those of the London & South-Western Railway for suburban traffic, the London & North-Western lines to Watford, and the Lancashire & Yorkshire Railway between Manchester, Bury, and Holcombe Brook. The voltage at the third rail was 600 for the two former, and 1,200 for the latter.

So far there did not appear to be any reason for supposing that when we could begin again to do work of that kind it would be rapidly extended for long lengths of main line of railway, but electrical working would remain for the present as a great stimulator of suburban traffic.

It was really remarkable how, when each suburban line had been worked by electrical trains with great frequency and increased rapidity, there had been a very great growth of passenger traffic, and he could not help thinking that the probable course of events would be that we should find the electrification of the lines immediately round our great towns would quickly take place all over the country, and probably be added to in widening circles as time went on; but it was not until those widening circles began to touch one another, and thus enabled longer-distance trains to run between one great centre and another, that we should see electrical working used for long-distance passenger trains.

The additional revenue required to pay interest on the large capital outlay could be made most rapidly from the suburban traffic in well-selected districts and then the extension of main-line work could be carried out without outlay which, taken by itself, might be unremunerative.

For shunting and operating in and about large towns where there were already electric railways for suburban traffic, there seemed to be an immediate future, and we should possibly see the application of such methods to heavy goods trains at a later date.

When expressing the hope of seeing great progress in the future for electric traction, he again, as he had done on several previous occasions, ventured to suggest that there was much to be gained by regenerative control on electric railways. The difficulties of obtaining it in all forms of electric traction were known, but let us hope they might be swept away. It seemed a barbarous thing to continue to convert power at every stop into heat by the abrasion of the tire and the brake block instead of turning the stored-up energy of the train into useful work by the generation of electricity.

The very successful operations in America which were detailed by Mr. Hobart in his "James Forrest" Lecture* were an indication of what could be done in hauling heavy trains by electric locomotives. It might be necessary to mention one or two cases where our American friends had produced extremely powerful electric locomotives to show the way in which they were seeking for more efficient haulage.† For instance, a very powerful electric passenger locomotive for the Chicago, Milwaukee & St. Paul Railway had been produced of 3,200 H.P., with a tractive effort of 112,000 lb., measuring 90 ft. overall, weighing 266 tons, and having an adhesive weight of 330,000 lb.

For freight services the Pennsylvania Railroad had built an electric locomotive weighing 240 tons, of which 198 tons was on the twelve driving wheels. It had a starting tractive effort of 130,000 lb., and was fitted with regenerative control.

In that case two locomotives were used, one at the head and the other at the tail of the train.

When operating with two locomotives it was intended to haul loads of 6,300 tons on a ruling grade of 1.33 per cent.

We should look forward to hauling much larger and heavier goods and mineral trains, once our structure gauges were altered and our bridges were strengthened, and it might not be looking too far ahead to suggest that the use of wireless telephony was one of the things which was going to help the operation of long goods or coal trains in the future.

The very successful use of wireless telephony by our Air Force—which was using an efficient and compact apparatus—pointed to the possibility of a locomotive so fitted at the head of a train being put in easy communication with another locomotive at the end of the train, the drivers of both being thus able to work together, stopping or starting or applying the brakes on the instant of receiving a message which could also be communicated to the rear guard.

WAR ITEMS.

Steel Prices.—An order by the Ministry of Munitions is printed in full in the *London Gazette* for November 8th, modifying prices and provisions for dealings in certain classes of steel.

Non-Ferrous Metal Industry Act.—A further list of licences granted under this Act appears in the *London Gazette* for November 8th.

Dr. Walther Rathenau.—It is recorded in past pages of the Electrical Review that Walther Rathenau, of the A.E.G., while confessing that this war was started too soon, counselled Germany to see that that mistake was not made next time. What does Rathenau think now? Those who have cherished "next time" ideas may be safely left to the attentions of the German people, but the Allies also must not be unmindful of those who have entertained such devilish aspirations.

* Abstracted in the Electrical Review of January 28th, 1916.

† See Electrical Review, June 21st, July 12th and 19th, 1918.

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Herr Ballin.—Reports from Hamburg state that Herr Albert Ballin, managing director of the Hamburg-America Line, has died suddenly, at the age of 62. One dispatch attributes his death to suicide.

The Huns' Work at Lille.—According to a French correspondent at Lille, who reports the German destruction of textile factories and engineering works, some steam engines, completely finished, packed, and ready for transport, have been reduced to scrap iron. The dynamos, transformers, conductors, and apparatus in all industrial works have been carried off, excepting certain dynamos which it was possible to hide underground.

Exemption Applications.—Before the Kesteven Appeal Court, on November 5th, P. A. Baxter (26), electric wireman, engaged at the Grantham Electricity Works, appealed, and the manager, Mr. J. E. Edmundson, said that if the man left it would place them in a "hole," as he was now running a shift on the switchboard. Exemption to January 31st was granted.

Oxford Tribunal has granted three months' exemption to J. R. Colston (46, Grade 2), electric light fitter and contractor.

Tribunals and Demobilisation.—Sir Evan Spicer proposed, at a meeting of the Camberwell Tribunal, that the Local Government Board be informed that the Tribunal felt that it would be a great advantage to the State if the work of demobilisation was centralised at the town halls throughout the country, and the machinery on which the very responsible work of maintaining an equilibrium between the Army and public requirements had fallen so heavily should be retained for the work of demobilisation.

The Tribunal suggested that copies of the trade cards which have been made for individual men serving in the Army should be sent to the local Tribunals where they were employed, and that the tribunals, having full knowledge of local requirements as to labour urgently required in the various branches of industry operating in their area, could so arrange matters that these men could be demobilised by the Army in the order that they recommend, and would thus be discharged direct from the Army into their civil employment.

This would apply not only to men who have joined up voluntarily, but also to men whose cases have been dealt with on an appeal, either by the employers or the men, previous to their Army service. The Tribunal considered that no department of the Government could be more cognisant of the facts concerning these men than they were, holding, as they did, the records of the employers and the men which were taken on hearing their cases.

The Tribunal adopted the resolution.

Enemy-Owned Patents.—In the House of Commons last week, Mr. Wardle, Parliamentary Secretary to the Board of Trade, answering Sir R. Cooper, said an order had been made by the Board of Trade vesting enemy-owned patents and the benefit of enemy patent applications in the Public Trustee, and under the Trading with the Enemy (Copyright) Act the copyright in any works first made or published in an enemy country during the war also vested in the Public Trustee, who would hold the enemy property vested in him until the termination of the war. The ultimate treatment of this property as well as of enemy-owned trade marks was a matter which was engaging the consideration of the Government.—*The Times.*

The German Economic System After the War.—An article in *Der Welthandel* (October 12th) discusses the prospects of the German economic system in the event of peace being concluded on the lines of President Wilson's proposals. "The panic on the Berlin Stock Exchange has induced a feeling of pessimism, but the sharp fall in prices was not, the article claims, occasioned by any fears as to Germany's economic future, but was largely due to a reaction consequent upon the exaggerated prices, which have obtained for so long. It would be idle to deny that the peace on President Wilson's terms will bring about momentous changes in the structure of Germany's economic system, but the production and labour of a nation like Germany cannot be dispensed with by other nations, especially at a time when a shortage of goods and manufactured articles will prevail everywhere. Coal and iron, the main props of every vigorous industry, are found in abundance in Germany, and the war has caused the importance of lignite and its by-products to win more general recognition. Germany's zinc resources enable her to employ this valuable metal as a substitute for copper and other metals, while other nations cannot dispense with the high scientific standing of German chemists and engineers. If the dreams of many industrialists as to a westward extension of Germany's iron deposits are doomed to disappointment, she has ample supplies of her own, and will also have at her disposal Russo-Caucasian ores, quite apart from those of Sweden and Spain. During the war Germany's industries have made a great advance technically, and will be capable of fulfilling the tasks imposed upon them after the war. It is possible that at first export will encounter great difficulties, since raw materials will be hard to obtain, but the industries will find strong support in the home market, whose demands will at first be so large that there will be no question of exports. It must not be forgotten that during the war the industries of Germany's main rivals, the United States and England, have also advanced and been extended. Before the war Germany was ahead of all her rivals in fine steel manufactures, and these will doubtless remain the basis of the German economic system after the war, since it will be precisely the finished manufactures which will be in greatest demand, and since these products command higher prices than half-finished articles, by giving every encouragement to this industry Germany's finances will regain their equilibrium and her exchange be improved. With regard to the competition of countries now hostile these will doubtless try to continue manufacturing articles formerly obtained from Germany, but owing to the stress of war produced at home. But the shortage of labour and technically-skilled operatives will prevent England and America from making themselves industrially independent of Germany."

The foregoing note was in print before the Armistice was signed, but the comments are nevertheless interesting.

The Position of Munition Workers.—Whatever many people may feel regarding the excessive wages that have been received by large numbers of munition workers, and the prodigality of some of them, there can be no question that it would be a penny wise and pound foolish policy to deal with them other than considerately, even generously, now that the change over from war conditions in the factories has to be made. The upheaval in the industries during the past four years has been so great that it is not to be supposed that we can get over all our difficulties either in a hurry or without expense. The change to peace productions has to spread over some time, and the outlay of millions more of money will be justified if it help to obviate some of the industrial unrest that it is not unreasonable to expect during its progress. We print in full below the official notice that was issued by the Ministry of Munitions on Sunday evening last to contractors, sub-contractors, and workpeople engaged on the production of munitions:—

The statement of Dr. Addison was made on Tuesday in the House of Commons, but it is too late to deal with it this week.

The great task before the country is the transformation of industry from war to peace. This necessarily involves the disturbance and dislocation of industries and workshops, and very large numbers of workpeople will have to change their employment, and in many cases their present abodes. This must be faced. In order, however, that the change may be made with the least possible hardship and the minimum of waste, exceptional arrangements are necessary.

The Government intend to recognise in these arrangements the good work which has been done by munition workers in helping to bring the war to a victorious conclusion.

The Minister of Reconstruction, on behalf of the Government, proposes on November 12th, to make a statement to Parliament on the general reconstruction policy of the Government, and will give full details of the Government's intentions about unemployment, donations to demobilised members of H.M. Forces and civil war workers.

In order, however, that munition workers and their employers may at once be made aware of Government policy, the following instructions are hereby issued to all factories and firms engaged on work for the Ministry of Munitions:—

There should, so far as possible, be no immediate general discharge of munitions workers.

All workers, however, who desire to withdraw from industry or to leave for any reason, and all workers who can be absorbed elsewhere, should be at once released.

Production on contracts for guns and gun ammunition, machine-guns, small arms, and small arms ammunition; trench warfare mortars, bombs and stores, pyrotechnic stores, aerial bombs; all accessories of the above stores; aircraft and aero-engines; and the manufacture of explosives, should be reduced in the following ways:—

All overtime should be immediately abolished;

Systems of payment by results should be temporarily suspended and the customary notice of the transfer from payment by results to time work should be given.

When a transfer to time work has taken place a reduction of the hourly week should, wherever possible, be introduced. The reduction of hours will also apply to men already on time work, and in their case the customary procedure as to reduction of hours should be followed.

Whenever reduced hours are worked on a time work basis, the number of hours worked must not be less than one-half of the hours in the present normal working week of the establishment. If in any case the earnings of the workpeople for the full weekly number of hours on the short time system fall below the following amounts for:—

Men of 18 years and over 30s. per week;

Boys under 18 years 15s. per week;

Women of 18 years and over 25s. per week;

Girls under 18 years 12s. 6d. per week;

their earnings will be made up to these sums by the employer, who will be reimbursed by the State. Where time is lost, the amounts payable will be sums proportionate to the number of hours actually worked.

The adoption of half-time may cause unavoidable discharges, but every effort should be made to minimise unemployment, utilising employés for a short period on labouring and clearing up work. In allotting this work preference should be given to workpeople who are ordinarily dependent upon industrial employment.

All persons discharged, or claiming release, can obtain free railway warrants for journeys from the place of employment to their homes or to places where they have found new employment. The warrants will be issued through the Employment Exchanges. In cases where large numbers are required, warrants can be obtained by the employers from the Employment Exchanges for issue at the works.

Directions will be given at an early date with regard to war munition volunteers, Army Reserve munition workers, and other special classes of workers.

The foregoing instructions are issued for the guidance of contractors until individual firms receive further and particular instructions from the Ministry of Munitions. The loyal and cordial co-operation of all employers is confidently invited.

To provide for the abnormal period that must immediately follow on the cessation of hostilities, the Government have adopted as a temporary measure the following general scheme of non-contributory unemployment donation, which has been laid before them by the Minister of Reconstruction in agreement with the Minister of Labour.

The broad conditions of the scheme are that this unemployment donation shall remain in force for a period of six months from a date to be announced

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shortly by the Government, and that the benefit can be drawn for a maximum of 13 weeks during that period in cases where unemployment cannot be avoided. The other conditions and necessary safeguards will be explained by the Minister of Reconstruction in his statement to Parliament, and he will then also deal fully with the scheme that will be applicable to the demobilised members of H.M. Forces.

Under this temporary non-contributory scheme, which will remain in force pending the introduction of a general contributory scheme, demobilised civil war workers will receive benefits on the following scale:—

To unemployed men over the age of 18 years, 24s. a week.

To unemployed women over that age, 20s. a week.

There will be an additional allowance in respect of the first dependent child under 15 years of age, 6s. per week, and 3s. for each additional dependent child under that age.

There is a further provision for unemployed juveniles between the age of 15 and 18 of 12s. per week for boys and 10s. for girls, conditional on their attending a course of instruction approved by the Board of Education or other central department concerned.

It is necessary that industry should be rapidly transformed to peace conditions in order to provide permanent and reproductive employment for the civil workers and for the fighting men returning from the war. The proposals outlined above are solely intended to bridge over the inevitable period of dislocation.

It must be emphasised that the non-contributory scheme is a purely emergency measure. While it is in operation the existing compulsory unemployment insurance scheme will remain in suspense so far as benefits are concerned.

Contributions will, however, still be payable in order to build up a reserve of benefits for contributors when the temporary scheme comes to an end. Thus the special interests of contributors are fully safeguarded; in the meantime the Government are pressing forward with their scheme for general contributory insurance, which will be based on permanent considerations, and must not be prejudiced by the non-contributory scheme here announced.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

"Fraternity"—or Tyranny?

In answer to the question, propounded by your correspondent "Unity," "Would it not be better for the two societies to work in harmony, &c."? I am compelled to admit that it would! for the E.P.E.A., who are now in process of discovering the futility of demanding increases of pay, without the power to enforce such demands.

It is probable that our friends of the E.P.E.A. are realising the truth of this statement, and would like to combine with the E.T.U. to help them out of their present difficulty. If this is so, I would remind them that there can be "no representation without taxation."

Let "Unity" refer to the letter, in the same column of the current issue, under the heading "Work without Pay," in which, to the writer's personal knowledge, the recent demands of the E.P.E.A. are treated "with contempt," and characterised as "absolutely ridiculous" by the powers that be.

As to the tyranny side of the question, has anyone ever heard of an E.P.E.A. member refusing to receive any of the advances, bonuses, or other concessions obtained by the tyrannical methods *and* effective organisation of the E.T.U., nor do I anticipate any objection on their part to partake of any future benefits which may accrue, as the result of the efforts of this society.

Finally, if your correspondent is now satisfied that his society is entirely unable to ameliorate his present condition, then, in the name of common sense, let him join the society whose demands on behalf of its members are not, and never will be, treated as "absolutely ridiculous."

Scented Soap.

Smooth versus Undercut Commutators.

I was very interested in the short paragraph in your issue of the 8th inst. on the above subject, taken from the *Electrical World*, and I believe it would be useful to users and designers of D.C. machines if those who have had experience both of smooth and undercut commutators would express their views on this important subject. My own experience has been that, in general, it is advantageous to have the mica segments undercut to a depth of not more than 1/16 in. both in generators and motors, but I strongly deprecate the practice adopted by certain manufacturers of cutting down the mica segments ½ in. to ¼ in. below the level of the commutator surface.

Motors appear to work satisfactorily for the first year or two with deeply undercut micas, but in course of time the interspaces get choked with carbon and copper dust, and short-circuiting results, which overheats the commutator and frequently causes unsweating of the leading-in wires, and sometimes even burning out of the armature coils.

In some cases makers fill the deep undercuts with an insulating paste; although this is preferable to having nothing at all, it is by no means as satisfactory as mica, and if the motor happens to be over-oiled—a common fault when unskilled labour is employed—the chances are that the oil will soften the paste and cause a troublesome and sticky commutator.

Undercutting should not be adopted in the case of low-voltage generators used for electrolytic purposes where copper gauze brushes are provided, as this type of brush drags the copper across the undercuts and soon causes heating and loss of excitation.

Electric motors are being installed more and more widely every year by the small-power consumer—the butcher, baker, and candlestick maker—and this class of consumer expects his motor to work with practically no attention except regular oiling.

When squirrel-cage induction motors are universally adopted for small-power requirements, this ideal condition will become more nearly a reality, but at present with thousands of D.C. motors of between 5 H.P. and 10 H.P., working at 500 volts, the commutator is the part most liable to give trouble, and anything which will tend to make it work satisfactorily under adverse conditions is, in my opinion, worthy of the closest attention.

I trust that this letter will bring out the views of those who have experienced trouble with undercut or smooth commutators, and I feel sure, if the methods adopted for overcoming these troubles were stated, they would make interesting and valuable reading.

C. S. Buyers.

Glasgow, *November 9th*, 1918.

LEGAL.

Siemens Brothers' Litigation.

Mr. Justice Astbury was engaged on November 5th and 6th, in the Chancery Division, in hearing three actions in which Messrs. Siemens Bros. were concerned. The first two were brought by Mr. W. S. Morgan Burns and Mr. Chas. Eric Hambro against Siemens Bros. Dynamo Works, Ltd., and the other was brought by Messrs. Siemens Bros. & Co. against Mr. Burns and Mr. Hambro. The three actions were consolidated.

Mr. F. Russell, K.C., appearing for Messrs. Hambro and Burns, said that the actions mainly concerned the rights of the shareholders in the Dynamo Co. One of the two actions against the company related to the splitting of certain shares held by the plaintiffs in the Dynamo Co. Their holdings were large, and at present the shares were registered in three joint names, Mr. Burns's being the first. By the articles of association of the Dynamo Co. it was provided that only the person whose name was registered first should be entitled to vote, and one of the actions asked that the company should be ordered, as regarded a portion of the shares, to place them in the joint names in the reverse order.

His Lordship asked whether the action was not one taken by trustees.

Mr. Russell said that it was by trustees under a debenture trust deed. The second action, he said, raised the question whether the plaintiffs, Messrs. Burns and Hambro, validly demanded a poll at a certain meeting of the company. The third action, in which Messrs. Siemens Bros. & Co. were plaintiffs, raised a question, as mortgagors, as to the property constituting the security for the debentures. This consisted of certain shares in the Dynamo Co., and the question raised by Siemens Bros. & Co. was that although Messrs. Hambro and Burns were the registered owners of the shares in the Dynamo Co., they were not entitled to vote in respect of them except under the direction of Siemens Bros. & Co. The issued capital of the Dynamo Co. was 20,000 shares of £10 each, and, except for the seven signatory shares, they were all allotted to Messrs. Burns and Hambro, and their names were entered in the share register in respect of one block. The trouble, said counsel, arose in this way. There was a proposal to issue further debenture stocks by the Dynamo Co., and notices were issued convening a special meeting for that purpose. Suggestions were made at that meeting for the first time by those representing the Dynamo Co. that Mr. Burns was not entitled to vote in respect of his shares otherwise than at the dictation and request of Siemens Bros. & Co.; a doubt was thereupon raised as to whether the trustees were not being hampered and crippled in the exercise of their voting powers. The Dynamo Co., continued counsel, had a considerable number of enemy shareholders, and the Public Trustee, as custodian of these shares of the Board of Trade, was in negotiation with the company with a view to getting the company's articles altered so as to exclude in the future the enemy holdings, and the directors of the Dynamo Co. took the opportunity of altering the articles.

His Lordship, after hearing the arguments, gave judgment, in the course of which he said the plaintiffs in the first two cases were debenture stock trustees, and as part of their security they held 19,993 fully-paid £10 shares in the Dynamo Co. out of the total of 20,000. Under the articles of association it was provided that if more persons than one were jointly entitled to share, the person whose name stood first on the register, and no other, should be entitled to vote in respect thereof if a dispute arose between the Mortgagor Co., Siemens Bros. & Co., and the subsidiary company, Siemens Bros. Dynamo Works, Ltd., on the one hand, and the trustees on the other, as to the rights of the latter to vote in respect of the shares. A considerable portion of the dispute had already been settled by a decision in the Court of Appeal, on an

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interlocutory motion. As matters stood, Mr. Burns alone was entitled to vote in respect of the shares, and if, in the event of his illness or absence from other causes, he was unable to vote, he could not appoint his co-trustee as proxy. In order to exercise the voting power which clearly existed in the trustees, they had requested the company to transfer a portion of the shares into the names of Hambro and Burns, in order that if at any time one of the trustees should be ill or absent, the voting power which belonged to them as trustees might be effectively exercised, and they claimed a declaration that they were entitled to require the Dynamo Co. to alter the register of members by inserting the name of Hambro as the person first named in respect of a portion of the shares. He had come to the conclusion that the trustees were entitled to have their names so entered in the register as to enable them to be in a position to exercise their admitted voting power in the event of one of them being unable to be present at any meeting. There must be a declaration in accordance with the claim, and a direction to the company to make the necessary change in the register. The defendant company would have to pay the costs.

Lighting Regulations.

In a lighting case, at Halifax, last Tuesday, the Chairman of the Bench (Mr. T. Hey) said the magistrates considered it was now desirable that some relaxation should be made in the carrying out of the Order, and therefore they were not disposed to impose fines as large as had been usual. In this case the defendant need only pay the nominal penalty of 1s. Whilst the Order continued, of course, cases would have to be brought to the Court, and they could not be dismissed.

Accumulator Company Fined.

According to the *Times*, the Fuller Accumulator Co., Ltd., Chadwell Heath, were fined £10 at Stratford Police Court, on Saturday, for failing to have a man employed by them on a lead process medically examined at least once a month.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

North-East Centre.

The first meeting of the session of the North-East Centre was held at Newcastle-upon-Tyne, on November 4th. Mr. A. H. Marshall, the retiring chairman, in opening the meeting, referred to some of the more striking developments of the past session, and said the most noteworthy was the changed attitude of the Council towards provincial members. The Council had shown a strong tendency under their worthy president (Mr. Wordingham) to organise the Institution on a more democratic basis, and their new chairman, that night in addressing them, would do so, not as the chairman of the Newcastle Local Section but as chairman of the new North-East Centre of the Institution. That was significant of the new outlook. He mentioned as an example of the effect of that change, the fact that a paper, however originating, or of however high value it might be, could be read at Leeds, Manchester, or elsewhere as the case might be, if more convenient, before being read in London, and would be considered as having come before the Institution, just as much as if it had originally come before it in London. It had been decided also to devolve some of the research work upon the Local Committees, and generally to make them more efficient parts of the Institution. A very important matter was the setting-up of the Local-Sections Committee—an idea which had originated with their own hon. sec., Mr. J. R. Andrews. As to research work, he mentioned that they had been entrusted with research into armoured cables, upon the initiative of Mr. Clothier.

Mr. A. P. Pyne, M.I.E.E. (the new chairman), then delivered his address. He said that not the least startling change in industrial conditions during the four years of war had been the developments in connection with electricity, which, having regard to the apathetic or deterrent nature of legislation in the past, would probably have been unattainable in this country for many years, without the stimulating influence of the war. The progress that was being made was by no means confined to generation and distribution, but was even more marked in connection with the application or utilisation of electricity for numerous industrial purposes. Such applications might be divided into three main categories:—(1) The provision of driving power for large works extensions, and for enormous munition factories which, it was hoped, would ultimately be used for industrial purposes; (2) the creation of industries almost, or entirely, new to this country, and dependent on a bulk supply of cheap electricity for their exploitation on a large scale, as in the production of nitrogen from the air; with this group might also be mentioned the electric furnace and the electrostatic method of removing suspended matter from gases; (3) the driving by electricity of heavy machinery, plant, &c., previously associated with steam. Electricity might there be said to be encroaching on vested interests to a much greater extent than in the previous cases, and, consequently, development proceeded on different lines. Where steam had been used with success in the past, it would not always be easy to demonstrate that electricity could be used with still greater success. The most noteworthy examples of this class were the electric propulsion of ships and the electrical driving of large rolling mills. The former had not been attempted on any large scale in this country, but the application of the electric drive to rolling mills was proceeding rapidly, and the one or two motors of 8,000 to 12,000 H.P. installed within the last five years were already being overshadowed by machines of from 15,000 to 25,000 H.P. now under consideration, which, so far as he knew, were as large as, or larger than, any plant of a similar character existing in Germany, which country was, prior to the war, vastly ahead of us in the electrical equipment of rolling mills. Sufficient motors for large reversible rolling mills were usually operated on the Ilgner modification of the Ward-Leonard system; the whole of the plant being placed in properly constructed and ventilated buildings, was not subjected to the smoke and dirt inherent in a steel works, and, consequently, such standard practice could largely be followed in the general design and appearance of these machines, as was consistent with the heavy duty they were called upon to perform. The mill motor must necessarily be of the direct-current type, of slow speed, and capable of rapid reversals. It was usual to provide independent cooling by means of fans suppling filtered air. The voltage would be as high as was consistent with good commutation. The generator, or generators, of the Ilgner set would be designed for high speed, and of corresponding voltage and capacity to the mill motor. The driving motor of the Ilgner set might be designed for either alternating or direct current; if the latter was available in close proximity there was no objection to its use, and it would be slightly more efficient than alternating current. Usually, however, local conditions would necessitate the use of alternating current, which allowed greater latitude in the choice of voltage, though not so much in that of speed. Large non-reversing mills requiring, say, 2,000 H.P. and upwards, were generally direct driven, and smaller mills through gearing with a fly-wheel on the motor shaft. The cost of totally-enclosed machine-cut gearing was so high that a low-speed motor and fly-wheel coupled direct to the rolls became a cheaper and simpler proposition. In cases where the speed or duty of the mill rendered it difficult to obtain the necessary fly-wheel effect with a direct drive, a rope drive should have serious consideration. The driving of rolling-mill auxiliary machinery by electricity had been more readily adopted in this country than had the driving of the actual mill itself, and in these minor drives greater divergence of practice was noticeable. This raised the question of the relative merits of A.C. and D.C., and in this country there was a strong tendency to use, or, at least, to advocate the use of A.C. Generally speaking, alternating current was not as convenient as D.C. for furnace-chargers, cranes, and similar hoisting machinery; it was, however, good enough, and where available, should be used in preference to incurring the expense, losses, and upkeep of transforming apparatus. In order to appreciate the problem, it was desirable to review the operating conditions, and the steps that should be taken to meet these conditions. The chairman then proceeded to deal with electrical equipment for live rollers, skids, and screwing-down gears. He presented tables giving, in each case, the average of a series of observations taken under actual working conditions, which emphasised the severity of the duty:—

TABLE I.—Live Rollers.

Live rollers. No.	Size.	No. of reversals per min.	Time from full speed to full speed.	Max. input during acceleration.	Full-speed input.	Size of motor fitted (1-hr. rating).	Remarks.
	Dia. Length		Secs.	KW.	KW.	B.H.P.	
9	1′ 6″ × 9′ 0″	—	—	16·5	10·5	20	40-cwt. ingots
20	1′ 6″ × 7′ 6″	6	6	46·9	32·3	50	6″ × 6″ billets
14	1′ 6″ × 9′ 7″	9	7	52·4	39	50	12″ × 3½″ bulb angles

It would be seen that the principal features of this duty were the frequent reversals and the rapidity of acceleration. Live-roller trains varied considerably in number, size, and weight of rollers, and the motor fitted must be of corresponding H.P.; but the weight of the ingot, billet, or section did not appreciably affect the load on the motor.

TABLE II.—Skids.

No. of skids actuated.	No. of operations (out and back) per hour.	Time of each operation (out and back).	Total time motor is running.	Time of acceleration to full speed.	Max. input during acceleration.	Full speed input.	Kick when bar comes against the heap.	Size of motor fitted (1 hour rating).	Remarks.
—	—	Secs.	Min. per hour.	Sec.	KW.	KW.	KW.	B.H.P.	—
2	15	24	21	0·7	27·6	20·8	37·2	20	One 6 in. × 6 in. shell steel bar 14 ft. long.
2	12	28	21	0·9	23·5	19	26·2	20	ditto ditto.
2	—	50	31	0·6	35·8	27	—	20	Three bars. ditto ditto.

N.B.—Motor is capable of exerting five times normal torque.

This duty was somewhat different from that of live-roller gear; seeing that more time was available between operations, reversal was not so rapid, and, when returning the skid, the load on the motor was comparatively light. Heavy starting currents were, however, encountered, due to initial friction when skidding one or more bars from rest, and also to a possible attempt on the part of the operator to skid an excessive number of bars. Provision must

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be made for ensuring that the motor or gear should not be damaged when a bar was skidded up against a heap of bars or other obstruction, thus bringing the skid suddenly to rest with current still on the motor.

TABLE III.—Screwing-Down Gear.

No. of operations per hour.	Time taken by each operation.	Total time motor is running.	Max. input during acceleration.	Full speed input.	Size of motor fitted.	Remarks.
	Secs.	Mins. per hour.	kw.	kw.	B.H.P.	
192	5·6	18	29	16·7	50	48-cwt. ingots to 6" x 6" shell billets.
216	6·2	22	26	16	50	ditto.
216	6·4	23	22	15	50	ditto.

The main feature of this particular duty was the short interval during which the motor was running, frequently amounting to "inching round" only. The usual practice was to screw down the top roll against the pressure of the balance gear. The load was, therefore, constant when screwing down, and was very light; when raising the roll the motor might sometimes be rapidly reversed should the operator overshoot the mark. It was also possible to screw the rolls hard together, but this was unlikely to happen with ordinary care.

The chairman emphasised the need for motors for such drives being placed in accessible positions; and, for the provision of suitable gearing, enclosed in dust-tight gear cases. The insulating material should be the best obtainable, consisting wherever possible of mica or micanite. The recognition of the necessity for a special type of motor for rolling-mill auxiliaries, and the extent to which these motors were coming into general use, made a considerable measure of standardisation highly desirable. The sizes of motors used in any particular works should be standardised, and the number of such sizes kept within small limits. This was facilitated by the fact that high efficiency was of secondary importance, and must give place to reliability and rapidity of replacement, which, therefore, permitted of the selection for a given duty of a motor of somewhat larger size than would be considered good practice in normal commercial work. Further, in some instances—such as long trains of rollers—it was advantageous to use two small motors in preference to a large one, and this might help to keep down the number of sizes.

The following table, taken from an actual rolling mill, would, with the possible addition of two or three motors, cover all the requirements of most mills of similar size. The columns headed 1 and 2, showed for purposes of comparison, the sizes proposed by two firms originally tendering for the installation; the next column showed the size of motor actually installed, and the final column the average normal and maximum H.P. actually developed:—

TABLE IV.—Schedule of Motor Requirements for Typical Mill.

—	B.H.P. of motor. Proposed.	Proposed.	As fitted.	Actually taken.
	B.H.P.	B.H.P.	B.H.P.	B.H.P.
Approach rollers No. 1 ...	68 }	190	{ 50	56
ditto No. 2 ...	68 }		{ 50	41·8
ditto No. 3 ...	68 }	160	{ 50	49·6
ditto No. 4 ...	68 }		{ 50	53
ditto No. 5 ...	68 }	160	{ 50	47
ditto No. 6 ...	68 }		{ 50	48·7
Long rollers No. 1 ...	33	30	50	50·8
ditto No. 2 ...	33	30	50	46
ditto No. 3 ...	52	50	50	49
Return rollers	52	50	50	51
Short rollers	20	20	20	20·4
Screw down gear	20	20	50	21·4
Skid No. 1 ...	20	20	20	19·5
ditto No. 2 ...	20	20	20	22·2
ditto No. 3 ...	20	20	20	21·3
ditto No. 4 ...	20	20	20	18·5
ditto No. 5 ...	20	20	20	20·3

It would be seen that two sizes of motor only were in use, and this without excessive first cost or undue effect on the efficiency. Where the use of these special motors was extended to cranes, and where mills of various sizes were to be found in the same works, then some extension of the number of sizes was desirable; but in all, except very exceptional, cases it would be feasible, by judicious arrangement, to ensure that four sizes should not be exceeded. The speaker referred at length to the relative merits of the A.C. and D.C. motors, and came to the conclusion that, taking the system as a whole, under the conditions enumerated, direct-current would be found considerably more efficient. Size for size, the A.C. motor would be considerably heavier and more expensive. Speaking of switchgear, he said that some form of automatic starting apparatus was necessary that would permit of accleration at a predetermined rate, which must be as rapid as possible without damaging the motor, and which must take place independently of the operator, and magnetically-operated switches, known as contactors, had been developed, which satisfactorily met those conditions.

A short discussion as to A.C. and D.C. for mill driving followed, in which Messrs. Peterson, Arnold, Booth, and Roberts took part.

BUSINESS NOTES.

"Made in U.S.A."—The Executive Committee of the Merchants' Association of New York decided, on September 23rd, that the designation "Made in U.S.A.," in plain type form, should be used by all its members on all goods manufactured by them in the United States of America, and that the use of all other markings to identify the country of origin of such goods be discontinued. —*Board of Trade Journal.*

Trade In Poland.—A scheme is being promoted in Germany for the formation at Warsaw of a concern under the title of the Polish Electricity Co.-A.E.G., for the establishment of installations in Poland and the sale of machinery, plant, and apparatus, together with participation in the industrial undertakings in the "Kingdom of Poland." The founders are the A.E.G. and individuals bearing Polish names at Sopnowice, Warsaw, and Lodz, the share capital being £50,000.

Rumours Denied.—Mr. Thomas McLeod, chairman of the Power Plant Co., Ltd., West Drayton, Middlesex, writes to us as follows under date November 9th, 1918:—

It has come to our knowledge that reports to the effect that there are persons of enemy alien origin exercising influence in the management of this company are still being circulated. As these are detrimental to the interests of the company and likely to prejudice our business prospects, and are entirely contrary to the facts, we shall feel greatly obliged if you will kindly give us an opportunity of denying these rumours through your journal. The managing staff is made up as follows:—

R. J. McLeod	Managing Director.
Robt. C. Salt	Secretary.
W. E. Sykes	Assistant General Manager.
H. H. Thorne	Technical Manager.
R. E. Hughes	Works Manager.

The above gentlemen are all British born and of British parents. No capital whatsoever is now held either directly or indirectly by any person of enemy alien origin, and neither is there any person of alien origin holding any salaried position or receiving any benefit whatsoever from the activities of this company.

Liquidations.—Merton Metallurgical Co., Ltd., —Winding-up voluntarily. Liquidator, Sir Woodburn Kirby, of Bassishaw House, E.C. Meeting of creditors, November 18th, at 2, Metal Exchange Buildings, E.C.

Blackwall Engineering and Welding Works, Ltd.—Petition for winding-up presented October 15th. Order made November 5th.

Catalogues and Lists.—Consolidated Pneumatic Tool Co., Ltd., 170, Piccadilly, London, W. 1.—Catalogue No. 9 E, of 46 pages, containing illustrated descriptive matter relating to their "Duntley" portable electric tools—drills, grinders, compressors, coal and ore borers, electric hammer and blower, &c. Views are given of the works at Fraserburgh, Scotland, showing electric tool assembling and a machine shop, also an armature-winding shop at Westminster.

Messrs. Drake & Gorham, Ltd., 67, Long Acre, London, W.C. 2.—List No. 253, 28 pages, containing illustrations and brief tabulated particulars, including prices, of various types of electric lamps, reflector fittings, lanterns, pendant fittings, shades, electric fires of many designs, electric heaters, boiling rings, toasters, fuseboards, &c.

Trade Announcements.—We are informed that Mr. W. Holehouse, managing director of the Davenport Engineering Co., Ltd., and patentee of the Bradford Patent Cooling Towers, has severed his connection with the company and is commencing in business at 21, Morley Street, Bradford, on his own account, to design and manufacture special cooling plant for large turbines.

Mr. F. M. Burley, electrical engineer, having been discharged from the Army, has resumed business at 14, Hamlet Court Road, Southend-on-Sea.

The Enterprise Manufacturing Co., Ltd., of Gun Street Electrical Works, Bishopsgate, London, E.C. 1, have been appointed agents for the whole of London, and the South Coast for Messrs. S. Hodgson & Co., of Halifax. Illustrated and descriptive price lists of Hodgson's D.C. motors and two and three-phase induction motors have been issued.

Messrs. Evershed & Vignoles, Ltd., give notice that they have closed their City Office at 110, Cannon Street, E.C. All letters should be addressed to the company's sole address, Acton Lane Works, Chiswick, W. 4.

Book Notices.—The "Punch Almanack," 1919 (1s. net), which has been issued from *Punch* office, is well worth securing both for mirth at home and for sending to our men "over there," who will want all the reading matter that we can send them during the next few months.

"Cutting Lubricants and Cooling Liquids."—A memorandum on this subject has been issued by the Department of Scientific and Industrial Research (Bulletin No. 2), in which is brought together a large amount of useful information likely to be useful to users of cutting lubricants, and to increase efficiency of production. The skin diseases produced by lubricants are also dealt with.

"*Transactions* of the Institute of Marine Engineers." Vol. XXX September, 1918. London: The Institute.

"*Transactions* of the Illuminating Engineering Society." Vol. XIII, No. 7. October 10th, 1918. The Society: Easton, Pa.

"*Journal* of the Engineers' Club of Philadelphia." Vol. XXXV—10, No. 167. October, 1918. Philadelphia: The Club.

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LIGHTING AND POWER NOTES.

Bray (Co. Wicklow).—Price Increase.—The U.D.C. has increased the charges for electricity by 10 per cent.

Castlerea (Co. Roscommon).—Proposed E.L.—A new development company has been formed, with a capital of £10,000, to supply the town with electric light.

Clayton.—Prov. Order.—The L.G.B. has informed the U.D.C. and the Bradford Corporation that, until the Government has arrived at a decision with regard to the report of the Electric Supply Committee, no new prov. orders will be granted.

Continental.—Denmark.—The Copenhagen Corporation has accepted the report of its chief engineer, and voted the sum of £173,300 for increasing the output of its central station by 10,000 kw. The boilers were originally ordered in England some years ago, but as it was found impossible to obtain the necessary export certificate, a tender has been accepted from Jönköping, in Sweden, for three boilers for the sum of £87,000. A Swiss firm offered a 10,000-kw. turbo-generator for the sum of £69,000. The machinery was intended for Russia, but could not be sent there by reason of the political conditions of the country. The estimated cost of the buildings was £17,300. These prices are very high, but there is no prospect of any reduction, and the existing machinery is quite unable to meet even present requirements.—*Ingeniören.*

Norway. The Norske A.G. for Elektrokemisk Industri, of Christiania, is increasing its capital from £800,000 to £1,600,000, with the object of opening up further mines and increasing its electricity generating stations by utilising additional water power.

Dover.—Proposed Boiler Improvements.—The T.C. has referred back to the Electricity Committee a recommendation that the boilers at the electricity works should be fitted with underfeed stokers, to enable Kent coal to be used.

East Ham.—Year's Working.—The annual accounts of the Corporation electricity department (some statistics regarding which appeared on page 420 of our issue of November 1st) show that the total cost per unit was 1·59d., against 1·29d., including fuel, ·87d. against ·72d.; wages, ·17d. against ·14d.; repairs and maintenance, ·03d., or the same as in the previous year; rates and taxes cost ·15d., against ·14d.; and management expenses ·11d., the same as in the preceding year; 3,962,904 units were sold, against 4,063,721, including private lighting, 1,502,374, against 1,554,076; public lighting, 102,570 against 100,950; traction, 2,357,960 against 2,408,695; 262,150 units were used on the works, against 249,740, and 264,326 against 204,799 were unaccounted for. The maximum load was 1,722 kw. against 1,938, and the load factor 29·9 per cent. against 26·6d. per cent. The average price obtained was 1·75d. against 1·59d.; private lighting, 2·61d. against 2·29d.; public lighting, 1·67d. against 2·16d.; tramways, 1·21d. against 1·11d.

Halifax.—Prov. Orders.—The B. of T. has informed the Corporation that it has decided not to entertain further applications for prov. orders for electricity supply until a decision has been arrived at with regard to the report of the Electric Supply Committee.

Ireland.—Water Power.—Mr. J. C. White, chairman of the Belfast Electricity Committee, has been asked by the B. of T. to become a member of the Sub-Committee for Ireland, appointed with the concurrence of the Minister of Reconstruction, to examine and report upon the water-power resources of the United Kingdom, and the extent to which they can be made available for industrial purposes. The Sub-Committee, of which Sir John P. Griffith is chairman, will deal specially with Ireland. Mr. White was associated with engineers in London as legal adviser for the Ulster Power Bill some years ago.

The Coleraine U.D.C. has applied to the Irish Society, in connection with the utilisation of water power at Cutts, Coleraine, for the generation of electricity, and the Society has promised to consider the matter.

Keighley.—Wages.—The Committee on Production has increased the war wages of charge engineers, switchboard attendants, &c., at the Corporation electricity works to 23s. 6d. per week, plus 12½ per cent. on total earnings, as from the first pay-day in October last.

Lighting Restrictions.—On Monday the Home Office issued instructions, which apply to Great Britain generally, to the effect that the shading of lights may be withdrawn, except in certain areas specified by the Admiralty, where lights are visible from the sea. Owing to the coal shortage, the prohibition of shop-window and advertisement lighting is still in force, and the total number of lamps in use for street lighting is not to exceed one-half of the normal. The use of lights in shop windows was allowed on Monday night only, as a special concession.

The B. of T. announced that the operation of Part III of the Lighting, Heating, and Power Order, 1918, relating to hotels, restaurants, clubs, and places of entertainment would be suspended during the present week.

London.—Stepney.—Year's Working.—For the year ending March 31st, 1918, the income of the B.C. electricity department amounted to £150,330, against £134,868 in the previous year, whilst the expenditure totalled £104,393, against £94,710. Debt repayments amounted to £23,527, temporary work done during the year to £409, and interest and other charges to £20,610, leaving a net profit of £3,642, compared with a debit balance of £3,584 in the previous year. Units sold numbered 24,880,717, a decrease of 2,130,813, and included—private lighting, 4,181,831, a decrease of 168,062; power and heating, 11,032,137, an increase of 158,775; public lighting, 156,856, a decrease of 22,367; bulk supplies in Stepney, 5,017,023, a decrease of 299,353; and public bulk supply, 4,492,870, a decrease of 1,799,806. The works and administrative cost per unit sold was ·993d., and the total cost 1·415d., compared with 1·232d.; the average income per unit was 1·450d. The maximum load was 11,105 kw.

Loughrea (Co. Galway).—For some nights during last week the town was practically in darkness, owing to the staff at the electric power station being laid up with influenza.

Lurgan.—Correction.—We regret that in our Lurgan note, last week, a name was spelled inaccurately. For *Mr. Scheneld* read Mr. J. Wardell Shemeld. Mr. Shemeld's relations on his father's side have been English for the past three or four hundred years.

Maidenhead.—Price Increase.—The T.C. has increased the price of electricity, as from December 31st next, by 1d. per unit for lighting and by 20 per cent. for power, a total advance on pre-war rates of 50 per cent.

Middlesbrough.—Year's Working.—At the annual meeting of the Cleveland Trust, Ltd., it was announced that the electric light undertaking showed a profit of £420.

Newport (Mon.).—Mains Extensions.—The American Red Cross Society has requested the Corporation to extend the electricity mains to the Coldra, 3½ miles from Newport, which is to be the chief American naval hospital in Europe.

Proposed Joint Supply.—The Town Councils of Derby, Nottingham, Leicester, Burton-on-Trent, and neighbouring towns have decided jointly to engage electrical engineers to report as to the best arrangement for securing the most economical supply of electricity in the district on the lines recommended by the B. of T. Committee.

Queensbury.—Electricity Supply.—The U.D.C. has granted permission to the Yorkshire Electric Power Co. for the supply of electricity to the whole of the Queensbury area.

Stirling.—Proposed Bulk Supply.—The Stirling Merchants' Association has decided to recommend the T.C. to take a supply of electricity in bulk from the Scottish Central Electric Power Co., instead of adding to its present plant.

Walsall.—Plant.—Further spare plant from the Corporation's electricity works at Wolverhampton Street has been sold for £800.

The Electricity Committee has approved of the claim of the Corporation against the Defence of the Realm Losses Commission in respect of commandeered plant.

The Committee recommends the purchase of a duplicate condenser motor for the Birchills station, at a cost of £325, a rotary converter at a cost of £3,370, and a feeder panel at a cost of £410, for the Darwell Street sub-station.

The change-over from 3,300 volts to 6,000 volts on the cable from Hospital Street to Darwell Street has been carried out.

Walkden.—Mill Driving.—Messrs. Burgess, Ledward and Co., of Wardley Mills, are about to adopt electric driving.

West Hartlepool.—Linking-up.—The Electricity Supply Sub-Committee has come to an agreement with the Cleveland and Durham County E.P. Co. upon the subject of linking-up supplies.

Proposed Loan.—The T.C. is to apply to the L.G.B. for sanction to a loan of £2,500, in connection with the extension of the supply of electricity to Irvine's Dockyard.

Price Increase.—From the December meter readings the charges for electricity to general consumers are to be increased by a further 10 per cent.

Wages.—The wages of shift engineers and station superintendents at the electricity works are to be increased by 5s. per week, and the wages of other employés by 3s. 6d. per week; in future the wages of these employés are to be automatically adjusted in accordance with the grants of the Committee on Production to the local engineering trades.

Whitwood.—Price Increase.—The Yorkshire E.P. Co. has informed the U.D.C. that the price of electricity for power will be temporarily increased from 1d. to 1½d. per unit from November 1st last.

York.—Price Increase.—The Electricity and Tramways Committee has decided that consumers of electricity in bulk, supplied under special agreements, shall pay an increase of at least 50 per cent. over pre-war charges.

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TRAMWAY AND RAILWAY NOTES.

Blackpool.—Proposed New Depôt.—In connection with the acquisition by the Corporation of the Blackpool, St. Anne's, and Lytham tramway system, the Tramways Committee has decided to acquire 4 acres of land in Rigby Road, for the purpose of a new central car depôt.

Clee Hill (Ludlow).—Proposed Light Railway.—A public meeting has decided in favour of a light railway to serve the Henley, Knowbury, Bitterley, Clee Hill, Doddington, and associated areas.

Continental.—Spain.—Application has been made for a concession for the construction and working of an electric tramway in the Province of Tarragona.

East Ham.—Year's Working.—The annual accounts of the Corporation Tramways Department show that the revenue for the year ending March 31st last amounted to £71,373, compared with £65,562 in the preceding year, and the expenditure to £67,712, against £61,069. Interest on loans amounted to £4,817; debt redemption to £5,881. Allowances to employés with the Forces amounted to £3,374, and £2,395 was transferred to the account from the borough fund, leaving a deficiency of £3,676 to be carried forward. The total cost per car-mile was 12·415d., including traffic expenses, 3·92d.; general expenses, 1·33d.; repairs and maintenance, 3·36d.; power, 2·02d.; and capital charges, 1·78d.; 1,442,436 car-miles were run, against 1,554,164, and 16,744,998 passengers were carried, against 18,618,754. The traffic revenue was 11·65d. per car-mile, against 9·91d., or an average of 1·01d. per passenger, against ·83d.; 1·7 units per car-mile were used, against 1·54.

Tramcar Lighting.—Following the Home Office instructions to the police authorities relaxing the lighting restrictions, normal interior tramcar lighting was resumed on Monday evening. The regulations as to headlights and red rear lights remain unaltered for the present.

United States.—N.Y. Subway Extension.—The New York subway extension system represents the world's greatest achievement in electric railway construction. It consists of 619 miles of track, serves four of the five boroughs of the city, and has a capacity of 3,000,000,000 passengers per annum. New York, after five years of construction work and the expenditure of $400,000,000, has completed and put in operation the greater part of her new system of rapid transit, known as the Dual System, because the Interborough Rapid Transit Co. and the Brooklyn Rapid Transit Co. have co-operated with the city in developing it. Four parallel elevated lines and a subway constituted the former rapid transit system in Manhattan. By the extensions, vast areas have now for the first time rapid transit and become easily accessible to the heart of the city. Thus the railway mileage of New York has been more than doubled, and it has the most extensive subway system in the world, comprising more than two hundred miles of underground railway. Some of the subway routes have necessitated the boring of tubes under the East river, at an enormous cost. Third tracks have been added to the elevated railways on which express service is provided during the rush hours, while instead of one subway there are now three, with express service all day. It is hoped that congestion will now be relieved, at least for a few years. A large amount of new equipment was naturally needed for the Dual System, and for this the Westinghouse Electric and Manufacturing Co. has furnished 600 control equipments and 978 motors for the Interborough lines, the total cost of this apparatus being over $3,000,000. To supplement its present power equipment the Interborough Co. has installed an 80,000-H.P. Westinghouse turbo-generator, which is the largest in the world. Further extensions are already being planned, notably a tunnel from Brooklyn to Staten Island.—*Electrical News.*

TELEGRAPH AND TELEPHONE NOTES.

Japan.—A large wireless station is to be built in Fukushima Prefecture, says the Department of Communications, and will cost 860,000 yen. The sending station will be at Hibarigahara, near Hara-Machi, and the receiving station will be at Hosoyacho. Survey work has been started by engineers of the Department. The direct distance between the new office and San Francisco is 4,600 miles, while that between the Funabashi office and Honolulu is 3,250 miles. Service will not be opened for two years. The new office will communicate direct with San Francisco without relaying in Hawaii.—*Indian Engineering.*

The Telegraph Service.—A New Federation of Postal Engineers was founded at Matlock on Saturday. The organisation demands to be treated separately in the application of the Whitley principles to Government departments.—*Daily Telegraph.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdeen.—November 21st. Great North of Scotland Railway Co. Six or 12 months' supply of stores, including telegraph material. Stores Superintendent, 80, Guild Street.

Bradford.—November 23rd. Tramways Committee. Stores for 12 months, including lamp fittings, insulating material, &c. General Manager.

Enniskillen.—December 1st. Sligo, Leitrim & Northern Counties Railway Co. 12 months' supply of telegraph material. Mr. J. Duff, Secretary.

London.—L.C.C. The Highways Committee recommends that tenders be invited for the supply of field coils, double cotton-covered wire, rolled-steel bars, for driving and pony-wheel axles, and insulated coils for magnetic brakes.

Manchester.—November 29th. Supply, &c., of three-phase, 6,600-volt sub-station switchgear at any sub-station in the area of supply. Specification, &c., from Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Newcastle-on-Tyne.—November 21st. Tyne Improvement Commission. Six months' supply of incandescent electric lamps and arc lamp carbons. Mr. J. McD. Mason, General Manager and Secretary, Bewick Street.

Spain.—January 20th. The Harbour Works Authorities (Junta de Fomento), of Melilla, are inviting tenders for the overhaul and repair, erection, and putting into operation, of an 80-ton Titan electric crane, which was sunk in the sea in March, 1914, and raised in 1916. No tender in excess of £6,400 will, it is stated, be considered.

Wakefield.—November 18th. Coal for the electricity works, Calder Vale, for year ending December 31st, 1919. Forms of tender, &c., from City Electrical Engineer, Old Town Hall.

Walsall.—December 5th. Electricity Supply Department. One 500-kw. rotary converter equipment. See "Official Notices" November 8th.

Warrington.—November 19th. Electricity & Tramways Committee. Underfeed mechanical stokers. Mr. F. V. L. Mathias, Borough Electrical and Tramways Engineer.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, November 15th. At 7 p.m. At 39, Victoria Street, S.W. Annual general meeting. Paper on "Some Notes on Newspaper Printing Presses," by Mr. H. J. Coventry.

Friday, November 22nd. At 39, Victoria Street. At 7 p.m. Lecturette, "Novelties in Pumping Machinery," by Mr. H. P. Anderson.

(Midland Section).—Friday, November 22nd. At 7.45 p.m. At the Imperial Hotel, Birmingham. Paper on "The Planimeter Simply Explained without Mathematics," by Mr. W. J. Tennant.

Institution of Mechanical Engineers.—Friday, November 15th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Adjourned discussion on papers already read, and if time permits paper on "Electric Welding," by Mr. T. T. Heaton.

Electro-Harmonic Society.—Friday, November 15th. At 6.15 p.m. At the Holborn Restaurant (Venetian Chamber). Ladies' night.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, November 15th. At 6.15 p.m. At Westgate Road, Newcastle-on-Tyne. Paper on "Scientific Research in Connection with Marine Engineering and Shipbuilding," by Sir Frank Heath.

Industrial Reconstruction Council.—Tuesday, November 19th. At 6 p.m. At the Institute of Journalists. Conference on "The Trade Unions of the Future," to be introduced by Mr. G. A. Isaacs.

Institution of Civil Engineers.—Tuesday, November 19th. At 5.30 p.m. At Gt. George Street, S.W. Paper on "The Tata Hydro-Electric Power Supply Works, Bombay," by Mr. R. B. Joyner.

Liverpool Engineering Society.—Wednesday, November 20th. At 8 p.m. At the Royal Institution, Colquitt Street. Paper on "Education in Relation to Industry, with Particular Reference to Engineering," by Mr. A. E. Berriman.

Royal Society of Arts.—Wednesday, November 20th. At 4.30 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. Inaugural address by Mr. A. A. C. Swinton, F.R.S., on "Science and the Future."

Belfast Association of Engineers.—Thursday, November 21st. At 7.45 p.m. At the Municipal Technical Institute. Paper on "Ljungstrom Steam Turbine and Generator," by Mr. T. H. Hurst.

Electrical Power Engineers' Association (Manchester and District Section).—Thursday, November 21st. At 7 p.m. At the Grosvenor Hotel, Deansgate, Manchester. Paper on "The Social Significance of Trade Unionism," by Mr. J. W. Thomas.

Institution of Electrical Engineers.—Thursday, November 21st. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "The Use of High Pressure and High Temperature Steam in Large Power Stations," by Mr. J. H. Shaw.

Students' Section.—Friday, November 22nd. At 7 p.m. At King's College, Strand, W.C. Address on "The Permeability of Faintly-Magnetic Materials," by Prof. E. Wilson.

Physical Society of London.—Friday, November 22nd. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary Meeting.

Manchester Association of Engineers.—Saturday, November 23rd. At 6.30 p.m. At the Grand Hotel. Paper on "Conveyors in Relation to Engineering Works," by Mr. W. H. Atherton.

Birmingham and District Electric Club.—Saturday, November 23rd. At 6.30 p.m. Concert (ladies' night).

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NOTES.

Electricity Supply Regulations.—The Minister of Munitions has issued the following order dated November 8th, 1918:—

1. No person shall on or after the date hereof except under and in accordance with the terms of a permit issued under the authority of the Minister of Munitions:—

(*a*) Connect or cause to be connected to any source or means of supply of electricity any place or any building, premises or plant or any part thereof not so connected at the date hereof, or

(*b*) Supply or cause to be supplied any electricity to any place or any building, premises or plant or any part thereof not supplied with electricity at the date hereof, or

(*c*) Use or cause to be used any electricity in or at any such place, building or premises or for the purpose of any such plant as hereinbefore mentioned.

Provided that in any case coming within the scope of the Household Fuel and Lighting Order, 1918, or the Household Fuel and Lighting (Scotland) Order, 1918, as defined by Clause 1 of these Orders respectively, where the previous assent of the local fuel overseer is required and has been duly obtained to any fitting, equipment, or supply under Clause 99 of the first-mentioned Order or Clause 77 of the secondly-mentioned Order, no permit hereunder shall be required for such fitting, equipment, or supply or the use of such supply.

2. All applications with reference to this Order should be addressed to the Director of Electric Power Supply, Ministry of Munitions, 3, Northumberland Avenue, London, W.C. 2.

3. This Order may be cited as the Electricity (Restriction of New Supply) Order, 1918.

Note.—The permission required by the Order is in addition to and not in lieu of the usual priority certificates and permit reference number.

Profit Sharing.—The Labour Co-partnership Association is holding a series of five conferences and discussions during November and December at Kingsway Hall, Kingsway, to discuss certain experiments in profit-sharing and co-partnership. The first will take place on Tuesday next at 4.30 o'clock, and subsequent dates are November 20th, 26th, December 4th and 10th.

Fuel Economy.—The great munition works of Coventry and Birmingham, while their output is ever increasing, are obtaining remarkable results in fuel and light economy. Saving, to help minimise the effects of the great coal shortage, is worked on system, and much ingenuity is shown in perfecting works arrangements. The magnitude of their fuel and light requirements has startled experts. In one establishment, typical of a score, the consumption is 200,000,000 cubic feet of gas—equal to 18,000 tons of coal—per annum, and 13,000,000 units of electricity, or about four times the electricity consumption of Watford with its 50,000 inhabitants.

The means of saving successfully applied in certain Midland works are:—

A careful grading of illumination to suit various classes of work.

Abolition of local lighting for separate machines and the substitution of general lighting with suitable reflectors and larger units such as the ½-watt metal-filament lamp and mercury vapour lamps.

A systematic patrol of the works to ensure that no unnecessary lights are kept burning.

Appointment of economy engineers whose sole duty is to supervise the operation of plant to secure the most economical results.

Periodic relining of shafting to reduce power consumption.

Burning of sawdust in steam boilers. One works saves 600 tons of coal per annum by this substitution.

Keeping down the temperature of workshops. In one well-known establishment the temperature is fixed at 55 deg. F.—*Board of Trade Journal.*

Volunteer Notes.—Royal Engineers (Vols.), London Army Troops Companies.—Headquarters: Balderton Street, Oxford Street, W. 1.

Regimental Orders No. 47, by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Captain of the Week.—Capt. W. Hynam.
Next for Duty.—Capt. W. D. Bentley.
Monday, November 18th, to Saturday, November 23rd.—Drills as usual.
Sunday, November 24th.—Commandant's Parade at Waterloo Station, 9 a.m., for Inspection at Esher. Drill order. Mid-day and tea rations to be carried.

C. Higgins, *Capt.* R.E., *Adjutant.*

Trouble at Johannesburg.—Municipal engineers of Johannesburg are again causing trouble by refusing to handle brake blocks procured from Cape Town.—*The Times.*

The Electro-Harmonic Society.—At the concert (ladies' night) to be held this evening at the Holborn Restaurant, commencing at 6.15 p.m., Mr. Gerald W. Partridge will be in the chair. Artistes: Miss Ada Forrest, soprano; Miss Dorothy George, contralto; Sapper Frank Webster, R.E., tenor; Sapper Joseph Farrington, R.E., baritone; Mr. F. Weist Hill, violinist; Mr. Walter Churcher, humorist; Mr. Maurice Charles, humorous cartoonist; Mr. Bernard Flanders, A.R.A.M., pianoforte solo and accompanist.

Appointment Vacant.—Meter tester and repairer for the Burton-on-Trent Corporation electricity department. See "Official Notices" to-day.

Electrical Trade Supplies.—The following letter has reached us just as we go to press:—

"May I ask the hospitality of your columns to draw your attention to a matter of the most urgent importance?

"Raw materials are in future to be apportioned to individual firms, not by Government Departments, but by Industrial Councils which are being set up to represent all the various trades, and these will be dependent on a Central Priority Council for their supplies.

"I understand that the engineering trade, for some reasons best known to themselves, have rejected the proposal of these Councils, and apparently intend to base their hopes on obtaining supplies on their various Employers' Federations.

"What is the electrical trade doing? Is it following the example of the engineering trade, or is it setting up its own Industrial Council?

"No one seems to know. I have made a number of inquiries, but everyone seems to be in the dark as to what is being done.

"I suggest that if such an Industrial Council is being formed by the electrical trade, a little information might be given in your columns by the secretary. If no such Council is contemplated at present, then I suggest that all firms interested should take immediate steps for its formation.

"Napier-Kimber, Ltd.
"A. W. Kimber, *Managing Director.*
"London, W. 1, *November 13th*, 1918."

Fire Warning.—The British Fire Prevention Committee has issued a timely warning against fire risks at celebrations and entertainments, of which copies can be had on written application to the Committee (8, Waterloo Place, S.W. 1), enclosing return postage.

Institution and Lecture Notes.—Institution of Electrical Engineers.—At the opening meeting of the session, last week, the president (Mr. C. H. Wordingham) moved a vote of condolence with the relatives of the late Prof. Bertram Hopkinson, Mr. J. O. Callender, and Mr. E. Russell Clarke; he also proposed that the Institution should establish a memorial to those who had fallen in the war. He announced the formation of a "Foreign Relations Committee" to facilitate the interchange of experience between British and foreign engineers, and the harmonising of their technical regulations—the latter function being already exemplified in connection with ship work. Premiums were then awarded to those who had read papers before the Institution during the past session, after which Mr. Ll. B. Atkinson read the Kelvin Lecture. At the close of the meeting some 40 members dined together informally at the Waterloo Restaurant.

Electrical Power Engineers' Association (Midland Division).—A general meeting of this Division was held at the Chamber of Commerce, Birmingham, on November 9th, when a large and representative gathering gave the president a hearty welcome on the occasion of his first meeting in Birmingham. Mr. Lunn, in the course of his address, reviewed the progress of the E.P.E.A. from its inception to the present time, and indicated the probable course of action of the executive in the future, his statements regarding the policy of the Association being unanimously endorsed by the meeting.

Southern Division.—At a recent meeting of the Divisional Executive Council of this Division, the following officers were elected for the ensuing year:—

Chairman, G. D. Bendix.
Hon. Secretary, A. C. Bostel, 3, Park Lane, Croydon.
Hon. Treasurer, W. L. Leece.
Hon. Publicity Secretary, T. W. Smith.

Inquiries relating to divisional matters should be addressed to the Hon. Secretary, as above.

Information *re* membership, &c., may be obtained from the Section Hon. Secretaries as under:—

London Western Section	...	W. J. Wilcocks, 8, Willow Avenue, Barnes, S.W. 13.
London Central Section	...	E. N. Christmas, 55, Calabria Road, N. 5.
London Eastern Section	...	W. Sawford, 74, St. Mary's Road, E. 10.
London South-Eastern Section	...	E. W. Martin, 169, Well Hall Road, S.E. 9.
South Coast Section	... ...	W. J. Gibbons, 8, St. Andrew's Road, Portslade, Brighton.
Portsmouth Section	... ...	P. L. Weir (*pro tem.*), 112, Laburnum Grove, North End, Portsmouth.
Bristol Section	... ...	F. J. Elliott, 8, Glena Avenue, Knowle, Bristol.

Junior Institution of Engineers (N.E. Section).—The syllabus of meetings for the new session, which opened on October 15th with a general discussion on the Coal Conservation Committee's Report, followed on October 29th with "Coal and Ash Handling Plants," by N. Thornton, contains the following:—

November 12th.—"Design of High-Speed Steam Turbines," by M. Ward.
November 26th.—"Boilers, Coal and Gas Fired," by Messrs. E. F. Oakford and S. H. Moore.
December 10th.—"Pumps, Condenser Systems, &c.," by Messrs. T. W. Stewart and H. J. Aldis.
January 7th, 1919.—"Design of High-Speed Generating U ," by G. Bonner.
January 21st.—"Design of Heavy Switchgear," by F. A. ard.
February 4th.—"The Construction of Large Transform

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February 18th.—"H.T. Transmission Lines, Overhead and Underground," by G. S. Lisle.
March 4th.—"Electrical Disturbances in Supply Systems," by L. C. Grant.
March 18th.—Subject to be announced later, by E. F. Oakford.
April 1st.—"General Electrical Indicating Instruments." by S. Evans.
April 15th.—"The Manufacture, Testing and Use of Portland Cement," by A. Stewart-Davies.
April 29th.—"A.C. Diagrams and their Systematic Development," by M. M. Hall.
May 6th.—"Design of Marine Turbines," by M. Ward.

Royal Society.—The following have been recommended by the President and Council for election on the Council for the ensuing year at the anniversary meeting on November 30th :—

President.—Sir Joseph J. Thomson.
Treasurer.—Sir Alfred Kempe.
Secretaries.—Prof. Arthur Schuster and Mr. William Bate Hardy.
Foreign Secretary.—Prof. William Herdman.

Other Members of the Council :—Sir George Beilby, Prof. Vernon Blackman, Mr. Charles V. Boys, Sir James Dobbie, Sir Frank Dyson, Dr. Martin Forster, Prof. Frederick Gamble, Dr. James W. L. Glaisher, Sir Richard Glazebrook, Sir Alfred Hall, Sir William Leishman, Prof. William J. Pope, Dr. W. H. R. Rivers, Prof. Ernest Starling, Mr. James Swinburne, and Prof. William W. Watts.

Royal Society of Arts.—The opening meeting will be held at 4.30 p.m. on Wednesday, November 20th, when an address on "Science and the Future" is to be delivered by the Chairman of the Council, Mr. Alan A. Campbell Swinton, F.R.S.

There is a long general provisional list of papers for next year on scientific and economic subjects by eminent authorities. The first series of three Cantor Lectures will be given by Dr. James C. Philip, Professor of Physical Chemistry, Imperial College of Science and Technology, on "Physical Chemistry and its Bearing on the Chemical and Allied Industries"; by Dr. J. A. Fleming, Professor of Electrical Engineering, University College, on "Scientific Problems of Electric Wave Telegraphy"; and by Prof. W. A. Bone, of the Imperial College of Science and Technology, on "Fuel Economy." The Juvenile Lectures are to deal with "Liquid Drops and Globules," the lecturer being Mr. Charles R. Darling, Lecturer in Physics at the City and Guilds Technical College, Finsbury.

Electrical Association of Australia.—In the course of an address to the N.S.W. Section, Mr. O. W. Brain, Government electrical engineer, stated that all the electricity consumed in the railway and tramway workshops and the numerous auxiliary services of the department throughout the metropolis came from the White Bay power house at Balmain.

The site at White Bay, he said, was an excellent one, especially in view of the proposed electric railways. The available area was sufficient for a plant having an output of over 100,000 KW. There was unlimited circulating water available from White Bay, and the site was fairly centrally situated in relation to the existing electric system and to the future suburban railway service. The requirements of railway traction might be expected to reach something of the order of 100,000 KW. within a measurable period after commencing operations.

The completion of the White Bay power house had progressed quite slowly for some time past, and it was not until May, 1918, that a full working equipment for ordinary operation was available. The following were the figures of the actual service for last May: Output in KW.-hours, 4,982,828; maximum load, 16,320 KW.; load factor, 42·3 per cent.; pounds of coal per KW.-hour, 1,934; pounds of steam per KW.-hour (used by turbines), 13·93.

For some time the department had been furnishing a supply to the Sydney City Council every evening, and provision had been made for an interchange of up to 6,000 KW. The Railway Commissioners would supply the Newcastle City Council with electricity in bulk, to meet the requirements of the whole district, from the Zarra Street power house, which had been designed for an output of 50,000 H.P. Already three important new industries were arranging to start under these conditions.

ELECTRIC STEEL FURNACES.—At Dudley, on Saturday, before the members of the STAFFORDSHIRE IRON AND STEEL INSTITUTE, Mr. F. J. Moffett read a paper on "Recent Developments of the Electrical Steel Furnace." In many parts of the United Kingdom the price per unit, he said, was now at such a level as to enable steel makers to employ the electric furnace for many purposes with commercial success. The cost of electrical energy was the most important consideration in the operation of an electric furnace. When it was possible to use blast furnace or coke oven gases for the generation of electricity, the cost could be brought very low. With the urgent need for economy in the use of fuel, and the demand for the by-products derived from coal, it was probable that in the period following the war very much more attention would be devoted to this method of power production. The supply of electricity to an electric furnace or furnaces could always be given at a lower rate than for the most other purposes, owing to the good load factor. They were, therefore, justified in looking forward to the possibility of obtaining in the near future electric energy for furnace work at a cost of something like 2d. per unit.

ELECTRIC WELDING OF SHIPS.—At a meeting of the Lancashire Branch of the BRITISH FOUNDRYMEN'S ASSOCIATION, held on Nov. 2nd at Manchester, a paper was read by Engineer Lieut.-Commander L. Jackson, R.N., upon "Welding," in which he described more particularly the method followed in effecting repairs upon the German ships which were taken over by the American Government.* In summing up, particular attention was drawn to the following points :—In welding cast-iron it was particularly essential that the welding material be held on the cast-iron surfaces with the greatest care, since it was the juncture between the cast-iron and the welding metal which was liable to be inferior. To accomplish this the welding metal should be laid over the cast-iron surfaces wherever possible before the patches were put in place. This method gave the welder more room to work, and permitted him to keep a steadier arc, and this reduced the probability of too much or too little heat spoiling that part of the weld. This metal as it was laid on the cast-iron surface should then be preened by a caulking tool, in order to develop any hard spot or spots where contact was not good. After this part of the operation was completed, the patches should be put in place and the completion of the weld then was merely welding of steel to steel, which was a very simple process.

Mr. Peakman, discussing the paper, said he had been interested in all types of welding for seven or eight years. All the people supplying apparatus for welding would say that they had never known a welded piece of steel to break at the weld—it was always away from the weld. Dr. Rosenhain, of the National Physical Laboratory, as well as others, was led to make inquiries why that phenomenon existed, and it was discovered that there was a boiling up of pearlite at the zone which had been produced during the welding at 600° C. It could be marked out as the spot where the weld would break unless annealed. Therefore, his advice to foundrymen was: "Do not weld if you can possibly avoid it. If you do weld, anneal afterwards."

Mr. W. S. Abell, chief ship surveyor of Lloyd's Register, read a paper upon "Electric Welding for Shipbuilding Purposes," under the auspices of the NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS, at Newcastle-upon-Tyne, on November 8th. Mr. Abell said that the question of the application of electric welding to ship construction had come very much into prominence during the past year, and the Committee of Lloyd's Register last winter conducted a series of experiments to determine the suitability of the process and the methods of its application. The lecturer dealt with the results of the experiments, and emphasised the importance of the tests to determine the ability of welded joints to stand the alternating stresses to which ships at sea were subjected. The opinion was expressed that electric welding was suitable for smaller-sized vessels, and if the result of its application to these craft proved satisfactory, he thought there was no question but that they would be justified in extending the use of the method to larger vessels. Prof. G. Stoney said electric welding marked a most important advance in structural work. It would be a great thing if they could get rid of riveted joints, and make a ship one homogeneous whole. He mentioned that a German aeroplane had been built up of steel tubes welded together, and if that could be done, why not a ship?

Bristol Technical Staff Engineers.—In our advertisement pages to-day is a notice of a mass meeting of Technical Staff Engineers to be held at the Grand Hotel, Bristol, to-day week, November 22nd.

The Nobel Prize.—The *Times* Stockholm correspondent says that the Nobel prize for physics for 1917 has been awarded to Prof. C. G. Barkla, of Edinburgh, for his discovery of characteristic Röntgen rays in elements.

Educational.—MANCHESTER MUNICIPAL COLLEGE OF TECHNOLOGY.—A report just issued for the years 1913-18 states that important researches have been undertaken for Government Departments. Although the war has drawn away from the College over two-thirds of its students, there are to-day actually more undergraduates than there were in 1911-12. At that time only 30 per cent. of those entering for the full course had matriculated. Now the proportion has reached 75 per cent. Seventy-five members of the College have laid down their lives for their country during the war, and many distinctions have been won by students. The delay in expanding the College buildings has made the need for extensions more than ever apparent.

£10,000 FOR SWANSEA TECHNICAL COLLEGE.—At a meeting of Swansea Town Council, recently, a gift of £10,000 from Mr. W. T. Farr, of Mumbles, formerly managing director of the Graigola-Merthyr Colliery Co., Swansea, for the endowment fund of Swansea Technical College was announced. Over half of the £150,000 appealed for has been promised.

A Channel Tunnel for Japan.—Permission has been applied for to construct a tunnel under the Shimonoseki Straits, connecting Kyushu with the mainland. The length of the tunnel would be about six miles.

Synthetic Coal.—As intimated in a previous note, Mr. Samuel C. Davidson, chairman and founder of the Sirocco Works, Belfast, has solved the difficult problem of making synthetic coal out of crude peat. The immediate difficulty was to get rid of the 60-80 per cent. of moisture in the raw material in winter weather, air drying being the usual mode in summer months. Mr. Davidson's process is very simple; he gave a demonstration of it a few days ago to his Excellency the Lord Lieutenant of Ireland (Lord French). The raw peat is macerated in a mortar mill, and lime and bitumen in certain proportions are added to the pulp. The latter is allowed to stand for a few hours, and is then put under hydraulic pressure, which drives out the 60-80 per cent. of water, leaving a "briquette" of a given shape or size, which burns well within a few hours of manufacture. Thus within forty-eight hours the raw peat can be converted into fuel. Mr. Davidson is erecting a demonstration plant on a larger scale at his Belfast works. It may be of interest to add that Mr. Davidson secured a clue towards the coagulation of peat whilst interested in the rubber industry of Ceylon. The residue of peat fuel thus manufactured is almost pure potash.

* ELECTRICAL REVIEW, April 5th, 1918.

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The Coal Shortage in Ireland.—A correspondent who has just returned from a business tour in Ireland informs us that in that fortunate country one hardly knows there is a war on, except for the shortage of coal. Practically all industrial coal is imported from England or Scotland, so that the present lack of tonnage accentuates the difficulties which we ourselves are experiencing, and a high rate for freight has to be added to the pit-head cost.

Under the circumstances, one would expect all coal importers and large users to check very carefully the weight of the coal which they purchase, but as a matter of fact very few do so. The Dock Authorities in Dublin and Belfast provide the cranes for unloading the steamers, but no facilities exist for weighing the cargoes.

Occasionally a merchant is able to pass a complete shipload over a weighbridge, but more often than not the cargo is discharged in different directions, so that a proper check is impossible. When a complete shipload *is* weighed, it frequently turns out below the advised figure. Naturally, the coal merchant does not intend to suffer if he can help it, and he is generally able to "pass on" any shortage to the user, who is without proper weighing machinery, and in consequence must pay for the weight advised; this is particularly easy when the coal is delivered by barge, and the rough-and-ready method of computing the weight of the cargo by the displacement of the boat is considered sufficient.

With the present dearth of weighing facilities at the docks, it behoves all large users of coal in Ireland to make certain that they actually receive the weight which they are supposed to do, and we are glad to learn that the Belfast Electricity Department, under Mr. T. W. Bloxam, leads the way in this respect. Coal is brought in barges to the Albert Bridge generating station, and unloaded by means of a crane and grab; the grab empties into an automatic scale, which weighs and totalises every pound of coal before passing it into the bunkers. By this means Mr. Bloxam knows the exact weight of coal brought by every barge. The neighbouring gas department—also a Municipal enterprise—is not so happily situated, and in consequence has to accept the merchants' weights.

The electricity department is also to the fore at Londonderry, where Mr. R. V. Macrory has recently installed a modern coal-handling plant fitted with an automatic scale similar to the one at Belfast; this machine has already been the means of a considerable economy.

At Dublin, the electricity supply for the tramways is provided by the Dublin United Tramways Co., and for lighting and power by the Corporation; we understand that the engineers of both undertakings are fully alive to the necessity of weighing their coal, and are considering the adoption of more up-to-date machinery for that purpose than they possess at present. The same remark applies to the Cork electricity department, under Mr. Nalder.

Money and Industry.—In a speech on the Supplementary Vote of Credit in the House of Commons on Tuesday, Mr. McKenna said (according to the *Times* report) that there was an urgent need now of ending all unnecessary expenditure; that was actually vital; and unless we proceeded to reconstruct at once we should fail in the competition with our foreign competitors, for we could not forget the fact that large masses of our foreign trade at the present time were lost to us. We had to recover these, and we could only do so by a rapid development of our manufacturing export power. It was of very great importance that there should not be any carrying on at reduced speed in the construction of unnecessary articles and that we should devote the whole of our capital expenditure and labour at once to the production of essential articles. There would be plenty of work, and high wages. Prices were high and would probably remain high, and consequently profits would be high. In fact there was no reason to anticipate that under skilful and prompt action the trade and industry of this country would not rapidly recover. But they must not be hindered by the continuance of governmental activities now when we had at length secured peace.

Proposed Tunnel to Ireland.—The first report of the Select Committee on Transport was published on Saturday. A sub-committee which visited Ireland obtained evidence in relation to the possibility of improving the transport connections between Great Britain and Ireland by means of a tunnel or of train ferries, but the Select Committee is not yet in a position to express any opinion or to make recommendations.

The Decimal Association.—The annual general meeting was held on Thursday last week at the Manchester Hotel, by kind permission of the British Electrical Federation. In the unavoidable absence of the president, Lord Belhaven and Stenton, the chair was taken by Mr. T. McKenna, chairman of the Executive Committee. The chairman referred in his speech to the progress which had been made during the past year, which had resulted in the introduction into the House of Lords of a Decimal Coinage Bill; the subject was now being considered by a Royal Commission, of which he was a member. He also alluded to the recent considerable increase in membership and revenue, and gave as further evidence of progress the issue of a quarterly journal, the first number of which was quickly sold out.

The report was unanimously approved, and fresh rules for the Association and its branches were adopted. The past members of the executive were re-elected, and the committee was further strengthened by the election of Mr. E. M. Rodocanachi, Mr. David Scott, and Mr. C. Turnbull.

Electrified Wheat.—On page 112 of our issue of August 2nd we referred to the process of electrifying seeds invented by Mr. Fry, of Godmanstone, Dorchester. We now learn from the *Daily Chronicle* that after careful examination by representatives of the Governments of France, the United States, Japan, and other countries, the process has been recommended for immediate trial. It is estimated that if the process were adopted universally throughout these islands the yield of grain would be increased by a million and a half tons.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Central Station Officials.—The Gillingham T.C. has increased the salary of the borough electrical engineer by £100 per annum, making a total of £400 per annum, including war bonus.

Poplar B.C. Electricity Committee recommends that Mr. H. W. UNDERHILL, station electrician, be placed in Grade V of the Council's scale as from January 1st, 1918, at a salary of £162 10s. per annum, rising to £185; and that Mr. L. C. TEMPLEMAN be appointed charge engineer as from August 1st last at a salary of £150 per annum, rising to £185.

Mr. H. PARSONS has resigned from the L.C.C. Stores and Contracts Committee. Lieut.-Col. E. W. MORRISON BELL has been appointed in his stead.

Mr. R. H. WILKINSON, tramways manager, Huddersfield, has been presented by members of the staff with a smoking cabinet on his departure for Bradford.

Mr. J. TOWNLEY, works superintendent at the Hylton Road electricity works of the Sunderland Corporation, has been appointed, and has now taken up his duties, as acting borough electrical engineer to the Barnsley Corporation electricity department.

The resignation of Mr. E. M. HOLLINGSWORTH, electrical engineer at St. Helens, who has accepted a position with the United Alkali Co., Ltd., takes effect on January 16th next. The Electricity Committee has placed on record its appreciation of his services and regret at his resignation. Mr. J. W. WARR, assistant electrical engineer, has also resigned to take up another appointment.

General.—The King has awarded the Edward Medal to JOHN GARNER, a stoker at the B.T.H. factory at Rugby, under the following circumstances:—

On April 29th, 1918, one of a battery of seven boilers in the boiler-house of the factory of the British Thomson-Houston Co., Ltd., at Rugby, exploded. Garner, a stoker, at once entered the house, which was filled with steam and boiling water, and in a serious condition, in the hope of rescuing any person who might be injured. Large masses of masonry were threatening to fall, and either of the remaining two boilers under steam was likely to explode at any time. The only light available was a hand lamp carried by Garner. After searching some five minutes, Garner discovered an injured man lodged on a projecting beam; but was unable to reach him. He stood by him, however, until the beam canted and the injured man fell to the ground without further hurt. No other persons were injured by the accident. Garner undoubtedly risked his life to save a fellow-workman.

Mr. H. B. RENWICK, of the County of London Electric Supply Co., Ltd., who has held the position of Director of Feeding Stuffs under the Ministry of Food since September, 1917, has found it necessary to resign in consequence of the urgent demands on his time in connection with the electric supply problems of the country.

Mr. J. C. WHITE, chairman of the Belfast Corporation Electricity Committee, who has been appointed a member of the Irish Sub-Committee on Water Power Resources (of which Sir John P. Griffith, Dublin, is chairman), acted some years ago as legal adviser in the promotion of the Ulster Power Bill, when the water power of Ulster for electricity and other purposes was the subject of considerable research.

Mr. F. L. WRIGHT, late of Queads, Ltd., and Messrs. Tyler and Freeman, has been appointed a Director of Messrs. Napier-Kimber, Ltd.

Roll of Honour.—Lieutenant J. GRAY, R.W. Surrey Regiment, son of Mr. James Gray, managing director of the Electric Construction Co., Ltd., has been awarded the Military Cross. The award, which follows the gaining of the Croix de Guerre some time ago, is made because "he repeatedly distinguished himself in action, especially when he led his company, with a total disregard for personal safety, under intense and accurate machine-gun fire. He inspired his men with great confidence, and successfully dealt with some difficult situations."

Sapper A. J. RANDALL, employed in the Poplar B.C. electricity department, who was awarded the Military Medal two years ago for conspicuous bravery in laying and repairing telephone cables under heavy shell and rifle fire, has again received commendation from the Major-General Commanding

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his division for distinguished services in the field in October last.

Company-Sergeant-Major E. J. Nunn, partner in Messrs. Bowden & Higlett, electrical engineers, of Guildford, has died at Bangalore, India, from influenza. He was an old Volunteer, and signing on for further service when he became time-expired, two years ago, he was drafted to India in October, 1916.

Private J. Ellis, Essex Regiment, who has died from influenza, was for nearly 20 years with Messrs. Crompton and Co., Ltd., Chelmsford.

Air-Mechanic E. Loveridge, R.A.F., who has died at Blandford from pneumonia, following influenza, was the son of Mr. Loveridge, electrician, of Southport. He enlisted from the business only three weeks ago. Sergeant F. Loveridge, King's Liverpool Regiment, another son of Mr. Loveridge, fell in action in May, 1915.

Company-Sergt.-Major W. Hedges, Lancashire Fusiliers, who enlisted from the Salford Corporation tramway staff, has been awarded the D.C.M. for great courage and determination under fire.

Second Lieutenant J. S. Youll, V.C., Northumberland Fusiliers, who was killed in action on October 27th, in his 22nd year, began work when he was about 15 years old as an apprentice electrician at Thornley Colliery, and on reaching military age he joined the Forces.

Private W. Walker, Worcestershire Regiment, who has fallen in action, was in the Sheffield Corporation electricity department.

Private R. Smith, who has been killed in action in France, was on his enlistment a member of the Carlisle Corporation electricity works staff.

Signaller H. Biggins, Manchester Regiment, wounded for the third time, was employed by Messrs. Ferranti, Ltd., Hollinwood.

Private S. T. Shuter, Manchester Regiment, killed, was 19 years of age, and a former employé of Messrs. Ferranti, Ltd.

Gunner H. N. Brennand, R.F.A., awarded the Military Medal for gallantry in battle, was employed at the Blackburn Corporation electricity works.

Private J. Lathrope, Royal Welsh Fusiliers, killed in action, was employed by Messrs. Charles Macintosh & Co., Ltd., Manchester.

Private J. Land, Manchester Regiment, who has died of pneumonia, was formerly employed at the British Westinghouse Co., Ltd., Trafford Park.

The death is reported in action of Private T. Kelly, Argyle and Sutherland Highlanders, who was employed at Burnley Corporation electricity works.

Private C. Stainthorpe, Duke of Wellington's Regiment, who has died of wounds, was employed at the Valley Road electricity works, Bradford.

Private S. J. F. Powers, who has died in Paris after an attack of Spanish influenza, was employed by Messrs. Ingleby and Sons, engineers, Hunslet, Leeds. He became an electrician in the 14th Divisional Supply Column, M.T., A.S.C.

Alderman J. H. Palin, secretary of the Tramway and Vehicle Workers' Union at Bradford, who is at present a sergeant in the Labour Corps on war transport service abroad, has been definitely accepted as the Labour candidate for the North Division of Bradford.

Signaller J. Waller, South Lancashire Regiment, who has been wounded, was employed by Mr. Harry Bibby, electrician, Warrington.

Private C. Heywood, King's Shropshire Light Infantry, who has died of wounds, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Lance-Corporal J. F. Powell, Manchester Regiment, who has died of wounds, was employed by Messrs. Veritys, Ltd., Manchester.

Private A. Wynn, Lancashire Fusiliers, killed in action, aged 32, was employed at the Rochdale Corporation electricity works.

There passed away on November 6th, at Newcastle-on-Tyne, of pneumonia following influenza, Lieutenant V. O. Davis, R.E. (S.R.), M.I.E.E. and A.M.I.C.E., A.C.G.I., manager of the Newcastle-on-Tyne branch of the British Thomson-Houston Co., Ltd., aged 33.

The *Times* "Deaths" column announces that Mr. F. N. Tallant, aged 23 years, was lost on October 4th on the torpedoed liner *Hiramo Maru*, whilst proceeding on service to Cape Town for the Eastern Telegraph Co.

Private W. Walker, employed at the Sheffield Corporation electricity works, was killed in action on October 14th.

Gunner T. G. Harris, formerly employed at the power station at Aston, near Birmingham, has been killed in action.

In these hours of victory and rejoicing, our readers, we are sure, will desire to join with us in tendering sympathy to Mr. and Mrs. A. P. Wood, on the loss of their eldest son, Second Lieutenant G. K. P. Wood, Lancashire Fusiliers. Mr. Wood is the managing director of the Lancashire Dynamo and Motor Co., Ltd., Trafford Park, Manchester, and the Lancashire Ordnance & Accessories Co., Heaton Norris, and a member of the Council of the British Electrical and Allied Manufacturers' Association. Second Lieutenant Wood, who was born in 1899, was educated at Bowdon College and Malvern College, and entered Sandhurst twelve months ago, passing out in August last. He had been in France only a few days, and met his death leading his platoon "over the top" at dawn on November 1st. His commanding officer wrote of him as being a most promising officer, possessed of great personal bravery.

Obituary.—Lieut. Wm. Llewellyn Preece.—We deeply regret to record the death, which occurred on November 10th, at the age of 52 years, at 42, Cheyne Court, London, from pneumonia following influenza, of William Llewellyn Preece, Lieutenant, R.N.V.R., M.Inst.C.E., &c., eldest son of the late Sir William Preece. Lieutenant Preece had been for some years in indifferent health, and there is little doubt that the strain of his work at the Admiralty and at Queen Anne's Gate, the offices of his firm, proved beyond his strength. He was born at Southampton in 1866, and after early education at private schools, he went to King's College School in 1882. He spent two years there, and then went to Germany for a year. In 1885 he studied at the Electrical College, Hanover Square, and in 1886 he joined the staff of the telegraph department of the Midland Railway under the late W. E. Langdon. He was appointed chief assistant to Mr. Langdon in 1892. In 1898 he resigned from the Midland Railway, and joined Sir William Preece, Major Cardew, and his brother, Mr. A. H. Preece, and became a partner in Preece & Cardew, consulting engineers. Subsequently, in 1909, Sir John Snell joined the firm, and in 1915 Mr. John H. Rider, the firm becoming Preece, Cardew, Snell & Rider. Mr. W. Llewellyn Preece devoted most of his time as a member of the firm to telegraph, telephone, and wireless telegraph matters. This included telegraphs and telephones and wireless telegraphy in all the principal colonies, both under the Crown Agents and the High Commissioners for South Africa and New Zealand. He was responsible for various wireless telegraph stations chiefly for the Colonial Office at Aden, Fiji, Ceylon, Solomon Islands, and, conjointly with Captain Brunot of the French Government, for the New Hebrides. In 1912 he undertook a special investigation for the Federated Malay States Government of the telephone and telegraph system in that colony. He also visited Trinidad and other colonies to report on similar questions. He gave evidence for the Post Office before the Parliamentary Committee upon the Marconi Contracts.

In 1917 he received a commission in the Navy as Lieutenant in the R.N.V.R., and his principal work has been in connection with scientific devices for detecting the presence of submarines. Mr. Preece read a paper in 1915 before the Institution of Electrical Engineers upon "Telephone Troubles in the Tropics." In 1914 he entirely revised the well-known text-book on "Telegraphy," written by Sir William Preece and Sir J. Sivewright. He has recently been engaged in preparing a biography of Sir William Preece. Mr. Preece was elected an Associate Member of the Institution of Civil Engineers in 1897, and a full member in 1907. He was also elected an Associate Member of the Institution of Electrical Engineers in 1887 and a full member in 1897. He was a member of the Council up to his death. He was also a member of many other scientific institutions. In addition to his electrical engineering work, Mr. Preece was keenly interested in Church matters, and wrote many papers on religious subjects. He was acting as a secretary of a branch of the Churchman's Union. He leaves a widow, three sons and four daughters.

The funeral took place at Carnarvon yesterday, and there was also a memorial service at Christ Church, Victoria Street, S.W., at midday.

Mr. Cecil Taylor.—We regret to record the death, which occurred on November 4th, from pneumonia, of Mr. Cecil Taylor, the younger son of Mr. F. W. Taylor, electrical engineer, Milnsbridge, Huddersfield. Deceased was 24 years of age, and was works manager for his father.

Mr. M. W. O'Connell.—We regret to learn of the death of Mr. M. W. O'Connell, director and secretary of Pope's Electric Lamp Co., Ltd., Willesden, who passed away in his 48th year last Friday morning from pneumonia, after a short illness. Mr. O'Connell had been connected with the electric lamp industry for the last 35 years, having had a wide and varied experience, not only in this country, but in France, Holland, and Germany. His loss will be felt both by the industry and by many with whom he came into contact and who looked upon him as a personal friend.

Mr. J. P. Stockbridge.—The death has occurred of Mr. J. P. Stockbridge, well known in Northern electrical engineering circles. He was born at Cambridge in 1883, and served his apprenticeship at the works of the Cambridge Electric Supply Co., Ltd., transferring in 1901 to Messrs. C. A. Parsons & Co., Ltd., Heaton Works, Newcastle-on-Tyne. He continued in service there until 1910, when he was sent by the firm to Australia to supervise the complete electric power-station equipment of the Adelaide Tramways Commission, for which Messrs. Parsons were the principal contractors. Returning to England in 1912 he was entrusted with the management of the Close Works at Gateshead, and continued in that capacity after they were acquired, in 1915, by Sir W. G. Armstrong, Whitworth & Co., Ltd.

Lieut. T. N. Browett.—We regret to read in the *Times* of the death, which occurred on October 30th at Dar-es-Salaam, East Africa, from influenza, of Lieutenant T. Norman Browett, R.A.F., a son of Mr. and Mrs. Thomas Browett, of Hampstead, N.W., aged 29 years.

The Hon. A. E. Gathorne-Hardy.—The *Times* reports that the Hon. Alfred Erskine Gathorne-Hardy, who was chairman of the Light Railways Commission and a Railway

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Commissioner, was found dead on Monday in his study with a revolver lying on the desk. He was 73 years of age, and a specialist had reported unfavourably on his health.

Lieutenant-Colonel Tremeer, D.S.O.—Lieutenant-Colonel Tremeer, D.S.O., H.M. Imperial Trade Correspondent at Johannesburg since 1903, died on November 2nd as the result of an accident.

Mr. Thomas Taylor.—The death has occurred at Buxton of Mr. Thomas Taylor, J.P., chairman of Messrs. Taylor, Tunnicliffe & Co., Ltd., manufacturers of porcelain electrical fittings, of Hanley. Deceased, who was 85 years of age, commenced business with the late Major W. Tunnicliffe in 1867, and was the pioneer in the Potteries of porcelain electrical fittings. He was a borough magistrate, served on the old Corporation of Hanley, and as a Freemason was one of the third oldest Provincial Grand Officers in Staffordshire.

NEW COMPANIES REGISTERED.

Arma Manufacturing Co., Ltd. (151,850).—Private company. Registered November 2nd. Capital, £5,000 in £1 shares. To take over the business of a manufacturer of and dealer in dry-cell batteries carried on at Jupiter Works, Holloway, N., by Edouard Armelin. The subscribers (each with one share) are:—H. S. Stelswell, 133, Queen's Road, N. 4, solicitor; J. P. Lyne, 50, Crofton Park Road, S.E. 4, solicitor. First directors: E. Armelin, 208-10, Tower Bridge Road, S.E., and H. A. French, 4, Sussex Road, Harrow-on-the-Hill.

The Electrical Co. (Glasgow), Ltd. (10,145).—Private company. Registered November 4th. Capital, £2,500 in £1 shares. To carry on the business of engineers, pattern makers, boiler makers, millwrights, fitters, iron and steel converters, founders, smiths, machine makers, metal workers, and manufacturers. The subscribers (each with one share) are:—C. McMillan, 170, Hope Street, Glasgow, writer; J. Mirrilees, 170, Hope Street, Glasgow, writer. First directors: G. B. Crockatt, J. Dickie, J. A. Hood, W. Neilson, and A. J. Smith. Registered office: 65, Bath Street, Glasgow.

Portable Tool & Engineering Co., Ltd. (151,866).—Private company. Registered November 4th. Capital, £10,000 in £1 shares (5,000 10 per cent. pref.). To take over the business of auto-tool and gauge makers and electrical and general engineers carried on by A. H. Stead, E. R. Dipple, and L. W. Watson at 243, Hertford Road, Enfield Highway, Enfield, and at Cedar Works, Enfield Highway. The subscribers (each with one share) are:—A. H. Stead, 112, First Avenue, Bush Hill Park, N., mechanical engineer; L. W. Watson, 508, Hertford Road, Lower Edmonton, N., mechanical engineer. First directors: A. H. Stead, L. W. Watson, E. R. Dipple, and J. Woodall. Registered office: 63, Finsbury Pavement, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

W. S. Laycock, Ltd.—Mortgage dated October 21st, 1918, charged on Woodend Farm, Beauchief, Derby, securing £1,900. Holders: C. Firth, Oxford, and L. J. Firth, Florence.

Small Electric Motors, Ltd.—Mortgage dated October 29th, 1918, to secure £2,500, charged on Eagle Works and land adjoining in Beckenham. Holders: S. H. G. Turney, 7, Park Square, W. Portland Place, London.

Laing, Wharton, Ltd.—Satisfaction in full on October 25th, 1918, of debentures dated July 26th, 1918, securing £500.

Mortgage debenture dated November 1st, 1918, charged on the company's undertaking and property, present and future, including uncalled capital, securing £1,000. Holders: Ministry of Munitions.

Thermo Electric, Ltd.—Charge executed outside the United Kingdom on July 2nd, 1918, to secure all moneys due at any time from the company to the Commonwealth Bank of Australia, Sydney. Property charged: Molybdenite, wolfram, wolfram bismuth, and scheelite ores and concentrates, and plant for treating same acquired by the compahy, and moneys to become due to the company after July 2nd, 1918, under an agreement with the Attorney-General of the Australian Commonwealth.

British Arc Welding Co., Ltd. (108,759).—Return dated August 26th, 1918. Capital, £15,000 in £10 shares. 727 shares taken up; £5,270 paid; £2,000 considered as paid. Mortgages and charges: Nil.

Bat Meter Co., Ltd. (99,327).—Return dated September 11th, 1918. Capital, £20,000 in £1 shares (12,000 pref. and 8,000 ord.). 10,683 pref. and 8,000 ord. shares taken up. £1 per share called up on 423 pref. and 15s. per share on 10,260 pref.; £8,118 paid; £8,000 considered as paid on 8,000 ord. Mortgages and charges: Nil.

W. A. S. Benson & Co., Ltd. (68,597).—Return dated May 7th, 1918. Capital £85,000 in £10 shares (2,000 pref. and 3,500 ord.). 1,908 pref. and 3,500 ord. shares taken up. £1,500 paid; £52,580 considered as paid. Mortgages and charges: £9,500.

Christy Bros. & Co., Ltd. (90,039).—Return dated July 19th, 1918. Capital, £12,000 in £1 shares (9,000 ord. and 3,000 deferred). 7,926 ord. and 3,000 deferred shares taken up. £1,826 paid; £9,100 considered as paid. Mortgages and charges: £4,600.

Electric Supply Corporation, Ltd. (52,036).—Return dated October 17th, 1918. Capital, £250,000 in £5 shares. 42,000 shares taken up; £175,000 paid; £35,000 considered as paid. Mortgages and charges: £154,914.

Everett, Edgcumbe & Co., Ltd. (84,764).—Return dated July 9th, 1918. Capital, £25,000 in 5,000 6 per cent. cum. pref., 19,997 ord., and 3 "A" shares of £1 each. 3,300 pref., 19,543 ord., and 3 "A" shares taken up. £11,996 paid on 2,500 pref., 9,495 ord., and 1 "A"; £10,850 considered as paid on the remainder. Mortgages and charges: £600.

Fors Accumulator Foreign Patents, Ltd. (108,151).—Return dated January 11th (filed August 15th), 1918. Capital, £3,000 in 952 pref. and 2,048 ord. shares of £1 each. 584 pref. and 2,048 ord. shares taken up. £132 paid on 132 pref.; £2,500 considered as paid on the remainder. Mortgages and charges: £125.

Dartmoor Electric Supply Co., Ltd. (110,871).—Return dated October 3rd, 1918. Capital, £2,000 in 10s. shares. All shares taken up. £2,600 paid; £2,000 considered as paid. Mortgages and charges: £4,000.

CITY NOTES.

French Companies.

The Constructions Electriques, of Nancy, intend to pay out of net profits of £34,000 a dividend at the rate of £4 per share for 1917-18.

The accounts of the *Maison Breguet* show net profits of £85,000 for 1917-18, as compared with £84,000 in the preceding year. It has been decided to pay a dividend of £2 per share, as against £1 16s. in 1916-17.

The Compagnie des Cables Télégraphiques records net profits of £255,000 for 1917-18, as contrasted with £144,000 in the previous 12 months. The shareholders have sanctioned the distribution of 18s. 4d. per share, as against 8s. 10d. in 1916-17.

The Société des Appareillages Electriques Grivolas states that the net profits and balance forward in 1917-18 amounted to £34,000, as compared with £25,000 in the preceding year. A dividend at the rate of 8s. per share has been declared, being the same rate as in 1916-17.

The directors of the *Société d'Applications Industrielles (Compagnie d'Entreprises Electriques)* state that they continued to devote their efforts in 1917-18 to the development of the distribution works in which the company is interested. The working of the hydro-electric works experienced an improvement, but the financial results of the steam power undertakings deteriorated under the operation of dear and inferior quality of the coal, &c. The net profits totalled £26,000, which sum has been carried forward, as in the case of £7,000 in 1916-17, so as to provide for the company's interests in works situated in districts invaded by the enemy.

German Companies.

The directors of the *Rhein. Electro-Werke A.G., of Cologne,* which undertaking belongs to the Stinnes coal mining group, report a slight loss for 1917-18, which was the first financial year.

The Brandenburg Karbid und Elektrizitats Werke A.G., of Berlin, records net profits amounting to £15,000 for 1917-18, as against £14,700 in the previous year. The directors recommend a dividend of 7 per cent., as in 1916-17.

The A.E.G. Unternehmungen A.G., of Berlin, whose share capital of £500,000 is held by the A.E.G., and whose assets consist chiefly of investments, reports net profits for 1917-18 of £34,000, as compared with £34,600 in the preceding year. It is proposed to pay a dividend of 6 per cent., being the same rate as in 1916-17.

The report of the *Kabelwerk Rheydt A.G., of Rheydt,* for the year ended June 30th abstains from referring to the course of business, mention merely being made of the increase in the share capital to £350,000. The net profits amounted to £150,000, as against £221,000 in 1916-17, and the directors recommend a dividend of 20 per cent., as in the preceding year, and a further 20 per cent. payable in war loan certificates.

The Elektrizitats A.G. vorm. H. Pege, of Chemnitz, reporting on the year 1917-18, states that orders for munitions, which in the previous year were twice as large as those for peace electrical products, now only form two-thirds of the latter. Although electrical manufactures were still of importance for the war, the directors believed that the transposition to normal articles had now for the most part taken place. The net profits earned last year amounted to £146,000, as against £127,000 in 1916-17, and the dividend is 28 per cent., as compared with 20 per cent.

The accounts of the *Elektro-Werke A.G., of Berlin,* whose share capital of £250,000, and loans made by the A.E.G. to the extent of £1,952,000, were taken over by the Imperial Treasury last autumn in exchange for Treasury bills, show a gross surplus of £54,000 for 1917-18, as compared with £6,000 in the previous year. The company's works are engaged on the supply of energy to the Imperial Nitrogen Works from the power station in the Bitterfeld lignite district. After defraying general expenses, interest on mortgages and loans, and setting aside £11,000 for depreciation, there remains a surplus of £1,700, which serves to extinguish the deficit brought forward from the previous year.

Escher, Wyss & Co.—The report for 1917-18 of Escher, Wyss & Co., of Zurich, states that it was possible further to increase the production, although the difficulties in obtaining raw materials and in forwarding manufactures were becoming more pronounced. The continued advance in the cost of raw materials was specially prejudicial to the company, as the orders almost entirely represented long-term contracts. The orders were abundant, and those on the books at the end of the financial year were greater than at the beginning. As net profits the accounts show the sum of £26,000, as contrasted with £20,000 in the previous year, and a dividend of 5 per cent. is proposed on the share capital of £260,000, being the same rate as in 1916-17.

United Electric Tramways of Caracas, Ltd.—Including £1,899 brought forward, the net revenue balance at June 30th was £19,194. Dividend 7 per cent., less income-tax, carrying forward £7,294. Percentage of operating expenses to gross receipts 49.20, against 52.85. Passengers carried 5,499,697, against 4,984,206.

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British Westinghouse Electric & Manufacturing Co., Ltd.—The *Financial Times* says that details of the proposed revision of the capital of this company, which was stated at the last meeting to be in preparation, will be laid before shareholders on Tuesday next. The directors will then propose that the company be empowered to form subsidiary undertakings at home and abroad. The capital will be increased to £6,395,000 by the creation and issue of 5,000,000 ordinary shares of £1 each, which, after an 8 per cent. non-cumulative dividend has been paid on the 685,000 preference shares of £2 each, will rank for 30 per cent. non-cumulative, before the deferred shares. After the latter have been paid 7½ per cent., ordinary shareholders will receive the balance of profits. The board's fees are to be fixed at £11,000 a year, excluding the managing director and local boards. Preference shareholders will be asked, when ordinary shareholders have consented to the conversion of their capital into preference, to permit the modification of their rights, so that the shares rank equally with the existing ordinary shares for a non-cumulative preferential dividend of 8 per cent. before anything is paid on the new ordinary or the 500,000 deferred shares of 1s. each.

Cape Electric Tramways, Ltd.—Profit £86,512. Net credit balance after providing for debenture charges is £42,391. £12,000 to reserve; dividend 5 per cent. on ordinary shares; £5,830 carried forward. Passengers carried 26,444,465, earning £264,137, against 23,752,016 earning £231,105 in 1916-17. High cost of supplies and materials and wages has prevented any reduction in ratio of working expenditure, but profits earned on account of the heavier traffic show an increase. Maintenance and repairs charges are likely to further increase in the future owing to arrears, which have to be made good as early as possible.

North Metropolitan Electric Power Supply Co.—According to the *Financial Times*, the directors have convened an extraordinary general meeting, for 26th inst., for the purpose of considering a resolution authorising the company to raise the remaining unissued portions of the capital, together £259,980, by the issue of preference shares ranking *pari passu* with those existing.

Manaos Tramways and Light Co., Ltd.—Gross earnings for the year ended April 30th £122,495, against £120,387; operating expenses £84,003, against £82,511. After providing for debenture and loan charges, loss on exchange, and putting £5,000 to renewals, £11,856 remains to carry forward.

Companies to be Struck Off.—The following are to be struck off the Register within three months unless cause is shown to the contrary:—

British Gas Traction Co., Ltd.
Grindell-Matthews Wireless Telephone Syndicate, Ltd.
Prested Miners' Gas-Indicating Electric Lamp Co., Ltd.
Meldrum Bros., Ltd.

International Light & Power Co., Ltd.—Net profits to June 30th, after providing for debenture charges and reserve, were £17,024. The surplus brought forward was raised to £34,100, which is to be carried forward.

Stothert & Pitt, Ltd.—Dividend, 10 per cent., free of tax, on ordinary shares. £11,394 carried forward.

Indian Electric Supply and Traction Co., Ltd.—Interim dividend 2½ per cent., less tax, for the half-year.

STOCKS AND SHARES.

Tuesday Evening.

The news of the signing of the armistice caused so profound a gratification in the Stock Exchange as to come almost with a shock. Prices became buoyant, and there has been a large volume of trade doing already. With the air filled with excitement and bunting, it is, of course, difficult to negotiate orders to buy and sell securities, but business has struggled as well as it could against the joyful handicaps, and in many departments advances have been secured as the result of the triumphant conclusion of negotiations in the field.

The main improvement, so far as the electrical markets are concerned, has come in railway stocks, but rises have also occurred in electric lighting, telegraph, and a few manufacturing issues. In addition to this, renewed strength is shown by foreign descriptions, in which Anglo-Argentine Tramways and Brazilian Tractions stand out with particular prominence.

A string of rises has taken place in the electricity supply list. Amongst those which have benefited, the West End companies stand out prominently, though the City shares are by no means neglected. Edmundsons have moved up to 10s. The investor is keen on buying the shares, and is prepared to pay what would have been regarded a few months ago as handsome prices for them. Expectation now looks well forward, and consideration of dividends leaps over the next half-year or two, hoping for a return to more normal and more successful times in the course of the next few years. Bromptons are better, so are Charing Cross, Chelsea, City of London, Metropolitan, Kensington, St. James's, London Preference, and Westminsters. Such a record this market has not seen since the outbreak of war.

Manufacturing shares are steady. British Westinghouse preference recovered to 2⅜, but Electric Constructions are a little easier at 1 5/16. Marconis are a much quieter market than they have been lately, and the price of the parent shares has gone back to 4¾. Americans keep good at 32s. 6d., and the other subsidiaries are a firm market.

Changes in the telegraph and telephone list are comparatively small. Indo-European shares have risen £1, but Eastern Extensions and Westerns are both ⅛ lower, though West India & Panama at 1¾ have regained the 1/16th they lost last week. Amongst home railway stocks, the strength of the market as a whole has helped the Underground list materially. Underground Incomes have risen two points to 91, and the 1s. shares of the company at 9s. 6d. are 1s. 6d. up on the week. The ten-pounders have gained 10s. at 3½d. Metropolitans further improved upon their big rise of a week ago, and are ½ higher at 30¼. British Electric Traction ordinary rose to 50½.

The foreign traction group is good throughout. Anglo-Argentine Tramways shares of both classes are substantially better. Brazilian Tractions at 60 are 2 points up, and rises ranging from 1 to 2 points have been secured by British Columbia and Mexican issues. Calcutta Trams at 7½ are 5s. higher. The difficulty once more is to get shares.

The rubber market is goodish, though the amount of business passing is not great. Armament shares are by no means as weak as some expected to find them on the probable termination of the war. Copper and tin mining descriptions show little variation, this being due to the uncertainty felt with regard to the outlook for base metals now that the armistice is signed.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1916.	Dividend 1917.	Price Nov. 12, 1918.	Rise or fall.	Yield p.c.
Brompton Ordinary	9	10	6½	+ ⅛	£7 12 10
Charing Cross Ordinary	5	4	3⅜	+ ⅛	5 14 4
do. do. do. 4½ Pref.	4½	4½	8⅜	—	6 13 4
Chelsea	8	5	3⅝	+ 1/16	7 8 2
City of London	8	8	13½	+ ½	5 18 6
do. do. 6 per cent. Pref.	6	6	10⅛	+ ⅛	5 18 5
County of London	7	7	11	—	6 7 3
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	6	7	5½	+ ⅛	6 13 4
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3⅞	+ ⅛	6 9 0
Metropolitan	3	4	3½	+ 1/16	6 3 1
do. 4½ per cent. Pref.	4½	4½	3½	—	6 18 6
St. James' and Pall Mall	8	9	7	+ ½	6 8 7
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	7	+ ⅛	6 8 7

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	6	6	99	—	6 1 0
do. Def.	1½	1½	23½	—	6 8 8
Chile Telephone	8	8	7⅞	—	5 6 8
Cuba Sub. Ord.	7	7	10¼	—	*6 13 4
Eastern Extension	8	8	15⅞	— ⅛	*5 0 10
Eastern Tel. Ord.	8	8	161½	—	*4 19 1
Globe Tel. and T. Ord.	7	7	14⅛	—	*4 16 5
do. do. Pref.	6	6	10½	—	5 14 3
Great Northern Tel.	24	22	84	—	6 9 5
Indo-European	13	13	58½xd	+1	5 11 0
Marconi	15	20	4¾	— ⅛	4 4 0
Oriental Telephone Ord.	10	10	8½	—	2 17 2
United R. Plate Tel.	8	8	7⅞xd	—	*5 5 0
West India and Panama	6d.	1/3	1¾	+ 1/16	*3 12 6
Western Telegraph	8	8	16⅞	— ⅛	*4 14 10

Home Rails.

Central London Ord. Assented	4	4	65½	—	6 2 2
Metropolitan	—	1	30¼	+ ½	3 6 1
do. District	Nil	Nil	20⅝	—	Nil
Underground Electric Ordinary	Nil	Nil	3½	+ ⅛	Nil
do. do. "A"	Nil	Nil	9/6	+1/6	Nil
do. do. Income	6	4	91	+2	*4 8 0

Foreign Trams, &c.

Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	4	+ ⅛	—
do. do. 2nd Pref.	5½	—	3⅜	+ ⅛	—
do. do. 5 Deb.	5	5	77½	+1½	6 9 0
Brazil Tractions	—	—	60	+2	—
Bombay Electric Pref.	6	6	10⅜	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	66½	+2½	7 10 5
do. do. Preferred	Nil	Nil	47½	+ ½	Nil
do. do. Deferred	Nil	Nil	45½	+1	Nil
do. do. Deb.	4½	4½	62	+ ⅛	6 17 3
Mexico Trams 5 per cent. Bonds	Nil	Nil	67	+2	Nil
do. 6 per cent. Bonds	Nil	Nil	51	—	Nil
Mexican Light Common	Nil	Nil	37½	—	Nil
do. Pref.	Nil	Nil	50	—	Nil
do. 1st Bonds	Nil	Nil	72	+1	—

Manufacturing Companies.

Babcock & Wilcox	15	15	3⅝	—	4 2 4
British Aluminium Ord.	10	10	1⅝	—	5 12 4
British Insulated Ord.	20	20	2½	—	4 9 0
British Westinghouse Pref.	7½	7½	2⅜	+ 1/16	5 14 0
Callenders	20	25	9¾	—	6 8 0
do. 5 Pref.	5	5	5⅛	—	—
Castner-Kellner	22	20	3⅝	—	5 10 4
Edison-Swan, "A"	—	—	⅞	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	10	1⅛	— 1/16	7 12 6
Gen. Elec. Pref.	6	6	10⅜	—	6 2 4
do. Ord.	10	10	18	—	*5 11 1
Henley	25	25	2½	—	5 11 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	—	*5 14 3
Telegraph Con.	20	20	42	—	*4 18 0

*Dividends paid free of Income Tax.

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ASH AND CLINKER PLANT.

In modern electricity works the removal of boiler-house ashes is a matter of considerable importance, particularly at the present time, when the percentage of ash is so high. For large plants attention is drawn to the pneumatic suction system. In spite of its advantages, the number of such installations in this country is quite small. American practice shows up better in this respect. Pneumatic ash plant is now being employed wherever the size of the works and the quantity of ash to be removed justify the initial outlay.

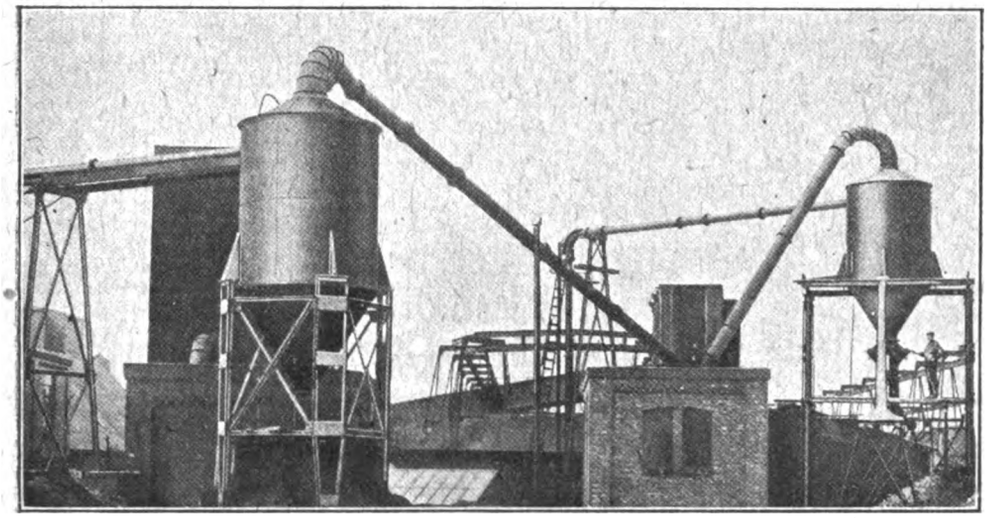

Fig. 1.—View of Fan House and Receiving Hopper.

Pneumatic Ash Plant.—The following description relates to an installation recently carried out to the order of His Majesty's Government. In general, however, it may be taken as typical. The plant is arranged to serve 32 Lancashire boilers, from which it takes the clinker and ash and deposits them in two steel ash tanks or receivers. Auxiliary branch lines are provided for cleaning the boiler flues, economisers, chimney bottoms, and so forth.

The installation comprises a motor-driven rotary exhauster, foul air cleanser, two ash tanks, and the necessary pipe lines for taking the ash or other material to the tanks. Holes are provided in the floor plates in front of each boiler flue, each hole being fitted with a dumping hopper, grid, and an air cut-off. As the ashes are drawn from the cleaning chamber at the back of the furnace bars of the stokers, they are dumped through these holes direct into the ash pipe, and are carried by suction into the ash tanks.

It is one of the curious properties of suction plant that wear only takes place to any degree at the points where the pipes are subject to a change of direction, viz., at the actual bend. The long, straight pipe lines do not suffer to anything like the same extent. The reason for this appears to be that the ashes are carried by the air in the centre of the pipe where the air is travelling at its highest velocity, and therefore they do not touch the pipes. At the bends, however, where deflection of air takes place, the ashes are constantly striking against the pipes with the inevitable result. Provision is made for this by placing special patent bends wherever the ash pipes are subject to change of direction. The wearing parts of these points are of exceedingly hard chilled iron and are easily renewable. For much the same reason there is a possibility that pieces of ash or clinker may be driven out of the air current and become lodged in the pipes at the bends. To provide against this contingency, a hand-hole with air-tight door is placed at each end of every bend to enable any such obstruction to be easily and quickly removed.

The ash tanks, two in number, are cylindrical in shape, and have a capacity of 20 tons each. They are built of mild steel plates lined with brickwork, angle iron rings being provided inside the tanks to support the lining. The top of each tank is coned to meet the end of the ash pipe line, whilst the bottom is hoppered to allow the ashes to be freely discharged by gravity. The discharge valves, water sprays, &c., are arranged inside the upper-coned portion of each tank, and a pipe is taken from the lower portion into a sump to get rid of any excess water which may have accumulated. This pipe is water-sealed in the sump. A large pipe is connected to the upper portion of each tank, and through it the foul air passes to a patent water-sealed cleaner or scrubber. This apparatus consists of a vessel filled with rows of water-sprayed bafflers, which catch any dust or fine particles of ash which might otherwise be carried into the exhauster. The large water seal at the bottom of the cleaner acts as a safety valve in case of undue pressure or vacuum in the apparatus.

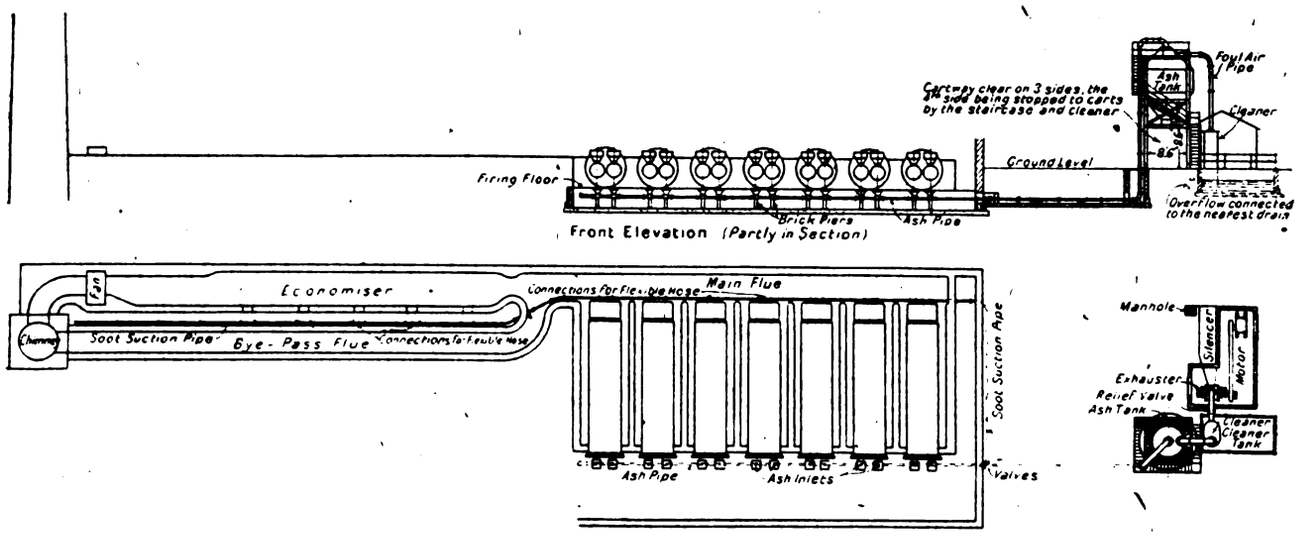

Fig. 2.—Typical Lay-out of Ash and Soot-handling Plant.

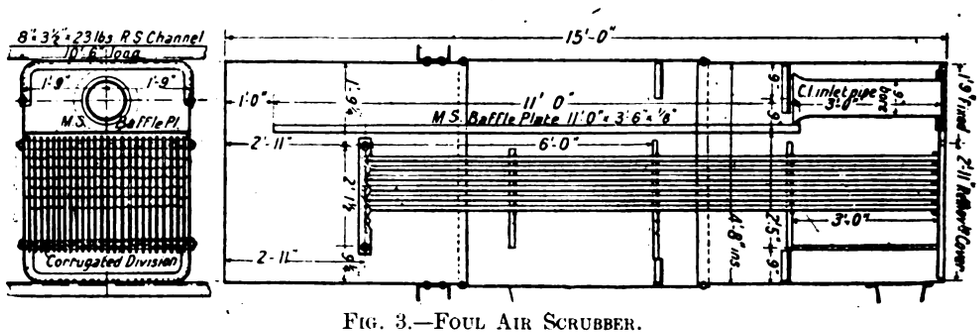

Fig. 3.—Foul Air Scrubber.

The method of discharging the ashes from the tank is as follows:—A patented balanced discharge valve is provided at the outlet from each tank, which allows of any required

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quantity of ashes being immediately delivered into the railway or other trucks drawn underneath for the purpose, or, as in some other installations, dropped through a shoot into barges in a canal. The rotation of a hand-wheel conveniently placed for operating, first loosens and then releases a catch, allowing the sealing door or valve to drop, which it does gently, being balanced. The rotary cut-off which actually closes the bottom of the ash tank is then opened, and as much ash deposited as required into the truck, when it is again closed. When the sealing valve is returned into its place, the catch automatically swings back into position, and,

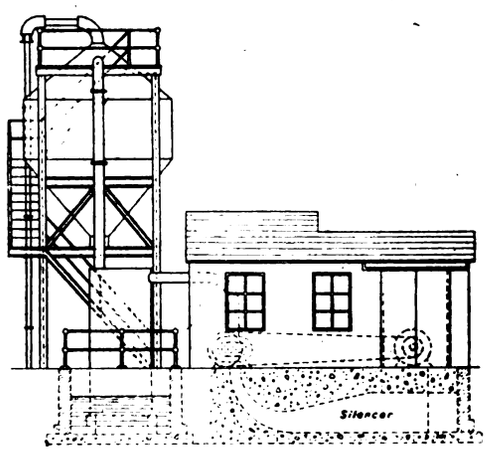
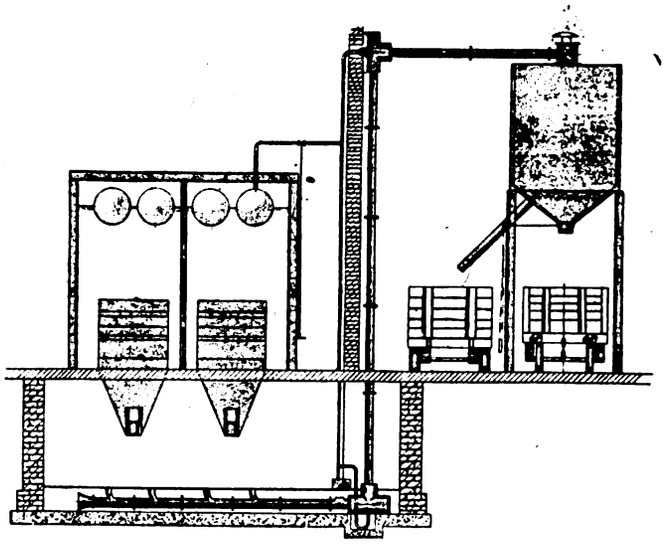


Fig. 4.—Arrangement of Exhauster, Cleaner, and Ash Receiver.

reversing the hand-wheel above referred to tightens up the whole mechanism again, rendering it completely air-tight.

The pipe line for removing the flue dust from the flues, economisers, and chimneys is entirely separate from the ash pipes. The flue dust is removed from the flues and economiser chambers through short flexible pipes, which are removable, and can be fixed to whichever branch it is desired to use. The flues and economiser chambers are provided with cover plates for closing down when the dust is not being removed. The suction end of each pipe is provided with a nozzle of patented design. The motor-driven air exhauster is of the rotary blower type, and the suction required in this plant is not much more than half that usually used in grain elevating plants, with a commensurate reduction in the motive power required and in the cost of operating. Several very large plants of this type have been installed recently.

Steam Suction Conveyors.—The need for a simple ash suction conveyor adapted to the requirements of small boiler-houses, and to installations where the capital cost of a pneumatic suction plant was not warranted, led to the introduction of a simple form of steam suction conveyor, made



Front Elevation.

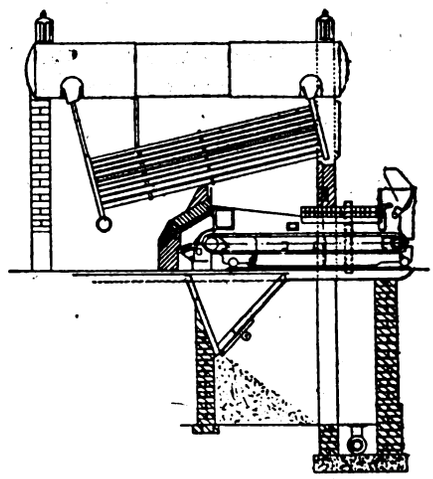
Fig. 5.—Typical Installation of Steam Suction Conveyor Delivering Ashes into an Overhead Storage Tank.

by Messrs. Ed. Bennis & Co., Ltd. This form of conveyor is adaptable to confined spaces, as a 6-in. or 8-in. pipe line can be placed where the space for an ash elevator is not available, whilst awkward curves and bends can be negotiated with ease. Moreover, it is not necessary to provide a large ash hopper, as ashes may be discharged, if desired, direct into a railway wagon or cart. There are no moving parts, so that wear and tear are reduced to a minimum.

This conveyor consists of a heavy cast-iron pipe line, made of special hard metal mixture. The pipes are fitted with patented bends, tees, and corner-pieces, which have renewable, chilled-metal wearing parts. For removing the ashes and clinker, a pipe line is laid in the boiler-house, generally under the floor plates, and ash intakes are provided in the floor in front of the boilers. Six-in. or 8-in. pipe lines are the sizes most in demand; the latter is generally regarded as the most convenient as it will take the larger lumps of clinker. The holes into the pipe are provided with hand valves, through which the ash is raked into the pipe. The economisers and flues are cleaned by similar means, branch lines of smaller size, usually 4 in. diameter, being used for this purpose.

When the steam valve is opened, the ashes are raked into the intake of the conveyor, and conveyed by suction to the overhead hopper, and thence removed as desired. The ashes can be elevated to a considerable height, and can also be carried comparatively long distances, say 200 or 300 ft. from the boiler house.

A special mixture of metal having high abrasion resistance qualities, is used for the cast-iron pipes. This metal is similar to that used for the troughs in the Bennis U-link chain conveyors, many of which have given 15 to 20 years' continuous service. The metal in the pipes is approximately 1 in. thick, and the pipes are faced at the ends. A gasket, usually of asbestos and copper wire, is employed. The bends are built up with an outside casing of cast-iron, with heavy chilled cast-iron liners to take the wear. The cover of the



Cross Section.

Fig. 6.—Typical Installation of Steam Suction Conveyor Delivering Ashes into an Overhead Storage Tank.

case can be easily removed to allow the liners to be lifted out and renewed. The liners are cast of a special abrasion-resisting iron, and highly chilled.

The steam nozzle is a separate fitting, bolted to the side of the case, and may thus be inspected or renewed at any time without disturbing the bend.

In suction conveyors it is found by experience that it is not desirable to have gently curved long bends. Their disadvantage lies in the fact that as the material carried through the pipes always tries to travel in a direct line, the ash or clinker strikes the pipe at the bend, rebounds, and strikes the pipe at another portion of the bend, this process being continued until the bend is passed. This causes scoring along the whole of the curve, and produces considerable wear and tear, whereas the sharp angled bend is so arranged that the wearing part is very much thicker at this point, and the steam nozzle being placed at the bend helps to keep the ash and clinker from hitting the inside of the liners. These bends may be 90 deg., 135 deg., or any other angle to suit the particular circumstances.

Ash Elevators.—The removal of ashes on the bucket elevating and storage system is deservedly popular, especially in small plants, on account of its simplicity and durability. A large number of such plants have been erected in works of all kinds. The view in fig. 7 shows an interesting self-contained plant in a Lancashire textile mill.

In this case the ashes are dumped into an 8-in. bucket elevator placed in a corner of the boiler-house, and are carried by the elevator into an overhead bunker, formed out of cast-iron plates carried on rolled steel joists, having a capacity of about 10 tons. The bunker is completely covered in to prevent the dust flying about.

A rotary cut-off valve, operated by a hand-lever from the ground level, is placed at the outlet of the bunker. This enables the ashes to be delivered into carts as required, ample head-room being allowed for this purpose.

The three boilers at this mill are fitted with "Bennis" elevator placed in a corner of the boiler house, and are supplied with coal by means of three independent bucket elevators. The whole plant is giving great satisfaction, and for a small installation represents, we are informed, a very near approach to perfection in mechanical coal and ash handling combined with maximum boiler efficiency.

Another method of ash removal, which finds favour in certain circumstances, is that where the ashes are raised by an incline from the ash gallery beneath the boilers, and delivered into a storage tank having a capacity of about 10 tons or more

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if desired. A valve fixed to the outlet from the tank and operated by a chain from the ground level enables the ashes to be discharged, as required, into a railway truck beneath. In this case, the incline is placed at the end of the boiler-house, and as the ashes are withdrawn from the boilers they are trimmed into trucks, which run on rails on the floor of the ash gallery. Each truck has a capacity of from 6 to 10 cwt. The trucks are pushed along to the end of the gallery, and tipped direct into another wagon, which is taken up the incline and automatically tipped into the bunker.

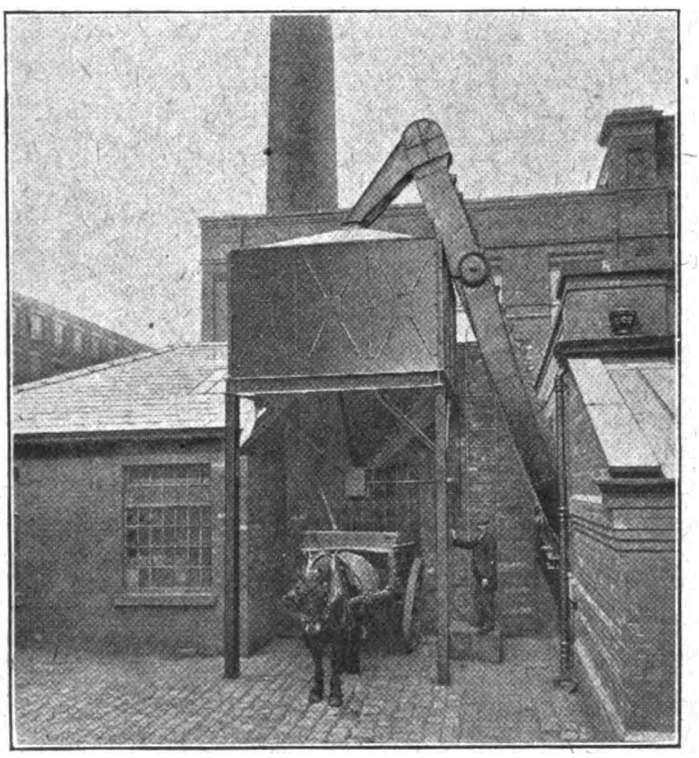

Fig. 7.—Ash Elevator and Covered-in Storage Tank.

The driving gear gives a winding speed of about 100 ft. per minute. A cut-off switch is placed on the structure at the top of the track, and when the truck reaches a certain point, the motor is automatically cut out to prevent over-winding. A similar device is fixed at the bottom of the track. This plant is in successful operation in a large Durham power station.

For the foregoing particulars and illustrations we are indebted to Messrs. Ed. Bennis & Co., Ltd., by whom the plant described was made and installed.

FEDERATION OF BRITISH INDUSTRIES.

The annual general meeting of this Federation was held on October 29th, 30th, and 31st at the Connaught Rooms, London. A special general meeting was held on the 29th ult., when the new constitution was formally approved, and on October 30th the retiring President, Sir R. Vassar-Smith, delivered his presidential address. He remarked that the Federation had nearly doubled its membership, and considerably more than doubled its strength. A year ago it represented 581 members and 78 trade associations; to-day the membership was 951, in which number 164 trade associations were included. He congratulated the committee which had drawn up their new constitution. If an organisation of that size was to avoid stagnation it was essential to provide it with an elastic constitution, so that each section might make its voice duly heard in the governing body. Such a consideration they now had; and he appealed to all connected with the group and sub-group committees to ensure that vital force might be breathed into the skeleton which had been evolved. A distinctive feature of the past year had been the organisation of the Parliamentary side of their work. Under the chairmanship of Sir Rowland Barran, the committee of this group had met with considerable success. No one could doubt that the Federation was justifying its existence by practical results. It was also evident that their past activities were founded on sound ideals. In the past it had been the object of unjustifiable criticism and suspicion, but that was fast dying out, and he hoped that the discussions which were to follow would put an end to it altogether. The President went on to refer to the various questions which were to be discussed, pointing out that the most urgent and difficult was the tariff question. They were now within sight of being able to present to the Government a national policy which would meet the requirements and safeguard the interests of every trade. Another vital matter of State policy was taxation. The resolution which would be proposed on this subject sought to define the principles which should guide the Government in apportioning taxation. Other important subjects they were to consider were labour, education, housing, and the organisation of industry through trade associations. It would add enormously to the strength of the Federation and to British industry generally if their huge membership would definitely adopt the policy of buying each others products in preference to foreign goods. Finally, it would be impossible to direct the process of reconstruction effectively without the co-operation of industry.

Sir Vincent Caillard was then elected President for the coming year.

Sir Algernon Firth proposed the first resolution (which was carried unanimously) impressing on the Government and country the necessity of maintaining the principle of private ownership of capital, and encouraging the free flow of capital into industry, and of preserving and encouraging that spirit of individual enterprise and initiative which was the vital principle of national life. In the course of a lengthy address, he pointed out that when the war commenced there were only 345,000 holders of British Government securities; now there were some 16½ millions, while there were 11 million accounts in the Post Office Savings Bank, and over two millions in the Trustee Savings Bank. After the war they must see that these savings would be encouraged to flow into productive industry. If the incentive to individual effort was removed and replaced by any system of governmental or communal control, the death-knell of the prosperity of their industries would be sounded. The interests of the community were best served by the fullest opportunity being afforded for the free play of individual talent. They wanted individual effort encouraged, security for their business, and not meddlesome interference, and that support of their workers which they could secure if left alone.

The next resolution, moved by Mr. Dudley Docker, emphasised the supreme importance of British industry, and urged upon the Government the necessity of recognising the importance of industrial interests, and of consulting the representatives of employers no less than of employed. He said that industry must recognise that it owed a duty to the community, and in pursuance of this duty the Federation would endeavour by co-operative and other means to raise production to the highest level both of quantity and quality, to reduce expenses of distribution and the cost of goods to the consumer, and to ensure the maintenance of industrial peace, and the enjoyment by all those engaged in industry of the fullest share practicable in the creation and distribution of wealth. It was for manufacturers to see that the industrial system did not lead to results which were not socially justifiable. In the past they had been careless of this aspect of the case, and they must recognise that many of the results of the old system were not justifiable. In these respects there must be an alteration, and they were all prepared to do their best to make the necessary alteration. The Federation afforded the best means for obtaining this result.

Sir Vincent Caillard moved a resolution on the subject of national economic policy, remarking that they had reached the point when they could look at the subject free from old prejudices and controversies. Their object was to frame a policy that should safeguard the requirements of all industrial interests whether by way of protective duties, maintenance of free import, subsidy, transport facilties, or otherwise, and thus enable each industry to attain its maximum productions. The whole strength of the country and the whole well-being of all classes, and of labour especially, rested on production.

The resolution also included declarations in favour of preferential treatment for the Empire and our Allies, and urged the Government to set about the preparation of provisional schemes immediately in order to apply a practical test to the problems involved.

The next resolution, moved by Mr. T. Biggart, urged the Government so to regulate and apportion taxation as to encourage the flow of capital into industry and increased production, the provision of adequate reserves to meet the cost of renewals and extensions, and the maintenance by manufacturers of adequate stocks.

On October 31st the first resolution affirmed the importance of improving education, both primary, secondary, and adult, with a view to enriching the mental life of the nation and developing individual character and initiative, and enabling every citizen to take his proper place in the activities of the community. The mover, Mr. F. W. Gilbertson, said that education would be more important in the future, especially of the young men, because so many educated men had died in the war. There was no one who was so well able to form an opinion as to the success of the educational methods as an employer, because he saw the results. A great deal of good would follow from a body like this taking a real interest in the subject.

Bailie John King, of Glasgow, moved a resolution on "Housing."

Sir Robert Hadfield, Bart., moved a resolution dealing with technical education, and inviting the co-operation of the Government, organised labour, and educational authorities, with a view to improving technical and higher commercial education, to promoting the employment by manufacturers of students who had taken advantage of the courses provided,

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and to securing the introduction into industry of an adequate and regular supply of suitably trained personnel. Sir Robert spoke of the great field which existed for the improvement of technical education, especially in the matter of science. It was remarkable that in the Civil Service examinations science was not a compulsory subject. He hoped the Federation would see to it that some change was brought about. He also pointed out the crying need for a building in London to house technical societies and organisations which at present were houseless. He hoped something in the way might be done in connection with the big building for housing this Federation, which they all had in mind. It would greatly help on technical education to have a proper technical centre where they could meet together.

Mr. Frank Moore moved a resolution affirming that the Federation viewed with grave concern the recurring instances of industrial unrest, and recorded its approval of the general principles underlying the first report of the Whitley Committee, and inviting the group and sub-group committees to consider how far these principles could be applied to their industries. When the report came out he was much prejudiced against it, but on fuller consideration of it he was converted to the main idea of the scheme. Industrial Councils, he felt convinced, led to greater harmony between employers and employed. Their interests were the same, and with the good feeling the report would bring about there should be no fear of any ill result.

Mr. Max Muspratt moved that with a view to consolidating the industries of the country and reducing the speculative fluctuation in prices, members were recommended, as far as possible, to draw their requirements of manufactured products from members of the Federation.

Mr. H. R. Armitage moved a resolution impressing upon manufacturers the great advantage to be derived from co-operation and the organisation of industry through trade associations.

The last resolution was one approving the general lines of the policy of the Minister of Reconstruction in forming joint committees of employers and workpeople to advise the Government on reconstruction questions, but emphasising the necessity of adapting this policy to suit the conditions of the different trades.

At the luncheon, Sir Vincent Caillard presided, and, in proposing "The Guests," included the names of Sir Auckland Geddes, Dr. Addison, Mr. Hewins, and Mr. Wardle. He remarked that manufacturers did not always see eye to eye with the Government. They recognised the great and sterling qualities of those gentlemen, and the tact and courtesy which they invariably displayed. The present gathering would afford those gentlemen an exceptional opportunity of saying anything they wished to say to British industrialists to a great assembly which represented pretty well the whole industrial energies of the Kingdom. They were very nearly a thousand in membership; they would probably be a thousand in the course of a few weeks; they represented through direct membership of firms and associations something like 16,000 manufacturing firms in this country, and an aggregate of £4,000,000,000 of capital. They would be glad to hear from their visitors the Government's intentions with regard to the control of industry, which they recognised as a necessity for some period after the war, but which they hoped would be relaxed as quickly as possible in order that industry may have the free play which was its life blood. They would like to hear something about the plans for demobilisation, and particularly those for the employment of the soldiers and sailors. They would also like to hear something about reconstruction—not the appointment of committees, but decisions taken and results attained. They would also like to hear something as to the future economic policy of the country.

Sir Auckland Geddes, who was the first to respond, said the war was drawing to its close. It was not long before they would be faced with the problems of reconstruction. It was a difficult question. Our reconstruction must have the effect of making every family in the State feel that its position and health and well-being were of real interest to the State. He did not wonder that there was industrial unrest. He only wondered there had not been revolution years ago with regard to health and housing. Only if production was carried on upon a larger scale could they meet the cost of the war and the cost of peace. The problems of the coming peace were more dangerous than any of the problems of the war. He would like to see the old parties done away with, and a great party of the centre, a new commonwealth party, formed for the common weal.

Dr. Addison, whose speech was briefly referred to in our pages last week, dealt with the subject of demobilisation, and said the first business of the Government would be as quickly as possible to re-establish the great basic industries of the country. The resolution on reconstruction passed by the Federation exactly expressed his own policy. He formally accepted the Federation's offer of co-operation.

Mr. Hewins, Under Secretary for the Colonies, dealt with the economic policy of the Government. They were not dealing with an ideal world, but were dealing with the circumstances and conditions of the British Empire with regard to foreign countries. Whether Protection or Free Trade were good things in the abstract he did not know; the question was whether as regards any particular trade or industry tariffs should be set up. It was a question of the particular requirements of the particular trades, and the resolution passed by the Federation was, he considered, on absolutely sound lines. He repudiated the suggestion that the Government had never declared its policy. In the Paris resolutions, and the resolutions of the Imperial War Conference in 1917, the Government had set out its intentions. What had to be done now were matters of detail. The reasons why the Government had not made a statement as to economic policy was not that the Government had not a policy. It was carrying out that policy effectively, but they could not deal with these questions as a set of philosophers.

Mr. G. J. Wardle, Parliamentary Secretary of the Board of Trade, said he hoped the time was not far distant when, instead of having separate congresses of employers and workers, they might have joint conferences. They must have self-government of industries, but not with Labour shut out. If the Kaiser must go, the autocrat of industry must go too. Employers would have nothing to lose, and the employed much to gain.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Septon-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

17,527. "Electrical recording graph." T. H. Escott, R. G. Horton & W. Leeming. October 28th.
17,543. "Electric furnaces." H. A. Kent. October 28th.
17,567. "Electrical fuse." H. E. Trent. October 28th.
17,575. "Switch control for automobile electric tail lights." D. G. Zaiocostas. October 28th.
17,621. "Magneto sparking plugs." H. D. Killick. October 29th.
17,631. "Oscillators or vibrators for wireless telegraphy, &c." M. Compare & Comparri Wireless Control Syndicate. October 29th.
17,639. "Systems of frequency transformation." British Thomson-Houston Co. (General Electric Co., U.S.A.) October 29th.
17,650. "Electrolysing solution of nickel salt." C. Heberlein. October 29th.
17,666. "Control of ignition devices for internal-combustion engines." W. W. Cunliffe. October 29th.
17,722. "Systems of electrical distribution." British Thomson-Houston Co. (General Electric Co., U.S.A.) October 30th.
17,708. "Electricity generating and supply means." Brush Electrical Engineering Co. & H. Roberts. October 30th.
17,731. "Electrically-heated fabrics." A. S. Lucas. October 30th.
17,735. "Electrical fitting connections." J. A. McKay. October 30th.
17,745. "Electrodes for sparking plugs for internal-combustion engines." E. H. Jones. October 30th.
17,747/8. "Sparking plugs for internal-combustion engines." E. H. Jones. October 30th.
17,754. "Manufacture of electric dry batteries." Burgess Battery Co. October 30th. (U.S.A., October 20th, 1917.)
17,777. "Electrical switches." A. C. Robinson. October 31st.
17,794. "Electric lampholders." T. L. Jones. October 31st.
17,795. "Sparking plugs for internal-combustion engines." F. A. L. Johnson. October 31st.
17,817. "Automatic voltage or current regulator for electrical generators." E. T. Cook & S. Merrin. October 31st.
17,824. "Separators for electric accumulators." E. F. Ablitt. October 31st.
17,837. "Non-spillable battery cells." E. H. Naylor & S. F. Tyler. October 31st.
17,841. "Detective and protective devices for electric cables." C. J. Beaver, E. A. Claremont & A. F. W. Richards. October 31st.
17,932. "Method of electrically treating steel, &c., and hardening steel, &c." W. J. Kendell. November 2nd.
17,947. "Sparking plugs for internal-combustion engines." D. McGregor. November 2nd.
17,962. "Galvanic cells." M. L. Kaplan. November 2nd.
17,972. "Galvanic cells." M. L. Kaplan. November 2nd.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

6,536. Apparatus for use in testing electric lamps and the like. British Thomson-Houston Co. (General Electric Co., U.S.A.) May 8th, 1917. (119,668.)

13,014. Apparatus for driving magnetos in connection with internal-combustion engines. Soc. Lorraine des Anciens Etablissements de Dietrich et Cie. de Luneville. September 30th, 1916. (119,672.)

13,083. Apparatus for driving magnetos in connection with internal-combustion engines. Soc. Lorraine des Anciens Etablissements de Dietrich et Cie. de Luneville. January 29th, 1917. (Addition to 13,019/17.) (119,674.)

13,084. Apparatus for driving magnetos in connection with internal-combustion engines. Soc. Lorraine des Anciens Etablissements de Dietrich et Cie. de Luneville. March 3rd, 1917. (Addition to 13,019/17.) (119,675.)

14,451. Dynamo-electric machines. Submersible & J.L. Motors, Ltd., and C. W. Durnford. October 5th, 1917. (119,683.)

14,557. Electric snap switches. J. S. Withers (Hart & Hegeman Manufacturing Co., U.S.A.). October 8th, 1917. (119,689.)

14,750. Coupling devices for electric cables. Submersible & J.L. Motors, Ltd., & C. W. Durnford. October 11th, 1917. (119,794.)

16,499. Starters for electric motors. Electric & Ordnance Accessories Co. & N. G. Langrish. November 10th, 1917. (119,736.)

17,136. Means for adjustably connecting a magneto and a gearbox with a common bracket of a motor-cycle. S. C. Poole, F. W. A. Smith & Clyno Engineering Co. November 21st, 1917. (119,745.)

17,930. Electromagnetic clutches. A. Soames & W. Langdon-Davies. December 4th, 1917. (119,754.)

18,080. Electric induction coils for medical purposes. E. E. Greville. December 6th, 1917. (119,756.)

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THE

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ELECTRICAL REVIEW.

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RECONSTRUCTION MOVEMENTS.

DURING the past 12 or 18 months we have endeavoured to keep our readers informed respecting Government investigations of problems of reconstruction and preparations that were in progress for the introduction of measures for carrying into effect schemes which, as a result of careful deliberation, were considered necessary in the interests of the well-being of the nation.

The end of hostilities came with greater suddenness than was expected, and our Government reconstruction measures may not have been sufficiently advanced; but, as we have shown in these pages, many of the leading engineering and electrical manufacturers have been making their preparations for a long time, and in their case the change over from munitions to normal manufactures will probably be conducted with greater smoothness than in some others. Theirs have been practical reconstruction operations for which no Parliamentary executive powers have been needed, though, to a certain extent, they have been made contingent upon the attitude of Government towards British manufacturing industries of their class, and upon the lessening of controls, the availability of raw material, and the provision of tonnage for accommodating export trade, which everybody recognises must be resumed and accelerated with the greatest possible expedition. Some further interesting developments that are being proceeded with by British manufacturers are referred to in our "City Notes" to-day, notably in the report of the speech delivered by Mr. Cayley at the meeting of Dick, Kerr & Co., Ltd.

The Armistice was signed on Monday, last week, but several days earlier official statements were made by the Minister of Munitions regarding contractors, workers, and productions coming under his control. Almost immediately after the signing of the Armistice, the flood-gates of official matter were flung wide open, and since then there has been a full and continuous flow of announcements.

We wish that the paper and, therefore, the space at our disposal permitted us to do all the proceedings justice. That, however, is quite impossible. There is to be a gradual suspension of munitions manufacturing; the Ministry of Munitions is to become the Ministry of Supply; political conferences have been taking place, in which policies regarding demobilised war-workers and soldiers have been discussed; there has been a conference between Ministers and employers and workpeople on the maintenance of war rates of wages for six months, so as to cover the period during which the cost of living may fall, and the necessary Bill is practically through Parliament; the Minister of Reconstruction has made a lengthy statement in the Commons respecting the proposals of his Departments and the work of his Committees; the Minister of Munitions has issued an Order concerning the transfer and discharge of munition workers and their treatment as regards wages, allowances, priority, &c.; both the Minister of Munitions and the Minister of Reconstruction have let it be known that they are open to receive proposals from industry for the future possession of some of the great national factories established during the war; restrictions on imports and exports of a number of classes of goods have been withdrawn, and more are to follow; in short, a great deal has had to be done in a hurry to facilitate the return to normal industrial operations. Labour has voted the withdrawal of its members from the Ministry, and the Premier has described that action as the height of folly. Mr. Barnes has severed his connection with the Labour Party. Last, but by no means least, Mr. Lloyd George has made public the coalition policy respecting Imperial Preference, "key" industries protection, the future of the railways, tramways, &c., and the development of electric power supply.

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We are compelled to assume that manufacturers and munition workers have been familiarised with many of the official pronouncements through the usual channels, but we must in conclusion draw the attention of all our readers to a twopenny pamphlet issued by the Ministry of Reconstruction on "The Demobilisation and Resettlement of the Army." It is important that everything should be done to assist the Forces, so that there may not be a shadow of doubt in their minds as to their position. The pamphlet ought to be given to every man as he is discharged—indeed, some millions of copies might with advantage be sent "over there" for them to study while matters are quieter and while they have time to think out their personal movements. Our correspondence has shown us that they have been thinking somewhat deeply; and while expert authorities are giving attention to their education and training as they wait for the signing of Peace terms, this question and answer pamphlet should be useful to them.

Wise Words from Lord Burnham.

In order that the foundations of prosperous industry and contentment in national life may be well and truly laid, few things are of greater consequence than the spirit in which we all approach the very difficult problems of demobilisation and the transfer from war work to Peace activity. We are aware that there is nothing either new or original in this remark. But it seems to be very necessary that we should say it at this particular juncture. Last week the Industrial Reconstruction Council listened to an interesting lecture from Sir A. Steel Maitland, which was full of suggestiveness in regard to the momentous changes which may be upon us. We all stand under obligations, which cannot be ignored, toward all who earn their livelihood in industry, and no reasonable proposition should be condemned without a proper hearing. For reactionary spirits among employers there will be no room to-day. Negotiations should be entered into with the goodwill which will go as far as possible, not just as far as compulsion dictates, in simplifying the settlement of industry. Of course, there will, as always, perhaps more so, be demands of an impossible nature forthcoming from visionaries or from those who shut their eyes to the danger of killing the goose that lays the golden eggs. But there will be many other matters that do not come within this category containing germs which, while not dangerous in the early stage, may be hurriedly developed unless they are met in the spirit which the peculiar times require. Interesting as Sir Arthur Steel Maitland's address was, we consider that the more important part of the proceedings at the Industrial Reconstruction Council, was to be found in the remarks with which the chairman, Lord Burnham, closed the meeting. With very weighty words he warned his hearers that, notwithstanding all that had been done on paper to prepare for the period of demobilisation and reconstruction, things were not practically ready for the great changes that were upon us. He appealed to the employers of the great City of London to open their doors wide for the ready return, and for the happy and contented absorption into industrial and commercial life, of those who left them in order to take up arms. It is perfectly true that many businesses have not been conducted with too great success during the past few years, and that taxation is heavy and is likely to continue so; but a warning must be given against the adoption of a short-sighted policy even in these cases. Ill weeds grow apace, and there are plenty of sowers of tares about who would choke the growth of all the good that should result from the terrible sacrifices of the war. The best way to defeat the objects of mischief-makers who would like to see industrial disorganisation here as elsewhere, is to display a broad-minded and generous policy in finding work for those who have saved the British Empire and, therefore, its industries. Most of the firms connected with electrical and allied manufacturing have a period of great activity before them, and they will have less difficulty than some trades in absorbing the specialised professional men and industrial workers who will be returning ere long; but the appeal of Lord Burnham requires to be made to others as well, and we make no apology for passing the counsel on to them.

World Communications.

From what we have published in these pages during the past twelve months, it has been plainly seen that the editors of newspapers published in different parts of the British Empire are unanimous in their appeal for additional cabling and wireless facilities to be established. Notwithstanding the interesting developments of the last four years, concerning which little can even now be said, the Press has found few things so great a handicap to community of thought as inadequacy of facilities for the freest possible flow of information and opinion between the Mother Country and all the branches of our Great Family. Cost, congestion from various causes, censorship and its delays, have given rise to restriction of communication, to ignorance abroad concerning the real state of things at the Front and at Home, and to a good deal of irritation not only among public newspaper men but among the people whose interests they serve. We are not now discussing the technical aspects of submarine or wireless telegraphy; we are addressing ourselves to the general question, and in urging that the whole matter of telegraphic communication throughout the world be taken in hand at once for expert investigation as part of the great work of reconstruction, we find considerable support in a letter of the London Correspondent of the Philadelphia *Public Ledger* (H. J. Learoyd). He advises that "in the interests of Anglo-American information and mutual understanding" no time should be lost in "multiplying the Atlantic cable services which have so utterly failed recently to meet even urgent demands." It has been an unfair tax upon the Press, which has had such power in fostering a good understanding between the States and ourselves during recent days, to have had to pay commercial rates for practically all messages from Europe to America. But what is of such great importance is the absolute certainty that vast developments of interest have been aroused between this country, the States, and the Empire during the past four years, which justify Mr. Learoyd's statement that "there is no probability that present existing facilities will ever again meet requirements." He says: "With the expanding interests and demands already in sight, it is plain the only way to approach the subject effectively is from a broad constructive point of view. Repairs are urgently needed, but additional cables are the only possible solution." His mention of the "broad constructive point of view" reminds us that the matter stands far higher than if it had to be considered as a mere commercial proposition—a question of dividend return on capital invested. The consolidation of British and inter-Allied interest will bring so valuable a compensation as to render percentage of profit a comparatively unimportant matter. It is well known that we range ourselves alongside those who think it folly to plan immense outlays upon great public social schemes, after the world's prodigal expenditure upon war, until we can see better where we stand; but there are practical proposals for the world's highest good and for the fostering of commerce which are an absolute obligation resting upon us all in these days, when we know well enough we must find national revenue to make up for recent waste, and must provide work for our population in our greatly-extended factories.

A matter of more immediate practical politics, which must be dealt with, is the removal of the censorship of foreign cablegrams, and of the ban on private commercial codes. We do not ask for complete relief one moment earlier than will be absolutely safe, but all handicaps on our foreign trading operations ought to be got rid of as speedily as possible. Of course there is the danger that Germans, through neutrals, will take advantage of any relaxation of commercial cable censorship, and flood the cables with their messages in furtherance of their own export trade interests. Complete removal of cable censorship is quite impossible at the moment, but inasmuch as commercial cable messages are of such vital importance in trade reconstruction, it should be modified as far as can be, with reasonable security, without delay.

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Indian Water Power.

Elsewhere in this issue we give abstracts of two papers relating to the industrial development of India, and we wish to lay emphasis on the extraordinary interest which attaches to this question—a matter of vital importance to the Empire, and incidentally to the British electrical industry. Our contemporary, *Indian Engineering*, directs attention to the rapid progress which is being made by the Native States of India, whilst British India is appointing Commissions and achieving nothing. The State of Gwalior, for instance—under a ruler noted for his progressive and enlightened administration—has sanctioned a scheme involving the generation of 8,000,000 KW.-hours a year, is laying out an industrial city under the direction of Prof. Stanley Jevons, and is promoting the establishment of no fewer than 25 factories. It is estimated that the water-power resources of this State alone could furnish nearly 7,000 million KW.-hours annually, and that the smelting of iron ore, the production of aluminium, and the manufacture of paper pulp, as well as a variety of other industries, can be profitably entered on. Iron ore and limestone are plentiful in Gwalior, but coal is not available within 600 miles of the State, so that electric furnaces, with charcoal as the reducing agent, have a most favourable opportunity for demonstrating their merits. The report of the Water-Power Committee which we recently abstracted shows that abundance of power is available in other parts of India; Mr. Joyner states that there are many places where the conditions are even more favourable than those under which the remarkable undertaking of the Tata company was carried out, and Mr. Dickinson refers to a site on the Koyna River whence 300,000 H.P. can be readily obtained continuously, or 730,000 H.P. during the normal working hours.

Such figures are amazing; taken in conjunction with the material economic resources of India, they indicate the immense potentialities of Indian industry which are as yet practically untapped. In passing, we would particularly direct attention to the fact that the great scheme of the Tata Hydro-Electric Power Supply Co. was planned and carried out by British engineers, and, to a large extent, equipped with British plant; there is no reason whatever why future schemes should not be *entirely* British—we have the men, the experience, and the ability to tackle any hydro-electric scheme whatever.

But we must not ignore a most important factor in the problem of developing the industries of India—the financial aspect of the matter. The Tata scheme could not be financed in London—it was readily financed in India; and other large schemes promoted by Indian business men are on the cards. Mr. Dickinson points out in his weighty address that the European must drop his exclusiveness, and admit the cultured Indian to his society on level terms—as a partner, not as an inferior.. The educated Indian is no whit behind the European in intelligence and ability, and he resents the haughty attitude of the European resident; unless that insular exclusiveness is profoundly modified, the consequences will be serious. India has established her claim, by loyalty, enterprise, and intelligence, to a full voice in the conduct of her industrial affairs, and she will not be denied.

An important report by the Indian Industries Commission has recently been published in India, but, so far, only a summary has reached this country; from this we gather that the report directs attention to the vital necessity of ensuring the establishment in India of those industries whose absence involves grave danger in the event of war, and refers to the harnessing of water power as affording a reliable source of energy, especially with a view to the development of thermo-electric industries. The Government is, therefore, urged to undertake a hydrographic survey, to determine the places which offer possibilities for the establishment of hydro-electric installations; as noted in our issue of November 8th, this survey has been set on foot. It is clear that the possibilities of industrial development are immense, and British electrical manufacturers would do well to maintain a close connection with this colossal market for their products.

Rural Amenities in Great Britain.

The imperative necessity of developing our agricultural industries, and to that end improving the amenities of country life, was one of the prominent features of the election address delivered by Mr. Lloyd George on Saturday last. The importance of this subject is beyond question, and it is of special interest to electrical men, because they can do a very great deal towards increasing the comfort and adding to the attractions of rural occupations. As Mr. H. Rider Haggard points out in a letter to *The Times* of Tuesday last, one of the most depressing factors which tend to drive people from the country to the towns is the "appalling darkness" during the winter months. We have on many occasions drawn attention to the merits of electricity supply as a means of mitigating this and other drawbacks, and we cordially endorse Mr. Haggard's suggestion that the development of electricity supply for lighting, heating and cooking in country villages would be a godsend to the residents. A very cheap supply is not so necessary as a very general supply. Mr. Haggard is mistaken if he supposes that this country is blessed with abundance of water power; in certain mountainous districts, it is true, a great deal can be done with *small* hydro-electric installations, as was shown recently in our pages by Mr. Thos. Smith, who gave some particulars of 200 small plants put down in Wales by a single firm*; but, as a rule, there is nothing to hope for in this connection. On the other hand, there is no agency so readily controllable as electricity; a combined oil engine and dynamo is an extremely simple and manageable machine, and there is not a village in the country, we should say, which does not now contain at least one man capable of running a petrol or oil engine. Thousands of such sets will shortly be coming back from France and other fields of war. It will be not months, but years, before the general supply of electricity is extended to all the little hamlets that are crying out for it, no matter how energetically the Government may develop the national scheme (and, to say truth, we have not yet seen a particle of evidence that it is acting at all in this matter). To many of the more isolated villages the public mains will never be extended.

Now, why should not those discarded lighting sets, thrown idle by the cessation of the war, be placed at the disposal of our village Councils, on easy terms, and used for the immediate introduction of electricity supply on a small scale? At first, no doubt, it would be necessary to restrict the demand to lighting; but ten kilowatts will supply no fewer than 300 25-C.P. lamps alight at once, or, say, 600 connected—enough for a good-sized village. The generating cost, with cheap oil fuel (and any petrol engine can easily be adapted to run with tar oil) would be small; light overhead conductors would distribute the current; no battery or other complication need be installed—an occasional failure of supply for an hour or two would not matter. We believe that some such plan would confer a great boon upon countless homes, besides efficiently utilising war material, and we earnestly press it upon the notice of the authorities.

High-Pressure Operation.

As the hour approaches for going to press, a torrent of matter of the first interest and importance is flowing in, taxing our limited space to the utmost; we are compelled to defer many items to a later issue, and to postpone our comments on some of the subjects dealt with in this issue. For the moment we must be content with drawing attention to the important report of the Council of the I.E.E. on Patent Law Amendment; the schedule of working conditions and rates of pay in electrical undertakings which has been agreed between the Committee on Production and the Trade Unions; and the statement of extensions to electricity works during the war, issued by the Ministry of Munitions—an astonishing record, which speaks for itself, and incidentally may be regarded as the reply of the Ministry to the attack recently made upon it by the I.M.E.A. Council. We hope to comment on some of these items next week.

*Electrical Review, August 30th, 1918, p. 197.

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THE GRADING OF DIRECT-CURRENT STARTER RESISTANCES.

By PERCY H. JACKSON.

The calculation of a resistance for a direct-current motor starter necessitates the careful consideration of the following factors :—

(*a*) The maximum value of the current peaks when switching on from contact to contact must not exceed 150 per cent. of the rated full-load current of the motor.

(*b*) The grading must be in the form of a geometrical progression.

(*c*) In order to reduce to a minimum the flashing between contacts, the spark volts must be limited to a predetermined value.

(*d*) The current allowed to pass on the first contact must be such as will avoid excessive flashing when switching off.

The realisation of these ideals is dependent upon the number of contacts provided, which number is, unfortunately, limited by trade competition. Nevertheless, it is possible to obtain successful results if the calculator will keep before him the foregoing requirements.

Many text-books deal with the methods adopted in calculating starter resistances, but the details are so vaguely explained as to render but little assistance to those without knowledge on the subject. A simple explanation, therefore, may be appreciated.

Take, as an example, a 50-H.P., 440-volt, direct-current starter resistance. If calculated correctly, the results will be as shown in fig. 1.

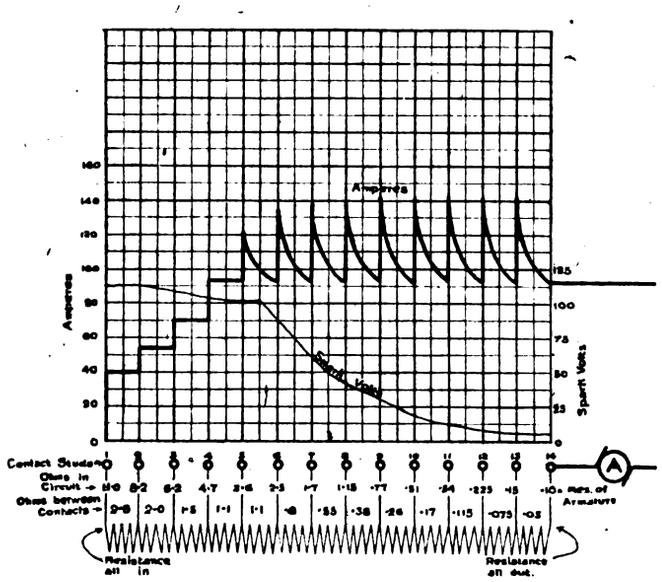

Fig. 1.

Let us deal, first, with (*a*), and ascertain what is meant by "current peak," why its value must be limited, and how it is calculated.

When starting a motor with an ordinary face-plate starter the resistance is cut out in steps, allowing the motor to accelerate as each contact is passed. At the moment of cutting out of circuit each step of resistance, the current will increase above the normal starting current to an extent governed by the amount of resistance remaining in circuit. This rush of current is momentary only, and again falls rapidly to normal as the motor gathers speed corresponding to the amount of resistance still remaining to be cut out.

The specification for starters for electric motors which is recommended by the British Engineering Standards Committee states that the maximum value of the current peak must not exceed 150 per cent. of the rated full-load current. This requirement is based on experience. Large rushes of current will sometimes interfere with the proper working of other apparatus on the same circuit. Furthermore, the overload coil on the starter very obviously must be set to operate at a higher current than the current peak, otherwise this would operate during the starting period, with the result that the "hold-on" coil would be short-circuited, because the normal current will be sufficient to retain the armature of the overload coil against the cheeks of the same when once it has pulled up. If, then, the current peak, as in fig. 1, is equal to 150 per cent. of the normal full load current, the overload coil on the starter must not be set to operate at a value lower than this. The usual setting of the overload coil is between 150 and 200 per cent. of full-load current.

As stated previously, the current peak, or maximum current when switching on from contact to contact, is governed by the amount of resistance remaining in circuit. In the example we have chosen, the normal full-load current of the motor is 94 amperes. The peak, therefore, must not exceed 14 amperes. For example, refer to contact 7, the resistance in circuit is 1·7 ohms. Imagine the starter lever moved quickly to contact 8, leaving in circuit a resistance of 1·15 ohms. Before the motor has had time to increase in speed, consequent upon the reduction of resistance, the current jumps to a value equal to the starting current × the resistance in circuit before switching on ÷ the resistance in circuit after switching on. This amounts to 94 × 1·7/1·15 = 139 amperes, or 148 per cent. of the rated value.

Take the starter a step further, and we have 94 × 1·15/0·77 = 140 amperes, and so on until the "full-on" position is reached.

If the resistance is in the form of a geometrical progression the value of the current peak remains constant at all contacts, and it becomes necessary to calculate one step only.

Referring now to (*b*) it is, of course, agreed that the grading of the resistances must be in the form of a geometrical progression to ensure even acceleration of the motor. Most text-books explain the method of obtaining this and also the mechanical method suggested by A. E. N. Pochin,* but the quickest method is undoubtedly the outcome of practice. To anyone frequently engaged on resistance calculation a rough mental calculation will show an approximate geometrical progression which can quickly be converted to accuracy by means of the slide rule. In the chosen example the resistance in circuit on the last contact—viz., the armature resistance—and the resistance required to start the motor—*i.e.*, on the fourth contact, are known values. Now, the grading must be such that the ratio between the ohmic value in circuit on contacts 14 and 13 must be similar between contacts 13 and 12, and so on as far as contact 4. Let us make a mental calculation, and assume that the resistance shall double itself at each contact; it is quickly realised that such a ratio is too large. Now take a slide rule, and, using the top scale, place the figures on the slide representing the armature resistance—viz., 0·1—against any figure lower than 0·2 (double its value) on the fixed scale, for example, 0·17 : now read off as 0·1 is to 0·17, so 0·17 is to 0·29, and so on. Again, it is realised that the ratio is too large. Further attempts will soon realise the desired objective. The writer finds this to be the quickest method yet devised.

Reference to (*c*) shows that the spark volts between contacts must be limited to obviate flashing. By spark volts is meant the voltage absorbed by the resistance between any two adjacent contacts. For example, the resistance in circuit on contact 1 is 11·0 ohms, whilst that in circuit on contact 2 is 8·20 ohms, the difference being 2·8 ohms. Now, as the current allowed to pass is 40 amperes, the spark volts will be 40 × 2·8 = 112. Between contacts 2 and 3 the resistance is 2·0 ohms, and the current allowed to pass is 54 amperes, therefore the spark volts amount to 108. After the maximum current has been reached, the resistance between contacts falls in value, consequently reducing the spark volts, from which it will be gathered that the first few contacts are those which require the most careful grading in this respect. If sparking between contacts is to be eliminated altogether, then a sufficient number of contacts must be provided to allow of the volts being kept within the neighbourhood of 40. The cost of such a starter would be prohibitive if it were desired to

* Electrical Review, August 19th, 1904, page 287.

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compete successfully with modern apparatus. However, experiments have shown that if the voltage absorbed by the resistance between contacts is limited to about 120 for this size of starter, satisfactory results will be forthcoming if the starter is used properly. If, when starting the motor, the starter handle is allowed to travel back slowly for such a distance as will insert one of the earlier steps of resistance, then heavy flashing will surely result, and often with disastrous consequences, and for this reason it becomes necessary for the prospective purchaser to consider the conditions under which the apparatus will be used. If it has to be handled by one whose knowledge of electrical apparatus is nil, then a step-by-step mechanism which prevents the lever travelling back slowly must be provided.

Referring now to the fourth factor (*d*), which we are considering, the current allowed to pass on the first contact should be limited to avoid heavy flashing when switching off. This value varies according to the capacity of the starter, but for a 50-H.P., 440-volt starter a maximum of 40 amperes may be assumed.

Specifications frequently determine the maximum initial current which has to be worked to, but, apart from this, the life of the starter must be considered. Although a quick break is provided, this is not sufficient to prevent heavy flashing if the full-load current is allowed to pass on the first contact of a 50-H.P. starter.

We have already found that if the motor starts on the fourth contact, this allows of the grading being such as will give a current peak not exceeding 150 per cent. of full-load current, and, consequently, take advantage of the first three contacts to build up the current. It might be concluded that the difference between the initial current and starting current values might be equally divided as follows:—Contact 1, 40 amperes; contact 2, 58 amperes; contact 3, 76 amperes; contact 4, 94 amperes, which gives an increase of 18 amperes per step. Such a conclusion would be totally wrong, because the spark volts between the first two contacts would be too high, hence the necessity for governing the current increments by the spark volts, and not *vice versâ*.

FACTS FOR RECONSTRUCTIONALISTS.

By M. E. NICHOLLS.

The dramatic turn of events at the Front, which without a doubt herald the speedy approach of Peace, must of necessity hasten the deliberations of those good people who have been selected to sit upon the Committee on Reconstruction, to investigate and to calculate, and to formulate some plan which will regulate the change over from war to peace industries. Particularly urgent is the problem of settling in civil life the demobilised soldiers and sailors, and also the future destiny of the great mass of people who, for the past three or four years, have been engaged in the great munition factories of the country.

A great many of these munition factories, which before the war were old-established engineering concerns, will, upon the cessation of hostilities, revert to their pre-war specialities, or embark upon a new line of manufacture, of a competitive character. It may safely be assumed in these cases that the number of persons employed will not diminish to any appreciable extent, although it must be borne in mind that thousands of demobilised soldiers, who, prior to joining the Colours, were employed by these firms, must be given the opportunity of resuming their positions, priority being given them over the people who entered the factories during the war period.

The great national factories, which have come into being during the war, will, no doubt, be utilised for the purpose of producing lines of manufacture which have been in abeyance during the past four years, and these factories will provide employment for many thousands of people. In this connection, however, the fact must be faced that the existing numbers of workers will probably have to be reduced, and that here, as in other factories, the employment of demobilised soldiers must be the prior consideration.

It is a mistake to assume that all the women will leave the engineering factories at the end of the war. Many thousands will, no doubt, do so, but more thousands will desire to remain. These women, who have served a three or four years' apprenticeship (though at a much higher rate of pay than is usual) are now proficient in their respective spheres, and will be extremely useful to their employers in the coming competitive era. Business is business, and the employer, as a rule, is not disposed to lose the services of a valuable worker for either sentimental or patriotic reasons.

It may, however, be assumed that all these points are receiving the consideration of the Committee, and that some practical scheme is being formulated with a view to distributing labour to the best advantage. The Government of the day is usually solicitous for the welfare of the manual worker, even though the help received from that quarter is not, perhaps, very substantial. A very different state of affairs exists, however, in the case of the clerical worker (who has always been looked upon as fair game by the employer), and it is quite possible that this class of worker will be overlooked, or, at the best, inadequately considered by those who are now deliberating.

The clerical staffs of the munition factories are mainly composed of women and low-grade men (physically), many of whom must be displaced when the original occupiers of their stools and chairs are released from the Army. Owing to the exigencies of war-time production, the numerous and detailed reports required by the Government Departments, &c., these staffs have swollen considerably, and there will be a big reduction in numbers when these conditions are no longer applicable. Even in pre-war days, the firm deciding to practice economy usually selected the staff as the first subject upon which to commence operations, and when the time arrives, when reconstruction is necessary, there is no reason to suppose that this procedure will be reversed. The stalwarts of the factory, whether clerical or otherwise, will, of course, receive favourable treatment, but with regard to the clerical rank and file, the position is somewhat obscure.

As with the manual workers, many women will relinquish their posts at the cessation of hostilities; but many will desire to remain. Many of the male workers, who have only entered the factory for the duration, will return to their own avocations as soon as circumstances permit: but these numbers will be more than equalled by the return of the soldiers.

It must be remembered that these people have not been paid the high wages which have fallen to the lot of the manual worker, consequently they have not been able to put a deal away for a rainy day. It is true that they have been granted war bonuses from time to time, but the total amount they have received in this direction has been more than counterbalanced by the high cost of living. The maximum war bonus paid to clerks at the present time varies between twenty and thirty shillings per week, and no one can deny that the cost of living per week for any one family has risen considerably in excess of these figures. These bonuses, too, have in many instances taken the place of increases in salary, so that the clerk, almost alone among the munition workers, is actually in a much worse financial position than he was before the war. The four-pound-a-week clerk (including thirty shillings war bonus) is still so rare as to excite the interest and the envy of his brothers, and what can be saved out of that sum by the man with a wife and family to support, in these days of high prices?

The clerk may be a very efficient worker when once he has become conversant with the system and the routine of the factory in which he is employed: but when his services are dispensed with this qualification is a small recommendation when applying for a fresh post. His duties are essentially of a routine character; and as the system prevailing in different factories varies considerably, it is obvious that he must serve a probationary period before being of much practical use to his new employer.

The mechanic always has his craft with which to barter, and by presenting himself at the factory gates he gets into touch with interested officials, and has the opportunity of personally stating his case. The clerical worker, however, is debarred by precedent from making a personal application for employment in the first instance, and has to rely upon his ability as a letter-writer to succeed in convincing

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the prospective employer that he is qualified to perform the duties required.

The only hope for the clerical worker is for him to specialise in one particular branch—such as wages, time, costs, and progress, which are universal throughout the engineering industry—and in this way the experience he has gained in one factory will prove a valuable asset in connection with his application for employment elsewhere. He cannot afford any longer to generalise, for the general clerk is a routine clerk, who is not wanted outside the one factory whose system he thoroughly understands.

The clerical profession has been overcrowded for years; and if there are any apprehensions of approaching unemployment, it may be taken for granted that the clerk will suffer severely. It is this fear that has inspired this article, and it is really necessary that special consideration be given in this direction. A large proportion of the engineering-works staffs at the present time are disabled soldiers, many of whom are incapable of performing manual labour, and numbers of these men must necessarily be displaced when general demobilisation is decreed.

It is a problem which will tax the ingenuity of the best brains in the country, and it demands early attention.

PATENT LAW AMENDMENT.

Last year the Council of the Institution of Electrical Engineers appointed a committee to consider the reform of the Patent Laws, in connection with the Bill introduced by the Board of Trade in 1917.

The report of the committee was adopted by the Council in June last, and was also adopted, subject to a few verbal alterations, by a conference of representatives of some thirty leading scientific and technical societies, convened by the Institution of Mechanical Engineers. A deputation from the conference waited on the President of the Board of Trade on October 10th, when the report formed the basis of the representations made to the Board by the deputation.

We have received from the secretary of the Institution a copy of the report, which, it will be seen, may be regarded as embodying the views of practically the whole of the engineering industry, and is therefore of exceptional importance. The committee consisted of the following members:—Mr. W. M. Mordey (chairman), the President (ex-officio), Mr. A. E. Cachemaille, Dr. S. Z. de Ferranti, Mr. J. Hunter Gray, Mr. John Gray, Mr. H. H. Harrison, Mr. S. Morse, Mr. D. Murray, and Mr. A. P. Trotter. [Mr. Cachemaille and Mr. John Gray represent the British Electrical and Allied Manufacturers' Association on the committee.] The following is an abstract of the report:—

Introductory Statement.—It is common ground that invention is the basis of industrial progress, but invention must be encouraged, and, if the reward offered by the State takes the form of a monopoly for a term of years, such a monopoly must be of a kind that will encourage capitalists to assist in developing commercially the inventions in which they are invited to take an interest. Without capital, few inventions can be developed or even made. At the best, monopolies in the form of letters patent, depending, as they should, on the question of novelty, cannot be regarded as gilt-edged securities, but it is possible, by legislation and otherwise, to provide that those who expend thought or time or money in devising useful processes or products shall obtain in return for a real invention a true monopoly which cannot be revoked.

The committee is convinced that the progress of invention during the past 25 years in this country has been much less than it would have been if proper encouragement had been given by legislation and otherwise. The effect of legislation as a stimulant or deterrent can hardly be overestimated. It is a standard upon which public opinion is largely moulded, and by which it is guided. Legislation couched in language which expressly or by influence treats inventors as meritorious or unmeritorious must exercise profound influence on the industries, all of which depend upon invention.

At no time in the history of this country so much as the present has there been so urgent a need or so great an opportunity for placing invention in the most favourable condition to help industry, and it is with this conviction that the committee has carefully considered the proposed Bill. It feels that the latter will not only not encourage, but will discourage, both inventors and capitalists, inasmuch as it adds to the already large risks of patentees, and still further lessens the value of letters patent as securities for the advance of money to develop inventions. It is of opinion that every effort should be made to reduce, if not to remove, the number of weapons available to people here and abroad, especially the latter, for attacking patentees who own real inventions, and in many cases have spent much time and money on them.

Patents Moratorium.—An extension for a period equal to the total duration of the war should, on application, be granted in the case of those patents which were in force when the war broke out, and are still in force when peace comes; in the case of patents which have expired by lapse of time during the war, the extension should be for a period equal to that from the commencement of the war to the end of the ordinary life of such patents; and for patents, other than war patents, which have been taken out since war commenced, the extension should be for a period equal to that between the date of application and the end of the war. It may be said that any automatic extension would unduly favour war patents, but such patents would be unremunerative after the war, and would therefore gain no benefit from extension.

It is satisfactory to note that in stating in the House of Commons that the Patents and Designs Bill was to be reintroduced this session, Sir Albert Stanley announced that it would contain clauses dealing with the life of patents, the working of which had been prevented during the war.

Clause 7 of the Bill which amends section 18 of the Act does not deal with the real difficulty. Under this clause the position still is that the extension can only be granted in the case of inventions of especial merit as before. The Bill perpetuates the evils of the present procedure, which are such that the number of petitions for extension presented annually is under ten, and in no year have more than three patents been extended. Something very different is needed to meet the war difficulty. No scheme of extension will be effective unless it is simple and inexpensive. The great majority of patents have, by reason of the war, been deprived of a considerable part of their useful term. To meet this condition a very general extension is desirable.

The renewal fees for such extended period should be low, for two reasons: (*a*) the renewal fees will have already been paid, generally on unproductive patents, and (*b*) renewal fees involve no appreciable expense to the Patent Office. It is therefore suggested that these fees should not be more than £1 per annum.

Compulsory Licences and Working of Patented Inventions.—Clauses 1 and 2 are intended to replace sections 24 and 27 of the Act. Section 24 provided for the granting of compulsory licences under certain specified circumstances, and section 27 dealt with the working of patented inventions. The latter section was introduced into the Act to compel foreign owners of British patents to work them in this country. It is very doubtful if it achieved its purpose in any single case, but it became a powerful lever with which foreigners could and did harass British patentees for some years. It was obviously to the interests of a foreigner (in most cases he was a German) to revoke patents belonging to a British subject so that he might freely flood the market with imported articles.

The committee is of opinion that section 24 of the 1907 Act with alterations, which are indicated below, would be amply sufficient, and much to be preferred, to clauses 1 and 2 of the Bill, which are not required.

Letters patent properly granted require that the invention should be new, should disclose sufficient invention, and should be properly and sufficiently described. If these requirements are complied with, it is, in the opinion of the committee, wrong and illogical that the letters patent should be revocable on the ground of non-working, except with the consent of the owner. The only justification for revoking a patent is that it is invalid. If the owner does not exercise his monopoly so as to give substantial benefit to the public there are remedies other than revocation which can be applied. No remedy should be capable of being applied except in favour of someone who himself is ready and willing to do what he alleges and proves that the patentee has failed to do, namely, to give substantial benefit to the public. Such a person can under the Act apply for a compulsory licence, and non-working is a good ground for granting such a licence.

The possibility of revocation on the ground of non-working is an incentive to blackmailers, and greatly detracts from the value of a patent as a security for financial support.

Even if there were no complete remedy other than revocation, which is not the case, it is doubtful if revocation should be possible, owing to the serious and disturbing influence it would have upon the progress of invention. It would penalise British patentees for the faults of foreigners. The same considerations apply to designs.

The so-called "abuse of monopoly rights" has been during the last 20 years almost, if not entirely, confined to foreigners, especially Germans, who obtained British patents and did not work them in this country, but held them for the sole purpose of stopping competition while they imported the patented articles. Obviously nothing could suit them better than the right to revoke British patents which interfere with their importation. The history of section 27 of the 1907 Act is strong evidence of this, as practically most of the applicants under this section were foreigners or persons who desired only to import the patented article. This matter can be properly dealt with without revocation.

The course which the committee would like to see adopted is that section 27 of the 1907 Act should be repealed, and that section 24 of that Act should be altered by enacting: (1) that the petition should be made to the Comptroller of Patents with appeal to the Court who would deal with it: (2) that the provision enabling the patent to be revoked

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should be cancelled. This, it is believed, would be most in the interests of invention and of industry. The "reasonable requirements of the public" is an expression much more likely to lead to commercial development than the expression "abuse of monopoly rights." The former expression appears in the forefront of section 24. It seems clear that provisions for compulsory licences are amply sufficient to protect the public from the danger of patentees holding up their patent rights. Such holding up as there has been has been largely done by foreigners, especially Germans, and simple machinery for obtaining licences from them would soon cause the evil to disappear.

(To be concluded.)

ELECTRICITY WORKS EXTENSIONS DURING THE WAR.

The following statement has just been issued by the Ministry of Munitions, and will be found exceedingly interesting. We understand that the figures showing the extensions during the war only cover those undertakings which have added or ordered additional engine-room plant since June 30th, 1914.

	Municipal.	Company.
Total number of undertakings operating	327	230
No. of undertakings who have installed or have been authorised to install more plant ...	56	20
Plant capacity of undertakings referred to above at June 30th, 1914	500,071 KW.	351,685 KW.
Additional plant installed or sanctioned (July 1st, 1914, to October 31st, 1918)	645,072 KW.	324,453 KW.
Proportion of additional plant sanctioned by present Director of Electric Power Supply ...	219,565 KW.	85,000 KW.
No. of schemes sanctioned by him	32	10

(Note.—In the following schedule, the foregoing figures are shown in detail.)

The units sold by the above 76 undertakings were as follows:—

Year.	Municipalities.	Companies.
1917	1,384,185,750	1,160,337,146
1914	802,333,100	691,116,312
Increase in three years	581,852,650	469,220,834

Certain statements have appeared in the Press during the past few weeks, evidently based on inaccurate information, alleging that the Sheffield district is denied electrical expansion, while the North-East Coast undertakings are permitted to develop. The following figures bring out the facts:—

	Sheffield Corporation.	Rotherham Corporation.	N.E. Coast Power Cos.
	KW.	KW.	KW.
Plant capacity of power stations in 1914	23,225	5,150	86,200
Installed or ordered since ...	73,000*	65,350	114,200
	138,350 KW.		
Total plant capacity installed or on order	96,225	70,500	200,400
	166,725 KW.		
Increase on 1914 of	580 p.c.		232 p.c.
Area of supply	60 sq. miles.		1,400 sq. miles.
Units sold, 1917	186,220,901		563,365,976
Units sold, 1914	31,474,377		344,544,247
Increase in three years, units	154,746,524		218,821,729

* This excludes a further 50,000 KW. provisionally sanctioned for Sheffield.

Sheffield and Rotherham combined have installed or ordered during the war about one-seventh of the extensions of all the local authorities and companies combined.

The Ministry of Munitions commandeered for, or allocated out of their own plant to, Sheffield no less than 37,000 KW. of the additional 73,000 KW. which Sheffield has installed or ordered during the war. Some of this plant was commandeered by the then Director of Electric Power Supply (Col. McLellan) from that which his firm had previously ordered on behalf of various clients. He also placed at the disposal of the Rotherham Corporation, entirely free of charge, a complete set of drawings, specifications, &c., of the Melbourne power house (designed by his firm for the Victorian Government) to enable the Rotherham Corporation to save months of delay which would otherwise have been inevitable, with serious consequences to the district.

At the present moment Sheffield has 28,000 KW. and Rotherham 50,000 KW. of generating plant under construction with boilers to steam the whole, which plant should be available for operation between January and June, 1919.

MINISTRY OF MUNITIONS OF WAR.

Electric Power Supply Department.

List of Municipal Electricity Supply Undertakings which have installed additional generating plant during period June 30th, 1914, to October 31st, 1918.

Name of Corporation.	Plant capacity, at June 30, 1914.	Additional plant installed or authorised. Period, June 30, 1914, to Oct. 31, 1918.	Proportion of additional plant sanctioned by present director of electric power supply.	Graded.
	KW.	KW.	KW.	
1. Aberdeen	8,380	9,380	5,000	P.4
2. Alloa	309	1,607	715	
3. Ayr	1,100	1,500	—	
4. Barrow-in-Furness	2,525	5,000	3,000	P.4
5. Battersea	5,092	5,000	—	
6. Bedford	1,945	2,305	—	
7. Belfast	13,300	10,500	10,500	P.4
8. Birmingham ...	33,000	51,650	30,400	P.2
9. Bolton	7,600	10,900	7,500	P.4
10. Bradford	16,800	27,450	12,000	P.4
11. Brighton	12,100	4,000	4,000	P.4
12. Bristol	15,050	9,000	6,000	P.4
13. Burton	2,700	4,200	3,000	
14. Bury	5,700	3,000	—	
15. Carlisle	2,670	2,880	2,000	P.4
16. Chesterfield ...	1,800	2,320	—	
17. Derby	7,050	7,500	4,000	P.3
18. Glasgow	54,900	99,050	36,000	P.4
19. Hackney	4,800	13,400	6,000	P.4
20. Huddersfield ...	7,450	4,000	—	
21. Hull	10,210	5,000	—	
22. Ipswich	3,500	3,000	3,000	P.4
23. Kilmarnock ...	3,000	7,000	—	
24. Kingston	1,140	2,000	2,000	P.3
25. Leeds	22,940	33,660	12,000	P.4
26. Leek	515	200	200	P.4
27. L.C.C. Tramways	38,500	9,000	—	
28. Londonderry ...	1,200	2,500	2,000	P.5
29. Loughborough ...	700	2,150	—	P.4
30. Luton	2,450	10,000	5,000	P.4
31. Maidstone	2,075	1,900	1,500	P.4
32. Manchester ...	72,300	46,450	—	
33. Newport	7,100	3,000	3,000	P.4
34. Northampton ...	3,640	3,500	—	
35. Paisley	4,200	8,200	5,500	P.4
36. Plymouth	5,475	4,800	3,000	P.4
37. Poplar	10,000	4,250	—	
38. Portsmouth ...	4,450	2,000	—	
39. Redditch	690	4,770	3,000	P.4
40. Rotherham ...	5,150	65,350	30,000	P.2
41. St. Pancras ...	8,850	3,000	3,000	
42. Sheffield	23,225	73,000*	—*	
43. Shoreditch ...	5,680	5,000	—	
44. Stockport	4,850	11,150	—	
45. Stoke-on-Trent ...	7,650	3,000	—	
46. Southampton ...	5,500	3,000	3,000	
47. Sunderland ...	8,500	7,500	—	
48. Swansea	5,100	5,000	5,000	P.4
49. Swindon	1,400	2,000	2,000	P.2
50. Tonbridge	370	570	—	
51. Watford	2,500	1,250	1,250	P.4
52. Warrington ...	3,150	4,900	—	
53. West Bromwich ..	3,300	4,000	—	
54. Wigan	4,820	6,500	5,000	P4.
55. Wolverhampton ...	7,050	16,450	—	
56. Keighley	4,620	5,380	—	
	500,071	645,072†	219,565†	
			(32 sanctions.)	

* Further 50,000 KW. recommended.

† Note.—These totals omit 50,000 KW. sanctioned for Sheffield as soon as they sign linking-up agreement with Rotherham.

List of Company Electricity Supply Undertakings which have installed additional generating plant during the period June 30th, 1914, to October 31st, 1918.

Name of Company.	Plant capacity, at June 30, 1914.	Additional plant installed or authorised. Period, June 30, 1914, to Oct. 31, 1918.	Proportion of additional plant sanctioned by present director of electric power supply.	Graded.
	KW.	KW.	KW.	
1. Central Electric .	26,283	7,570		
2. City of London ...	27,000	6,000	6,000	P.5
3. Clyde Valley ...	35,000	37,500	15,000	P.3
4. County of London	19,800	14,400	—	
5. Lancashire Elec.	16,500	6,000	+	
6. London Electric Supply	25,450	12,000	—	

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Name of Company.	Plant capacity, at June 30, 1914.	Additional plant installed or authorised. Period, June 30, 1914, to Oct. 31, 1918.	Proportion of additional plant sanctioned by present director of electric power supply.	Graded
	KW.	KW.	KW.	
7. Mersey Power Co.	4,900	24,500	20,000	
8. Metropolitan ...	22,500	4,000	—	
9. Midland Electric	10,600	10,200	—	
10. Newcastle-on-Tyne and Assoc. Co.'s	86,200	114,200	25,000	P.3
11. North Metro. ...	16,122	21,068	6,000	P.4
12. Scottish Cent. ...	3,300	6,230	3,000	P.4
13. Shropshire, Worcs. and Staffs. ...	28,325	15,850	—	
14. South Metro. ...	6,000	15,000	5,000	P.4
15. Trafford	5,200	7,950	—	
16. Twickenham ...	1,180	4,000	2,000	P.4
17. Uxbridge & Dis.	1,030	3,650	2,000	P.4
18. Woking	1,100	1,000	—	
19. Yorkshire Elec.	14,500	12,000	—	
20. Slough & Datchet	695	1,335	1,000	
Totals	351,685	324,453	85,000	

(10 sanctions.)

WAGES TO EMPLOYÉS IN ELECTRICITY UNDERTAKINGS (LONDON DISTRICT).

Two awards have just been issued by the Committee on Production in respect of the above. The first, No. 2,772, refers to electricity undertakings (general) London district, and the second, No. 2,773, to electricity undertakings—railway companies operating in the London district. By the former award uniform basic rates and working conditions have been established for this section of the electrical industry. We are informed by Mr. W. J. Webb, London District Secretary of the Electrical Trades Union, that the basic rates are plus 23s. 6d. (28s. 6d. as from December 7th next), and plus 12½ per cent. on all wages earned.

The terms of reference to the committee were as follows:—

(*a*) Claim for the application to the workpeople concerned of the award of the Committee on Production of July 24th, 1918, for the engineering and foundry trades.

(*b*) Claim by the unions affected for new card rates and altered working conditions.

(*c*) A counter-claim by the executive committee of the conference of municipal undertakings on wages.

The matter was referred by the Ministry of Labour to the Committee on Production for settlement, and representatives of the parties were heard on August 19th and October 22nd, 1918. The parties to the reference were the I.M.E.A., representatives of municipalities and companies supplying electricity in the London district, and electric tramway authorities on the one hand; and the Electrical Trades Union, the National Union of General Workers, the Workers' Union, and the National Amalgamated Union of Enginemen, Firemen, Mechanics, Motor-men, and Electrical Workers. The committee issued an award on September 6th dealing with item (*a*) of the claim. As regards the new card rates and working conditions, the committee suggested to the parties at the hearing on August 19th, that this part of the claim should be the subject of a conference between representatives of the electricity undertakings affected, and the several trade unions, with a view to ascertaining to what extent an agreement could be arrived at thereon. It was agreed that this course should be adopted. In pursuance of this agreement several conferences between the parties took place, as the result of which a large measure of settlement was arrived at in regard to the various matters dealt with. Arising out of these discussions the parties intimated to the committee that they desired that any award which might ultimately be made, should not only deal with outstanding points, but should also confirm, if the committee deemed fit, the decisions come to by agreement on various matters. The committee in the present award, No. 2,772, gives effect to this request. The award of the committee is as follows:—

This award shall apply to the workpeople concerned who are employed in the electricity undertakings affected and who are engaged in the generation, transmission, and distribution of electrical energy and on the maintenance of plant and cables in connection therewith.

(I.) WORKING CONDITIONS.

The working conditions shall be those set forth below:—

(*a*) Shift Work.

Definition.—Shift-workers are employés who take alternate shifts, that is, "rotating shifts." They shall be regarded as weekly servants. Seven days' notice of termination of engagement shall be given on either side.

Hours of Labour.—Eight hours shall constitute a shift. Seven shifts (56 hours) shall constitute a week's work.

Overtime.—Time worked in addition to the normal shift, which includes change over, shall count as overtime.

Overtime shall be paid for as follows: First two hours ordinary time, afterwards time and a-half; if men are called in time and a-half shall be paid.

All overtime work shall be paid for on the basis of actual time worked after each shift, and not on the aggregate basis of a week's work.

Every man shall have eight hours off duty before commencing another shift when overtime is worked.

Holiday Pay.—The men concerned shall receive 14 days' holiday with pay after 12 months' service. Double time shall be paid for work on Christmas Day. Good Friday and Statutory Bank Holidays shall be paid for at ordinary rates.

(*b*) Day Work.

Hours of Labour.—The hours of labour shall remain as at present.

Overtime.—Each day shall stand by itself for the purpose of calculating overtime. The first two hours after the normal hours of the day have been worked shall be paid for at the rate of time and a-quarter, and time and a-half thereafter. Sunday work shall be paid for at the rate of double time.

If work continues after midnight the men shall be paid at the overtime rate until starting time next morning.

Men required to start before their usual starting time in the morning shall be paid at the rate of double time up to the usual starting time.

No man shall work more than 36 hours continuously, meal time included.

Holiday Pay.—All work done on Christmas Day and Good Friday shall be paid for at the rate of double time. All work done on Statutory Bank Holidays shall be paid for at the rate of time and a-half.

(*c*) Day or Shift Work.

Equal Rates for Men and Women.—Men and women shall be paid equal rates for equal work.

Charge Hands.—All charge hands shall receive a minimum of 1d. per hour extra.

Existing Rates.—Where existing rates are better than those provided for under this award, no change shall be made.

Dirty Work.—When men are required to work on flue cleaning or in accumulator chambers with acid or when blowing out plant by compressors, outside the ordinary sphere of their employment, they shall be paid 1s. per day or shift extra.

Holidays.—The holiday conditions of other than shift workers shall remain as at present except as herein provided.

Assistants and Probationers.—The following rates shall be paid to assistants under 21 years of age on generating station switchboards and in sub-stations:—For the learning period, 10s. per week first six months (probationary); 15s. per week second six months; 20s. per week third six months; afterwards, 75 per cent. of the minimum rate for the next 12 months, followed by an additional 5 per cent. on the rate per annum up to the age of 21. The number of probationers (learners) training on switchboards shall not exceed the number of sub-stations on the system, together with three per generating station. No probationer shall be employed on shift except under the control of the man in charge of the switchboard or sub-station.

Application of Conditions.—These conditions shall apply to all workers of 21 years of age and over, subject to the age reservation of 21 years not applying to unskilled labourers of 18 years or over who do not come under agreements as to probationary period of training.

(II.) BASIC RATES.

The following shall be the basic rates for the grades of employés set forth below:—

Grade.	Rate.	Grade.	Rate.
Electrical fitter / Electrician / Electrical wireman	10½d. hour.	Battery fitter ..	10½d. hour.
		Battery attendant ..	9d. ,,
		Conduit system:	
Jointer	9½d. ,,	Leading hands.. ..	8½d. ,,
Plumber jointer	1s. ,,	Cable hands	7½d. ,,
Armature winder.. ..	10½d. ,,	Fitter's mate	8d. ,,
Mains foreman	60s. week.	Wireman's mate	8d. ,,
Cable ganger	10d. hour.	Electrician's mate ..	8d. ,,
Pub. litg. foreman ..	10d. ,,	Jointer's mate	8d. ,,
Pub. litg. leading hand..	9½d. ,,	Telephone electrician ..	10½d. ,,
Pub. litg. attendant ..	8d. ,,	Telephone linesman ..	9½d. ,,
Arc lamp trimmer ...	8½d. ,,	Telephone operator ..	30s. week.
Installation inspector ..	55s. week.	Boiler cleaner (inc. rate)	8½d. hour.
Meter insp. and tester ..	10½d. hour.	Labourers, indoor ..	7d. ,,
Meter repairer (mech'an)	11d. ,,	Labourers, outdoor ..	7½d. ,,
Meter fixer..	8½d. ,,	Cleaner	7d. ,,
Meter reader	8d. ,,	Ash hopper, convey. men	8½d. ,,
Overhead linesman (skld)	9½d. ,,	Coal handling (not trim.)	8d. ,,
Storekeeper (stk. ledgers)	50s. week.	Coal weigher (not weigh-bridge clerk)	8d. ,,
Storekeeper	40s. ,,		
Assistant storekeeper ..	8d. hour.	Shunters and tippers ..	8d. ,,
Tool storekeeper (skld.)	50s. week.	Gatekeeper	30s. week.

Operative Staff.—Power House.

Switchboard attendant up to 5,000 kw. installed	50s. week.	Assistant driver .. / Turbine attendant / Pump attendant / Water-softening plant attendant	8d. hour.
Above 5,000 kw. installed	60s. ,,		
Assist. ditto or regulator up to 5,000 kw. installed	85s. ,,		
Ditto above ditto ..	40s. ,,	Greaser .. .. / Aux. plant attendant	8d. ,,
Fitter driver	11d. hour.		
Driver	9½d. ,,		

Operative Staff—Boiler House.

Leading stoker, 10½d. per hour; stoker, 9d. per hour; trimmer, 8d. per hour.

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Operative Staff—Sub-station.

Rotary Sub-stations.—Sub-station inspector, 5s. per week above highest rate paid to the attendants at sub-stations under inspection.

Sub-station charge engineer or sub-station attendant:—

Under 1,000 kw. installed, 40s. per week; under 3,000 kw. installed, 50s. per week; 3,000 kw. and over, 60s. per week; subject to an additional 5s. per week being paid when any or all of the following conditions apply:—

(*a*) Sub-stations which are supplied from two or more generating stations in which attendants in charge have to synchronise or parallel such generating stations.

(*b*) Sub-stations where the attendants in charge are responsible for the area supplied from sub-stations and have to isolate sections of the network external to sub-stations in case any mishap occurs.

Assistant sub-station attendants:—

Under 3,000 kw. installed, 35s. per week; over 3,000 kw. installed, 40s. per week.

In assessing the kilowatts installed in a rotary sub-station, the following matters shall be taken into consideration:—

1. The battery capacity to be included as part of the sub-station equipment on the following basis:—

Traction Supply.—One-hour rate of discharge.

General Supply.—Three-hour rate of discharge.

2. Where both rotary and static machinery is in use in one sub-station the capacity of both shall be taken as the basis of rotary kw.'s installed subject to the static transformers forming part of the rotary equipment being excluded.

Grade.—Static Sub-stations—Sub-station Attendants.—All sizes under 2,000 kw., 40s. per week; all sizes over 2,000 kw., 45s. per week.

Where workmen other than those referred to in the above clause are employed and governed by other recognised trade union rates and agreements, such rates shall be paid. This understanding shall cover the following grades:—Mechanical fitter, boiler smith, boiler fitter, driller, hammerman, crane driver, lorry driver, bricklayer's mate, carpenter's mate, navvies, scaffolders, timbermen.

(III.) GENERAL.

It was stated at the hearing on behalf of the electricity undertakings that a very large proportion of their officials belonged to another trade union known as the Electrical Power Engineers' Association. In the case of the shift or charge engineers, it was stated that 174 out of 196 belonged to the latter union. It appears that the E.P.E.A. is at present considering the submission of a claim with respect to the rates of pay of its members. The suggestion was made to the Electrical Trades Union that representatives of the two organisations should meet with a view to arriving at a line of demarcation in regard to their respective membership, but this proposal was not agreed to by the E.T.U. The committee has very carefully considered the matter, and in view of the fact, which does not appear to be in dispute, that a great proportion of these officials belong to an organisation which was not represented at the hearing, it feels a serious difficulty in attempting to determine the rates of pay of the officials. The committee has accordingly come to the conclusion, and it so finds, that in the absence of a substantial representation of the section of the employés affected by this part of the claim, no alteration shall at present be made in the existing rates. It appears to the committee to be desirable that in the first instance this question should be discussed between the organisation which represents a great majority of the men involved and the undertakings themselves.

The question was raised at the hearing on October 22nd of the definition of the London district, to which any award which might be made should apply. It was suggested by the unions that this should be an area covered by a radius of 20 miles from Charing Cross. The adoption of this proposal would have the effect of including undertakings not covered by the present reference. The committee's decision is that the claim under this head has not been established.

The question was raised on behalf of the suburban undertakings that, in view of the different conditions obtaining in the districts concerned, special rates should be fixed on a lower basis than that adopted in the case of the undertakings in the central area. After careful consideration, the committee has decided that no distinction shall be drawn in this respect so far as regards the undertakings included in the reference.

At the conference which took place between the parties the question was raised as to the establishment of machinery for dealing with certain questions which might arise in the future, and it was understood that an arrangement on the following lines was agreed upon:—

Pending the setting up of district boards under the proposed Joint Industrial Council for the Electric Supply Industry, it is proposed that if any questions arise with regard to:—

1. The intent and application of any award of the Committee on Production,
2. Rates for additional grades,
3. Regrading,
4. General questions,

the parties shall confer after requisite notice has been given and endeavour to arrive at a mutual settlement. Failing such settlement, any matters of difference to be referred to the Committee on Production.

RAILWAY COMPANIES.

The second award, No. 2,773, refers to electricity undertakings—railway companies operating in the London district. The parties to the reference were the Railway Executive Committee on the one hand, and the four Trade Unions above mentioned on the other. The claim submitted by the unions concerned was for the establishment of new card rates and altered working conditions. The committee in this award deals both with the matters that were agreed upon by the parties and those which have been decided by the committee.

The award applies to employés solely engaged in electricity generating stations and sub-stations and on high tension cables between generating stations and sub-stations. The working conditions and the application of the award are the same as those set out in the first award, No. 2,772. The award reads:—

The committee in its award, No. 2,772, of this date with respect to general electricity undertakings in the London area, prescribes the basic rates to be observed in respect of a large number of grades of employés concerned in the working of such undertakings. The large majority of such rates were agreed upon between the parties at conferences which took place prior to the hearing on October 22nd of the application of the unions with respect both to the general undertakings and the railway undertakings. The question of rates was also the subject of discussion between the representatives of the railway companies and of the unions at different conferences, but no agreement was arrived at, as the companies were not prepared to agree to the uniform adoption of similar rates to those obtaining in general electricity undertakings. The general question of the principle involved in this matter, namely, the payment to tradesmen in the employment of railway companies of the same rates as obtain for similar classes of workpeople in employment outside the railways has been the subject of discussion between the various railway companies and the representatives of their workpeople for a long time past, both before and since the outbreak of war. It has also been the subject of reference from time to time to the committee. On all occasions upon which the matter has been brought forward the railway companies have submitted that the advantages of railway employment in the shape of greater continuity of service, cheap travelling facilities, and similar matters, and the special statutory position the companies occupy, justify a distinction being drawn between the rates to be paid. These same arguments were advanced by the railway companies in opposing the present claim. The committee gathered that when the matter was discussed at the conference between the parties, the railway companies expressed their willingness to make certain adjustment of rates. Having very carefully considered the matter, the committee has come to the conclusion that it would not be justified at the present time in disturbing a long-standing and pre-war practice by conceding the principle of the payment of the same rates to the employés here concerned as obtain in the case of electricity undertakings proper.

The award of the committee with respect to this part of the claim is as follows:—

1. That the claim for the payment to the employés of the railway companies concerned in the present application of the same rates of wages as obtain in the case of the general electricity undertakings in the London area is not established.

2. This decision is without prejudice to the matter being further discussed between the parties with a view to such readjustments in rates being agreed upon as may be necessary having regard to the special conditions of railway employment.

Both awards take effect as from the beginning of the first full pay after August 19th, 1918, and are signed by William W. Mackenzie, J. Duncan Elliott, and F. S. Button, and dated November 8th, 1918, H. J. Wilson being the secretary, at 5, Old Palace Yard, S.W. 1.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

"Fraternity"—or Tyranny?

As one having an enthusiastic interest in the well-being of mortals who work for their living, especially in the electrical industry, I venture to ask you to insert the following comments *re* the remarks put forward in the letters of Brother Webb and Mr. John Vincent, in your issues of October 25th and November 1st.

In the first instance, the idea Brother Webb has instituted, in possibly approaching other trade union secretaries to inquire into the E.P.E.A.'s credentials, is an excellent one, and should prove a great factor in somewhat clearing the air, and, further, I sincerely hope Brother Webb will allow these remarks to be a notice to other doubtful secretaries to do likewise, and would remind Brother Webb that once upon a time a certain man called a trained body of men "A Con-

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temptible Army." Historical instances, however, have a habit of repeating themelves, with the all too well-known *finale*.

In regard to Mr. Vincent's letter in your issue of November 1st, I believe I am correct in stating that the A.E.S.E. was resuscitated for obvious reasons by far-seeing men, the majority of whom were not members of the existing A.E.S.E., but who saw the need of an organisation for their particular class, which they, as everyone, have every right to do without question.

I think, therefore, that Brother Webb should appreciate the fact that a body of educated men (forming the nucleus of the future chiefs), who admittedly control the destinies, to a very large extent, of the members of his association, have organised themselves to better their conditions in a manner they consider compatible with their position, and which organisation has saved him the worry and trouble.

Therefore, I would ask Brother Webb to kindly allow those who, in the majority of cases, have had to fight hard for the position they now hold the credit of being able to insist as a body that their demand for better conditions be acceded to.

E. Napier Christmas.

Highbury, N. 5, *November 12th*, 1918.

I think "Unity's" suggestion a good one. However, I presume both the E.P.E.A. and the E.T.U. would consider it beneath their dignity to approach each other. I suggest that you, Mr. Editor, should invite both sides to meet. To any unbiased person it is obvious that there is ample room for both, as it is just as undesirable that an engineer should belong to a mechanic's trade union as it is that a mechanic should belong to an engineer's association, but there is no earthly reason why their aims should clash.

Borough Electrical Engineer.

November 9th, 1918.

[The suggestion that both sides should meet has already been made by us on p. 362 of our issue of October 18th, 1918.—Eds. Elec. Rev.]

In a technical journal it ought to be unnecessary, but for the purpose of my letter it may be as well to point out that during the four years of war the electrical industry has leaped forward at a rate of development which pre-war methods of advertising had not effected in 30 years.

"Electric power is so necessary to industry and comfort that it must be taken in hand." This invaluable publicity from the lips of the Prime Minister of England on Saturday last.

For the purposes of increased productivity, to make good the material losses of the country, it is necessary that all sections—employers, management, and workers—should extend themselves to ensure that this most important factor, the electrical industry, is organised and ready for service at the highest efficiency.

There should be unanimity of effort, as it is true that the success of those engaged in any industry can follow only on the success of that industry. There are hopes that by the new councils set up, no section will be permitted to take unfair advantage over another.

It is to be regretted that in the floodtide of success there should be troubled water. Some electrical workers are threatening to take drastic action if within a specified time certain engineers do not join the E.T.U. in preference to the E.P.E.A. Such pettiness ought not to be.

If these incidents, which have occurred in the provinces and now are happening in the Metropolis, are merely guerrilla actions of irresponsibles, it is the duty of the governing body of the E.T.U. to end them; if they are the considered stratagem of those in authority, then it would be well for them to reconsider if such coercive tactics are likely to advantage the industry and the members of their union. It may be made public now that no member of the E.P.E.A. will be intimidated into joining the E.T.U. If the Bolshevist methods continue, and it were somehow to occur, which is surely unlikely, that these had any authoritative support, the members of the E.P.E.A. would oppose it to the utmost of their power. The time has come for peace.

Both the E.P.E.A. and the E.T.U. have their utility, their line of demarcation is clear, and their co-existence ought not to turn either aside from the main purpose of its existence.

W. Arthur Jones,
Hon. General Secretary,
Electrical Power Engineers' Association.

London, S.W., *November 19th*, 1918.

[We cannot but regard the action attributed to the members of the Electrical Trades Union with profound regret; at a time when co-operative effort and fraternal harmony are most necessary to the progress of the industry, it is most unfortunate that discord should be accentuated, and we trust that calmer counsels will prevail. It is, of course, unthinkable that a nation which, at the cost of immense sacrifices, has just succeeded in securing the freedom of the world would sanction the destruction of individual liberty which is implied by the policy in question.—Eds. Elec. Rev.]

The E.P.E.A. and the Electrical Industry.

After the manner in which the E.P.E.A. has been trumpeting abroad their many virtues as representing all classes of electrical engineers, I think the following facts should be given as wide publicity. In spite of the E.P.E.A.'s assertion that they represented the electrical industry when they were out to smash the A.B.E.E. they are now purely representative of electric supply only. They have now repudiated representation of manufacturing electrical engineers.

This is a vital point for those engineers who have already joined the E.P.E.A., and others who are now not represented by any other association covering the electrical industry. The A.B.E.E. whom the E.P.E.A. considered superfluous did have a manufacturing section as well as supply. Now, having exploited the electrical manufacturing engineers to gain their points, the E.P.E.A. have reverted to the narrow limits of their old title of A.E.S.E. In effect E.P.E.A. is camouflage for A.E.S.E.

Camouflage.

November 18th, 1918.

Work Without Pay.

In the main I agree with Mr. Hewlett. I have nothing to complain of with regard to courtesy and sympathy from the heads of the Coal Mines Department, with whom I have come in touch. I know Mr. Wilson personally, and have a great respect for him.

When I was asked to act as district engineer on a voluntary basis, I was pleased to do so, as I considered the work would be in the national interest; and I shall still do the work to the best of my ability.

However, I still adhere to my opinion that if the transport officers and fuel overseers are paid, the district engineers should be treated in the same manner.

As regards the remarks of "District Engineer No. 2," I certainly knew on what terms my services were to be rendered, but I did not know at the time that road transport officers and fuel overseers were to be appointed on entirely different terms.

Also, I served in the South African war as a volunteer, and, therefore, it is hardly fair to put me in the same category as those who desire to make capital out of their country's trouble.

District Engineer.

November 8th, 1918.

Smooth versus Undercut Commutators.

In common with your correspondent, Mr. C. S. Buyers, I also was interested in the article mentioned, and consider a smooth commutator, with the treatment given, the best solution of a rather unique problem. With machines which can be stopped, say, once a month, however, undercutting possesses important advantages. My experience has been that undercutting is almost a cure-all for troublesome commutators. The chief precautions are: Don't cut deep; don't leave high mica on either side of cutting tool, *i.e.*, cut the full width; examine closely to see that this is done, as it is illusive. With these precautions a commutator will run for weeks without attention. When sufficiently skilled labour is available, an occasional dab with a clean linen rag is an advantage. I have had a number of dynamos and motors under my care, including both "prehistoric" and modern, and have never had one which did not yield to the above treatment. I have never used abrasives on the commutator.

L. Bradburn.

Ashton-under-Lyne, *November 16th*, 1918.

With reference to the correspondence on the above subject, our experience is that smooth commutators are more satisfactory than undercut commutators, as we find that the latter become choked with carbon and copper dust, and cause short circuiting, as mentioned by Mr. Buyers. Moreover, we find that motors with undercut commutators are more noisy than motors having smooth commutators, the undercutting of the commutator producing a distinct hum.

We also find that commutators built up with pure mica are more satisfactory than those in which built-up mica plates are used. It is, no doubt, cheaper to use built-up mica plates, as the latter can be purchased to any desired gauge, and of uniform thickness, while pure mica has to be split and carefully gauged by hand. We find, however, that with built-up mica insulation, the heat generated in the commutator, and the sparking, cause the resinous matter in the built-up mica to carbonise, with the result that short-circuiting takes place between the bars of the commutator.

We would suggest that makers of the various brands of micanite should look into this matter, and endeavour to produce a built-up plate which will not carbonise through any heating or sparking.

E. P. Allam & Co.
E. P. Allam.

London, W.C., *November 18th*, 1918.

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In your issue of the 15th inst., C. S. Buyers wishes for views of those who have experienced trouble with undercut or smooth commutators; perhaps the following may be of interest to some of your readers. In my experience with D.C. machines I have had both smooth and undercut commutators to deal with, and I must say that the former have always given more satisfaction.

In the case of smooth commutators, the mica was always examined after an appreciably long run, and if found higher than the segments, it was carefully trimmed down to the level of the commutator. This I found the most satisfactory way of getting good commutation.

In the case of undercut commutators I have always experienced trouble and difficulty in avoiding sparking and overheating of the armature. When the mica is cut down—even 1/16 or ⅛ of an inch—the space between the segments cannot be kept perfectly free from carbon and copper dust; and if oil from the bearings happens to get between the segments, with the carbon and copper dust, it would short-circuit the armature coils.

To quote an actual case. The exciter of an alternator had the mica cut down to about ¼ in., the armature was found to get very warm, and on one occasion several coils were unsweated at the lugs. The brushes were kept well trimmed, but sparking could not be avoided, and after a day's run the brushes were found to be chipped in various places. In time, owing to continual sparking, pits formed on the commutator, and the edges of the segments became rough and worn; the former were continually being filled with commutator cement, which gave very unsatisfactory results, and the latter could not easily be remedied, and thus difficulty was always experienced in exciting the field of the A.C. machine. Had the mica been kept trimmed with the commutator this trouble would probably have been avoided, and more satisfactory results obtained.

C. C. Sleigh.

West Kensington, *November 18th*, 1918.

LEGAL.

BARLOW BROS. *v.* THOMAS & REGAS.

MR. MUIR MACKENZIE, High Court Official Referee, on Monday, Nov. 18th, heard an action in which Messrs. Barlow Bros., electrical engineers and fitters, of Brunswick Road, City Road, sought to recover from Messrs. Thomas & Regas the sum of £105 10s. 8d. for work done and materials supplied in connection with the erection of a skin-dressing plant.

Mr. Lort Williams appeared for the plaintiffs; the defendants, although they had put in a plea of contract, did not appear, and the case was consequently taken as an undefended action.

Counsel for the plaintiffs said that the defendants had admitted indebtedness to the amount of £58, which they said was the contract price, and the only issue was whether there was a contract or not. A portion of the balance of the claim was for electrical work done by the plaintiffs to defendants' orders, which had nothing whatever to do with the original work which the plaintiffs were engaged to do, which had relation to the erection of the skin-dressing plant only, and as to which judgment had already been obtained under order 14. The plaintiffs' case was that there was no contract for any fixed sum, and that the price charged for the work which they had done was fair and reasonable.

Mr. H. M. HARRIS, manager to Messrs. Barlow Bros., proved having received an order from the defendants to fix up the skin-dressing plant, and said that there was no agreement as to the price at which the work should be done, nor was there any contract. While the work was being proceeded with the defendants gave an order to repair the motor for the plant and connect it with the new plant. That work was done, and the charge for it was £29 4s. 9d. They also did work in connection with the lighting of the premises for which £9 10s. and £8 10s. 6d. were claimed. That work was also outside the original order. The whole of the work was done under his supervision, and the prices charged were fair and reasonable.

The OFFICAL REFEREE, in giving judgment for the plaintiffs for the amount claimed (£105 10s. 3d.), with costs, said that as the plaintiffs had already been paid £58 execution would be limited to the balance of £47 10s. 3d., and the costs would be on the High Court scale.

Judgment was entered accordingly.

SOUTH SHIELDS ELECTRICITY SUPPLY.

THE future of the electrical undertaking was discussed at the South Shields Council on November 4th under the chairmanship of the Mayor (Ald. Wm. Allon). The electrical committee reported at length on the subject of the power supply and the correspondence and negotiations with Mr. W. B. Gridley, Director of the Electric Power Supply, on the question of the extension of plant and the proposal for the Corporation to take bulk supply from the Newcastle Electric Supply Co.

Ald. Henderson, chairman of the Electrical Committee, moving the adoption of the report, referred to the proposal to install new plant and make alterations to the old to increase its capacity, and to the efforts of the borough electrical engineer to get the sanction of the Ministry of Munitions and the Local Government Board to borrow the money. Those two bodies made it quite clear that before anything could be done it would be necessary to obtain the approval of the Director of Electric Power Supply.

Both Col. McLellan and Mr. Gridley contended that the Corporation should endeavour to purchase a supply of electricity rather than install additional plant. Ultimately a quotation by the N.E.S. Co. on a sliding scale basis was duly considered. The committee was not satisfied; it would have had to pay the company more per unit than it would have cost the Corporation to generate it. The deputation appointed by the Council waited on the Director of Electric Power Supply, who, however, maintained that the Corporation had not established its case, and that it should endeavour to come to terms with the supply company. The N.E.S. Co. later agreed to enter into a short-period agreement, and to supply energy at a figure 10 per cent. below the Corporation's own generating costs, but on condition that the Corporation paid for the cost of extending a cable, and that it should install the necessary converting plant. There was nothing to be gained so far as the Corporation was concerned by such an arrangement, and the committee turned it down, as the plant, involving an expenditure of nearly £10,000, would be of no use to the undertaking at the end of the period of agreement. Mr. Gridley was urged, under the circumstances, further to consider the proposal to install new plant. He replied that the case had been presented to the Electrical Service Committee—a committee recently set up by the War Priorities Committee—and after full consideration it had decided that it would not be desirable further to extend the generating station at the moment, and that the arrangements for taking a bulk supply should be completed.

As a result of further interviews, permission was given the Corporation to install at least one new boiler to enable the steam plant to be run satisfactorily, at a cost of £7,500, "subject to terms being completed for purchasing the bulk supply recently under consideration." The advantage which the Corporation would get from this arrangement would be 1,000 KW., which would have cost £17 per KW. On the other hand, had the Corporation installed its own plant entirely at a cost of £40,000, it would have had available 3,000 KW., the average price of which worked out at £13 per KW.

The committee's report was adopted, and it was resolved: "That the Council be recommended to decline to fall in with the decision of the Director of Electric Power Supply, which will have the effect of forcing the Corporation to take a supply of electricity from a private company having a monopoly of supply in the adjoining area, being of opinion that such a course would be unfair and prejudicial to this municipality which has supplied electricity in South Shields for 22 years to the satisfaction of the public, and particularly in view of the recent findings of the Departmental Committees and the possible proceedings arising thereout, and they recommend the Council to authorise this committee to take every possible step to obtain the sanction of the Government departments to the necessary extension of plant to meet the demands for electricity."

BUSINESS NOTES.

The F.B.I. War Congratulations.—The following very **felicitously expressed congratulatory war messages from the F.B.I., sent on November 13th, are self-explanatory :—**

The members of the Federation of British Industries representing the great body of the manufacturers of this country, desire to offer to His Majesty the King their respectful homage and congratulations upon the wonderful success which has crowned the efforts of the British Empire and her Allies in the struggle which has been brought to such a glorious conclusion.

The members of the Federation of British Industries desire to offer to the Forces of the Crown of all three services, and from every part of the Empire, profound appreciation and thanks for the superb courage and endurance with which they have borne the terrible trials of the past four years.

The members of the Federation of British Industries tender to the Right Honourable D. Lloyd George, the Prime Minister, an expression of their sincere admiration and thanks for the magnificent courage, steadfastness of purpose, energy, and skill with which he has guided the Nation through years of the gravest difficulty and anxiety to final victory.

The members of the Federation of British Industries desire to express their sincere and hearty appreciation, which is based upon actual knowledge and experience, of the loyal and devoted service which has been given by the staffs and workpeople of the manufacturing and business establishments of this country throughout the period of hostilities, which has contributed in such great measure to the success of the Allied cause.

Munitions Orders Revoked.—The Minister of Munitions **has issued an Order revoking the Order of December 12th, 1917, prohibiting the employment of certain classes of munition workers. The Machine Tools, &c., Orders of August 28th, 1916, June 5th, 1917, and April 15th, 1918, have also been revoked so far as they relate to second-hand articles.**

Import Prohibitions Removed.—In the *Board of Trade Journal* for November 14th will be found a lengthy list of articles for which a general licence to permit of importation has been issued.

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Trading with the Enemy.—The *London Gazette* for November 15th contains further additions to the lists of persons and bodies in the following countries with whom trading is prohibited: — Argentina, Brazil, Chile, Cuba, Denmark, Mexico, Morocco, Netherlands, Netherland East Indies, Spain, Venezuela.

A Swedish Consolidation.—It is reported from Stockholm that the Allmäna Svenska Elektricitäts A.B. are proposing to absorb their subsidiary companies, and to raise their share capital for this purpose by £1,373,000, thus bringing the total to £3,571,000.

The A.E.G. and the Ukraine.—The A.E.G., of Berlin, has registered in that city a company, under the title of the Ukrainische Allgemeine Elektrizitäts G.m.b.H., of Berlin, with a share capital of £15,000.

New Works in Spain.—Our Spanish correspondent says that Messrs. Pirelli have under consideration the construction of a factory in Bilbao for the manufacture of all kinds of rubber and asbestos packing.

For Sale.—Redditch Corporation has for disposal a Babcock & Wilcox boiler, working pressure 160 lb., with a Foster superheater. Particulars are given in our advertisement pages to-day.

Catalogues Wanted.—A correspondent—Lieut. Swinford-Harrison, O.C. Workshops, 1019, M.T. Co., Mesopotamia—asks for catalogues of wireless apparatus and sets (to work with 3-kw. dynamo. 110 volts); catalogues of dynamos, suitable to be driven by belt, from 30-35 H.P. lorry engine (petrol); catalogues of bells and fittings; catalogues of portable and intercommunicating telephones and fittings.

Auction Sale.—Messrs. Debenham, Storr & Co. will sell by auction, on November 29th, at King Street, Covent Garden, by order and account of the Marshal of the Admiralty, a large quantity of miscellaneous goods, including about 50 dozen electric globes, &c. See advertisement pages to-day.

American Reconstruction.—The financial correspondent of the *Daily Telegraph* at New York says that the U.S. Government is making every effort to prepare a careful programme of reconstruction which will avoid economic and industrial depression, and it seems likely that a Commission will be appointed to guide the nation's conversion from war to peace. Officials are convinced that so long as the transition is gradual, factories and the workers engaged in war production can be diverted to constructive industries without much disturbance. As an instance of the trade boom ahead, it is mentioned that France alone will require 10,000,000 tons of structural steel from America.

Steel Makers' Restrictions Eased.—The Ministry of Munitions announces that, until further notice, iron and steel makers are at liberty to accept and execute orders for iron and steel ranking for priority below Class B, subject only to conditions shortly to be issued, as regards prices, and to the Order as to priority dated March 8th, 1917. For this purpose the operation of such clauses of the Control of Steel Supplies Order of November 20th, 1915 (as amended by Order of December 4th, 1917), as prohibit the manufacture of iron and steel for orders ranging below Class B, is suspended.

Co-operative Export Trade.—Like most of our great trades, the section dealing with hardware has suffered a heavy loss in exportation during the last few years. And probably, like others, it will only be revived by means of very special efforts. One scheme that has been prepared by Mr. G. W. Goodchild, of Eagle Street, Southampton Row, London, W.C., now lies before us. It is based on the principle of co-operation in the reorganisation of tool and cutlery exports, and involves the formation of an export association amongst those in the trade, under the leadership of a firm of merchants having the necessary experience of international trade, markets and finance, without being manufacturers, and thus, as the pamphlet before us says, "unavoidably more or less biased." Sample exhibitions in all industrial and trade centres in certain territories, the holding of local stocks, the appointment of general agents, and the opening of a London headquarters, are all parts of the project which it is proposed to develop as a self-supporting undertaking, managed by Mr. Goodchild on a percentage-profit basis.

Catalogues and Lists.—The "Z" Electric Lamp Manufacturing Co., Ltd., Southfields, London, S.W. 18.—Price stock list (in folder) of their accessories and lighting sundries—adaptors, battery material, bell pusher and wire, ceiling roses, lampholders, fans, fires, shades, switches, pocket lamp material, and various other lines. The folder is for permanent use, as revised editions of the list are to be issued monthly.

The B.E. Co. (of London and Birmingham), Ltd., Mansion House Chambers, London, E.C. 4.—Illustrated price leaflet of the "Beco" combination electric radiator and stove (convertible), and of "Hendon" drawn-wire lamps.

Messrs. Higgs Bros., Summer Hill Street, Birmingham.—Stock list, with prices, of shunt-wound motors.

Dr. Addison's Speech on Raw Materials and the National Factories.—In the course of his speech in the House of Commons on November 12th, the Minister of Reconstruction said that he estimated war stores would probably realise about £500,000,000. The Shipping Controller, who was in touch with the work of supplies of raw material, had prepared a tonnage programme which, he believed, was already in operation. The Controller hoped to issue in about ten days' time a revised freight rate (*ex* war risk), which was very necessary to give security. The tonnage programme was drawn up on essential raw materials exclusively; he was not speaking of luxuries.

"The country will desire to know at the present juncture what stocks of raw material are available for peace production, and what preparation has been made to supplement these stocks by importation during the difficult year that lies before us. I will deal first with metals, especially those which are most vital to our industrial welfare—namely, iron ore, pig-iron, and steel. There has been a great increase in our capacity for the utilisation of home ore, and arrangements are being made by the Shipping Controller which will render it possible to import as large a quantity of foreign ore as was imported prior to the war. It is proposed to release iron and steel forthwith. The difficulties which may arise owing to the fact that through the exigencies of war the price of steel now stands at an artificial level have not been overlooked, and it is intended to continue Orders fixing for a period a maximum price for steel, though this may involve continuing some measure of Government assistance for that period."

With regard to other metals, there was a sufficient supply available to render it possible to release some from control now, and nearly all the rest within six months. "I am convinced after a close survey of the position that we shall be able to meet the demands which reconstruction will make on our resources. But while I am satisfied that there will be enough for all if it is equitably divided, there must be no selfish attempts on the part of individuals to secure more than their share, and for this purpose it may be necessary to take precautions against hoarding."

As to the question of national factories, he had often been asked what the Government were going to do with them after the war. A number were entirely State-owned, others were partially State-owned, and there were a large number of which the firms were really the owners. There were 115 of this class. Then there were 25 factories serviceable for storage purposes. The conditions had been carefully examined, and in the case of certain factories it had been determined that it would be injudicious either to part with them or substantially alter them. As to factories which were considered redundant, offers for their utilisation would be received. A great group had been reserved for storage purposes.

A great opportunity presented itself before British traders, an opportunity which he hoped would be grasped by improved organisation among themselves. There was vast room for it. But all their efforts would be in vain; they could plan as they liked in regard to demobilisation, the disposal of stores, and the allocation of orders and other matters, but if they had not industrial peace all their efforts would be in vain. He had explored the various avenues of approach to industrial peace, and many of them ended in a blind alley. They would not get industrial peace by any Government restrictions. It was suggested that they should have a great meeting of Labour leaders and employers to see if they could not evolve some plan. All his advisers were of opinion that it was no good to proceed that way. It would be a Babel. The interests of one trade were different from those of another, and they could not settle them all on a single plan. What they had to do was to strive to get organisation in the industry, authoritative and representative, which would be able to settle these things for themselves. That was why they had set up the Joint Industrial Councils.

Demobilisation.—It is announced that inquiries regarding priority of release of officers and men in the Army should be addressed to the Demobilisation and Resettlement Department of the Ministry of Labour, 6, Whitehall Gardens, London, S.W. 1, and not to the Admiralty, War Office, or other Department. The Admiralty, War Office, and Air Ministry will continue to deal with individual applications for the release of officers and men on compassionate grounds.

The War Office is anxious that it should be generally understood that the military situation does not yet admit of the commencement of demobilisation of the Military Forces, and that, consequently, until further notice, releases from military service can only be granted on compassionate grounds as hitherto, and in a limited number of special cases, where particular persons or classes are urgently required for the purpose of reconstructing industrial conditions preparatory to demobilisation. The responsibility for dealing with all applications in the latter class of case rests with the Ministry of Labour.

Exports to China.—The *London Gazette* for Nov. 19th contains a further list of persons or bodies to whom exports to China may be consigned.

Non-Ferrous Metal Industry Act.—A further list of those to whom licences have been granted appears in the *London Gazette* for November 19th.

Wage Advance.—In view of the increase in the cost of living since July, the Committee on Production has made further awards to the engineering and shipbuilding trades, chemical trade, heating and domestic engineers, railway shopmen, and Mersey ship repairing trades. The new award comes into force the week ending December 7th. Men over 18 are to receive a further advance of 5s. a week, and boys under 18 2s. 6d. a week.

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Trade Announcements.—Sir W. G. Armstrong, Whitworth & Co., Ltd., of Openshaw, Manchester, have now appointed the following district representatives throughout the country, and have opened permanent district offices in connection with their tool steel and small tools business :—

London and Southern District :—Representative, Mr. Ernest Wilson, 8, Great George Street, Westminster, S.W. 1. Telegrams: "Zigzag, Parl, London." Telephone 4010 Central.

Scotland and Ireland. Representative, Mr. A. S. Jones, 137A, St. Vincent Street, Glasgow. Telegrams: "Tulesteel," Glasgow. Telephone: 2214 Central.

Midland District.—Representative, Mr. Walter Todd, 158-161, Great Charles Street, Birmingham. Telegrams: "Waltod, Birmingham." Telephone: 417 Central.

North-Eastern District.—Representative, Mr. J. D. Smith, Pilgrim House, Pilgrim Street, Newcastle-on-Tyne. Telegrams: "Crucible, Newcastle-on-Tyne." Telephone: 241 Central.

Lancashire and Wales.—Representative, Mr. T. W. Etchells, 5, John Dalton Street, Manchester. Telegrams: "Hispeed." Telephone: 899 Central.)

The executors of the late Mr. E. J. Philpot, electrical engineer, of Canterbury and Ramsgate, announce that the business will be continued as usual.

Book Notices.—*Electric Furnaces.* Reprinted from the *Transactions* of the Faraday Society. Pp. 37 ; 18 figs. London : The Society. Price 3s. 6d.—A general discussion took place on electrical furnaces, at a meeting of the Society held on February 14th, at Manchester. Mr. H. Etchells, B.Met., M.Inst.Met., contributed the first paper to the symposium, entitled "Application of Electric Furnace Methods to Industrial Processes." Mr. J. Bibby, M.Sc., read a paper on "Electric Steel Refining Furnaces," and a paper by Mr. Frank E. Hill and Mr. A. P. M. Fleming on "Control of Electric Furnaces" was presented by Mr. Hill. The subject was then thrown open for general discussion. These papers, including the discussion, have now been brought together and reprinted under one cover, and we welcome them as timely. The papers are most interesting, containing important suggestions for the improvement of steel manufacture. In many branches of industry progress has been stimulated by the war to a marked degree, and when free discussions of these developments become possible, it will be seen that the advances of electro-metallurgy in Great Britain have been remarkable.

"*Proceedings* of the American Society of Civil Engineers." Vol. XLIV, No. 8. October, 1918. New York : The Society, 33, West Thirty-Ninth Street.

"*Transactions* of the Institution of Engineers and Shipbuilders in Scotland." Vol. LXII, No. 1. November, 1918. Glasgow : The Institution.

"Industrial Electrical Measuring Instruments." By Kenelm Edgcumbe. Second Edition. Pp. xvi. + 414 ; 260 figs. London : Constable & Co., Ltd. Price 16s. net.

LIGHTING AND POWER NOTES.

Abercanaid.—Price Increase.—The electricity consumers at Abercanaid and Pentrebach have appointed a Committee to report on the increase of charges for electricity by 100 per cent. above pre-war charges.

Barnes.—Loan Sanction.—The U.D.C. has received the sanction of the L.G.B. for the borrowing of £5,500 for extensions in connection with the electricity undertaking.

Bedford. — New Power Station Opened. — On November 9th, the new Corporation power station was formally opened. A large party attended the ceremony at the invitation of Councillor W. E. Sowter, chairman of the Electricity Committee.

Cirencester.—Price Increase.—The Electric Supply Co. has applied to the B. of T. for powers to increase the price of electricity from 11s. 8d. for any amount up to 20 units per quarter, and 7d. per unit beyond, to 11s. 3d. up to 15 units, and 9d. per unit beyond.

Darlington.—Enemy Contracts.—The T.C. has settled the question of the unfinished contract by a German firm for the erection of a cooling tower at the electricity works by accepting the sum of £204 and 50 per cent. of the remainder from the Official Receiver, which is almost as much as the Council claimed.

Deal and Walmer.—The B. of T. has extended the Deal and Walmer Gas and Electricity Act of 1914 for one year.

Edinburgh.—Year's Working.—The annual accounts of the Corporation electricity department show that for the year ended May 15th last the income amounted to £167,065 and the expenditure to £106,823. Redemption of debt absorbed £39,323 ; interest on loans, £15,694 ; income-tax, £7,613 ; and other capital charges, £568, the gross surplus of £60,241 being converted into a net loss of £2,957. This has been met from the reserve fund, which now stands at £99,838. Units sold during the year totalled 20,945,404, against 17,997,251 in the preceding year, and included private lighting, 9,040,892, against 8,651,321 ; power, 11,470,080, against 9,050,990 ; traction, 130,357, against 118,840 ; street arc lamps, 228,000, against 93,167 ; street incandescent lamps, 76,075, against 82,933 ; 3,156,114 units were used on the works, against 2,528,305 ; and 2,102,248, against 1,952,851, were unaccounted for. The total capital expenditure on the undertaking amounted to £1,201,626, of which £7,767 was incurred during 1917-18.

Proposed Extensions.—The E.L. Committee has appointed a deputation to urge the Ministry of Munitions to grant facilities for the construction of the new power station at Portobello ; meanwhile, the alterations at Dewar Place are to be proceeded with.

Glasgow.—Proposed Extensions.—We are now able to state that at a meeting in September of the Electricity Committee, the engineer reported that since ordering the fourth turbo-alternator set for the new generating station at Dalmarnock in February last, he had received applications for additional supplies of electricity of approximately 20,000 H.P., and that, subject to Messrs. Beardmore & Co. being granted certificates by the Ministry of Munitions for a supply of between 10,000 and 15,000 H.P. for furnaces, an additional generating set of 15,000 KW. should be ordered. The estimated cost of the turbo-alternator is £100,000, and its installation will complete half of the Dalmarnock station : the estimated cost of the equipment of the second boiler house is £150,000. The Committee recommended that, subject to the certificates being granted to Messrs. Beardmore & Co., tenders for an additional turbo-alternator set, with accessories, be obtained, and that the equipment of the second boiler house at Dalmarnock be proceeded with when the turbo-alternator has been ordered.

Guernsey. — Explosion.—On the morning of the 8th inst. an explosion occurred at the St. Sampson's power station of the Guernsey E.L. & P. Co. The gable of the building was blown away. The cause is unknown, but thought to be due to the ignition of an accumulation of gas in the basement.

Hetton.—Street Lighting.—The U.D.C. has appointed a deputation to interview the manager of the Sunderland District Electric Tramways Co., with reference to the lighting of the streets.

Huthwaite. — Mains Extensions. — The U.D.C. has granted the New Hucknall Co. permission to erect an overhead cable to supply electricity to the Institute.

Lighting Restrictions.—The Coal Controller has issued a statement to the effect that the Household, Fuel, and Lighting Order is still in force, and that illuminations, shop-window lighting, and outside lighting cannot be permitted until reserve stocks of coal are in existence and the mines are producing sufficient for requirements. The notice states that because the street lighting restrictions have been modified, and hotels and theatres were allowed to remain open later last week, private consumers appear to be under the impression that they may use more light ; this is not the case, and unless the economy is kept up, there will be hardship in the early part of next year.

According to the *Irish Independent*, the Chief Secretary for Ireland has admitted that the early closing rules made under the Irish Lighting Regulations Order are unreasonable and impracticable, and he has promised to take steps to have them revised. The Dublin Chamber of Commerce is asking for some means of quick and easy appeal to some impartial tribunal in cases of individual hardship. As to the Corporation lighting restrictions on private consumers, it is stated that a hard and fast rule is unfair, as is also the adoption of the 1914 consumption as the basis of comparison in all cases.

Minimum Charges.—In the House of Commons Sir Albert Stanley, in a written answer to Mr. Jacobson, says :—I am aware that some electric supply bodies are enforcing a minimum charge. The right to make this charge is a statutory one which is commonly conferred on electric supply bodies whether companies or local authorities, who are under the obligation to maintain a general supply sufficient for the use of all consumers, and the object of the provision is to ensure to them a reasonable return for the expenditure incurred. The charge is, as a rule, small, and I should be sorry to think that there are many persons to whom it acts as an inducement to consume energy unnecessarily. I am taking steps to suspend the charge as far as possible when application is made for a revision of price under the Statutory Undertakings (Temporary Increase of Charges) Act of this Session, but to do it generally would require further legislation, which I am not prepared to recommend to the House.

Proposed Joint Supply.—At a meeting of the Derby T.C. it transpired that the two engineers appointed to report on a scheme for the linking-up of the electricity supply systems of nine towns in the Midlands (referred to in our last issue) were Sir John Snell and Mr. Worthington ; the fee is to be 1,000 guineas each, and a further £2,000 is to be expended on the preparation of a report. It was stated that the matter was urgent, as coalowners and others were preparing individual schemes.

Redditch.—Year's Working.—For the year ended March 31st last, the income of the Corporation electricity department amounted to £20,610 and the generation and distribution costs to £15,289, the net profit being £338 ; £2,000 was placed to reserve for capital repayments, part of which was met from the rates.

Skelton and Brotton.—Street Lighting.—The U.D.C. has arranged to resume electric street lighting.

South Lancashire.—New Installations.—It is said that big contracts were placed on Saturday, and others were to be ratified this week, for opening new coal mines and installations of electrical plant in various parts of South Lancashire.

Sunderland.—Price Increase.—The E.L. Committee has recommended that the war charges for electricity for power purposes be increased from 15 per cent. to 33⅓ per cent. from the November meter readings, and that war charges to L.T. consumers, except at the domestic rate, be increased by 10 per cent. to 20 per cent.

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Tiverton.—Proposed Street Lighting.—Sir Ian Amory has offered to provide public electric lighting in the town by the utilisation of water power; the T.C. is considering the scheme.

TRAMWAY AND RAILWAY NOTES.

Ashton-under-Lyne.—Proposed Loan.—The T.C. has decided to apply to the B. of T. for sanction to borrow £15,309 in connection with the proposed extension of the tramway depôt in Mossley Road.

Australia.—Melbourne.—According to the *Financier*, an electric train has been run between Newmarket and Essendon, with complete success.

Birmingham.—For sticking to their work during the armistice celebrations, tramcar drivers and conductors have been given an extra day's pay.

Blackpool.—Year's Working.—The report of the manager of the Corporation tramway department for the year ended March 31st last states that, in spite of the increased operating costs, the percentage of working expenses to the total income only increased from 56·4 to 57·36 per cent. The manager is opposed to the system of annual contract tickets, and is of opinion that, unless some revision of charges is made, this class of passenger will dominate the system to the detriment of the ordinary fare-paying passenger. In July last year the lease of the Squire's Gate-Station Road line of the Blackpool, St. Anne's and Lytham Tramways Co. expired, and has since been worked by the Corporation, although only at the expense of other routes, owing to the lack of new rolling stock. The income for the year amounted to £119,339, against £96,224, and the expenditure to £66,456, against £55,085. Of the gross profit, loan charges absorbed £20,576, £3,307 was carried to the reserve fund, £12,000 to the permanent way renewals fund, and £15,000 to the relief of rates. A total of £107,497 has been contributed to the borough fund since the inauguration of the undertaking, and the reserve fund now stands at £24,575. Passengers carried numbered 22,251,657, against 17,810,538, and car-miles run were 1,252,878, against 1,131,728; 2,055,120 units were used, or 1·64 per car-mile, the power costs per car-mile being 2·84d. The average revenue per car-mile was 22·86d., and the average expenditure 13·11d. Passengers carried per car-mile averaged 17·76, and the average fare was 1·21d. The 41 cars in use ran an average of 83·7 miles per day.

Chesterfield.—Fare Revision.—The Corporation has applied to the B. of T. for permission to increase the tramway fares by 50 per cent. in excess of the fares now authorised.

Dover.—Track Renewals.—The Tramways Committee has decided to expend about £10,000 on the improvement of the tramways; the line to River is to be taken up and re-used, and motor-buses are to be used on this route.

Huddersfield.—Power for Tramways.—The Tramways Committee has placed under the control of the Electricity Committee the generation of electricity for tramways, as well as for lighting and power purposes. The power station at Longroyd Bridge would, therefore, be under the supervision of the Electricity Committee as from the 1st inst.

London.—The whole of the tramway service in Old Kent Road was blocked on Thursday morning, last week, by the breakdown of a steam wagon.

Wages.—At a meeting of the N.U.R., the Associated Society of Locomotive Engineers, and the B. of T., last week, it was decided that the war bonus of the railwaymen should be increased by a further 3s. per week from November 1st last, in accordance with the arrangement by which the wages are to be fixed on a sliding scale according to the cost of living. The bonus now amounts to 33s. per week, and is to stand until January, when the subject will again be considered.

Hammersmith.—The B.C. has communicated with the L.U.T. Co., urging that the tramway track within the borough, which the Council states is in a dangerous condition, be repaired immediately.

District Railway's Jubilee.—We are reminded by the *Daily Telegraph* that this year is the jubilee of the District Railway. Opened on October 1st, 1868, from High Street, Kensington, to Gloucester Road, the line on December 24th, 1868, was extended from Gloucester Road to Westminster. The first experiments in the electrification of the system were made in May, 1900, with an electric train which ran between Earl's Court and High Street. On November 5th, 1905, all steam trains on the District Railway were withdrawn, and electric working became universal.

Overcrowding.—In reply to a question in the House of Commons, on Monday, the Parliamentary Secretary to the B. of T. stated that the desirability of improving the transit facilities, in view of the present overcrowding, was being brought to the notice of the tramway, railway, and omnibus authorities.

Slaithwaite.—Tramways and Street Lighting.—At the U.D.C. meeting, last week, a letter was received from the Huddersfield Branch of the Amalgamated Society of Tramway and Vehicle Workers, asking for all street lamps to be lighted on the main tramway routes in the Council's area, and intimating that if this request was not granted the drivers would refuse to take the cars beyond the Huddersfield boundary. The Council felt that this was an impertinent threat, and, after a discussion on lighting as a whole, decided to light alternate lamps.

Swansea.—Suspended Service.—The tramway service was suspended for three days last week, and the workers now refuse to resume work unless paid for the three days in question.

TELEGRAPH AND TELEPHONE NOTES.

New Cable to Ireland.—The *Evening News* learns that the Western Union Telegraph Co. hopes soon to have working a cable between the English and Irish coasts, which will obviate the difficulty of keeping up communication with landlines.

In regard to the statement that the American cables have "failed recently to meet even urgent demands," it is pointed out that it has been difficult to repair existing cables during the war.

Spain.—A system of wireless telephony has lately been put in operation between Barcelona and the Island of Minorca, with, it is stated, satisfactory results.

United States.—It is reported that the U.S. Government has selected the site of what is to be the largest naval radio station in the world. It is situated four miles from Monroe, in North Carolina, and will comprise 640 acres. A Bill empowering the Government to purchase the site is shortly to be submitted to Congress, and steps are already being taken to begin the construction of the plant.—*Evening News.*

A telegram from Secretary of the Navy Daniels, to the Boy Scouts of America, characterising them as chivalrous young crusaders, disclosed that the Scouts, working on behalf of the Government, discovered 100 illegal wireless plants, 26 of which were found in one day.

The American cable and postal censorship has been abolished.

Plans have been under discussion between the U.S. Government and other nations with reference to the control of cable communications, and it is now reported that the U.S. Government has taken over the operation of all ocean cables owned in the United States.

The Postmaster-General announces the consolidation of the services of the Western Union and the Postal Telegraph Co. under Government control. The new arrangement will come into force on December 1st.

CONTRACTS OPEN AND CLOSED.

OPEN.

Bradford.—November 23rd. Tramways Committee. Stores for 12 months, including lamp fittings, insulating material, &c. General Manager.

Dublin.—November 27th. Electricity Supply Committee. 3,000 to 5,000-kw. steam turbo-generating plant. City Electrical Engineer, Fleet Street.

Enniskillen.—December 1st. Sligo, Leitrim & Northern Counties Railway Co. 12 months' supply of telegraph material. Mr. J. Duff, Secretary.

Manchester.—November 29th. Three-phase, 6,600-volt sub-station switchgear. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Walsall.—December 5th. Electricity Supply Department. One 500-kw. rotary converter equipment. See "Official Notices" November 8th.

CLOSED.

Hammersmith.—Electricity Committee. Boiler plant extensions:—

Foster Construction Co., Ltd.	£365
D. Rowell & Co., Ltd.	247
H. Young & Co., Ltd.	221
Aston Construction Co., Ltd. (recommended)	**200**
Redpath, Brown & Co., Ltd.	180
Measures Bros., Ltd.	178

Mechanical stoker:—

E. Bennis & Co. (travelling step chain grate)	£1,980
Stirling Boiler Co., Ltd. (chain grate)	1,600
Underfeed Stoker Co., Ltd. (travelling grate)	1,655
Erith's Engineering Co., Ltd. (Erith-Riley) (recommended)	**1,350**

Owing to the Coal Controller having diverted several consignments of coal from the electricity undertaking, due to the continued curtailment of coal supplies, the engineer has made inquiries as to obtaining other fuel, and after inspection of the plant of the South Primrose Coal Co., is of opinion that "anthracite culm" can be used as fuel in the furnaces of the electricity works; as a trial, 250 tons of this coal has been ordered at 18s. per ton, plus 11s. per ton for carriage.

Sunderland.—T.C.:—

Switchgear.—Ferguson, Pailin & Co., Ltd.
Motor for coal conveyor.—British Thomson-Houston Co., Ltd.

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FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, November 22nd. At 39, Victoria Street. At 7 p.m. Lecturette, "Noveltics in Pumping Machinery," by Mr. H. P. Anderson.

Wednesday, November 27th. At 2.30 p.m. Visit to Bryant & May's Match Works, Bow.

Friday, November 29th. At 7.30 p.m. At 39, Victoria Street, S.W. Social evening.

(Midland Section).—Friday, November 22nd. At 7.45 p.m. At the Imperial Hotel, Birmingham. Paper on "The Planimeter Simply Explained without Mathematics," by Mr. W. J. Tennant.

(North-Eastern Section).—Tuesday, November 26th. At 7.15 p.m. At the Mining Institute, Newcastle-on-Tyne. Paper on "Boilers, Coal and Gas Fired," by Messrs. E. F. Oakford and S. H. Moore.

(Sheffield Section).—Friday, November 29th. At the Cutler's Hall. At 7.30 p.m. Presidential address by Dr. P. Longmuir.

Institution of Electrical Engineers (Students' Section).—Friday, November 22nd. At 7 p.m. At King's College, Strand, W.C. Address on "The Permeability of Faintly-Magnetic Materials," by Prof. E. Wilson.

(North-Eastern Centre).—Monday, November 25th. At the Mining Institute, Newcastle-on-Tyne. At 6.45 p.m. Address by the President, Mr. C. H. Wordingham, C.B.E.

(North Midland Centre).—Tuesday, November 26th. At the Metropole, King Street, Leeds. At 7 p.m. Address by the President, Mr. C. H. Wordingham, C.B.E.

(North-Western Centre).—Tuesday, November 26th. At the Engineers' Club, Manchester. At 7 p.m. Paper on "The Use of High-Pressure and High-Temperature Steam in Large Power Stations," by Mr. J. H. Shaw.

(South Midland Centre).—Wednesday, November 27th. At the University, Birmingham. At 7 p.m. Paper on "The Use of High-Pressure and High-Temperature Steam in Large Power Stations," by Mr. J. H. Shaw.

Physical Society of London.—Friday, November 22nd. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary meeting.

Manchester Association of Engineers.—Saturday, November 23rd. At 6.30 p.m. At the Grand Hotel. Paper on "Conveyors in Relation to Engineering Works," by Mr. W. H. Atherton.

Birmingham and District Electric Club.—Saturday, November 23rd. At the Swan Hotel. At 6.30 p.m. Concert (ladies' night.)

Electrical Power Engineers' Association.—Saturday, November 23rd. At 6.30 p.m. At the Foresters' Hall, Cardiff. General meeting for the purpose of forming a South Wales Section.

Industrial Reconstruction Council.—Wednesday, November 27th. At the Saddlers' Hall, Cheapside, E.C. At 4.30 p.m. Lecture on "Labour and Industrial Development," by Mr. E. J. P. Benn, C.B.E.

Greenock Association of Electrical Engineers.—Saturday, November 30th. Visit to Coats's Observatory, Paisley.

NOTES.

Employment of Officers.—The official mechanism for placing officers and ex-officers in employment on demobilisation is the Appointments Department of the Ministry of Labour. This department, which is under the direction of Mr. T. C. Home McCall, has been in existence since March last, but it is now extending its authority to deal with the re-employment of all officers, disabled or otherwise. The department has an efficient system by which officers can be found positions if they are qualified, or can be trained for positions if their education has been neglected or interrupted. At the present time 2,000 officers are being trained by the department for special posts in civil life.—*Financial Times.*

The Premier on Reconstruction.—At the meeting with which the Prime Minister, Mr. Bonar Law, and Mr. Barnes opened the Coalition campaign, which was held on Saturday at the Central Hall, Westminster, Mr. Lloyd George indicated a general line of policy upon which the three sections of the Coalition were agreed. Better housing, better wages, better working conditions, all of them as a means of remedying the appalling condition of the national health revealed by the recruiting statistics; State regulation of the means of transport, protection of key industries, the development of agriculture, the development of industrial production, were some of the lines of progress that he indicated.

This country, he said, had for generations set an example to the world; let it continue to set that example. We could not return to the old conditions; we could not go back. If the new Parliament rose to the level of its great opportunities the Empire would be firmly established on the only solid basis—that of a happy, prosperous, and contented people.

The task of reconstruction should begin immediately; delay there was dangerous. The condemnation of the old wasteful system was to be found in the recruiting statistics, which revealed a higher percentage of physical unfitness in this country than in any other. That was a disgrace. It was not through poverty—we were the richest country in the world—but through mismanagement, which allowed the people to be underfed, ill-housed, and overworked. The health of the people must especially be the concern of the State. The housing question must be a national task. Wages which had been forced up by the war must not be permitted to drop to the point where the strength of the worker could not be maintained in efficiency.

That was one of the war revelations. The other was that, industrially, we were an ill-organised State. Every industry had been told rudely by the State to mind its own business, and, under the circumstances, some did well and others did badly. Unfortunately, among those which did badly were the industries which were discovered during the war to be essential to the national safety. We found many industries crippled by deliberately unfair competition, and the only answer they had was "That was their look-out." That would not do. Agriculture was almost completely neglected by the State. The problem of transportation had been left very largely to chance. Railways, canals, roads, tramways, all were vital to the life, the industry, the amenities of the people. This problem must be taken in hand under the direct inspiration and control of the State. Electric power, so necessary to industry and comfort, must be taken in hand. All these problems required a thorough, sympathetic, and courageous working out. We must face them like patriots and not partisans.

The problem for the nation in the coming election was to choose its builders for the great reconstruction. He wished it had been possible to get every party, every section of the community united for that task. He wanted the traditions that made Mr. Disraeli in his best days plead in that great book of his for a minimum wage, for better houses, for shorter hours, and for making the life of the people a national concern. The conduct of the war by the Government in these days was a great piece of national organisation. It affected every trade, every business; all the life of the nation had had to be reconstructed and reorganised for war, and he claimed that if a Government could do that for war it could do it for peace.

Mr. Bonar Law supported the Prime Minister. He said a clear issue had been raised, the nation had got to decide whether the problems in front of us were to be faced not from a party point of view, but from a national point of view. We were going to be faced with problems the nature of which we could not foresee. The whole life of this country, its social and its economic life, had to be changed, and one could not foresee to-day the exact nature of the problems which would arise or the way in which we should have to deal with them. These problems would come very quickly, and would have to be settled quickly. If the condition of wages and of well-being of which the Premier had spoken were to be maintained, production would have to be maintained and increased.

Mr. Barnes said that his appearance that day marked for him a definite break from a political party. There were times when one had to choose one's course apart from personal considerations; his highest ambition was to serve Labour, and he thought he would be serving Labour best by staying in the present Government until normal life had been resumed in peace and security. When he said peace, he included industrial peace and social peace. He believed in co-operation as against competition, and he looked with some alarm upon the eagerness in certain quarters to get rid of governmental control. He was in favour of the nationalisation of monopolies and the control of essential services until such time as the release from control was consistent with public welfare. We had to get through immediate, practical, pressing problems. Those problems were upon us now. Two things were necessary in industry after the war. The first was the highest possible standard of living, and the second was the highest possible production of goods; the one depended upon the other. It was because he believed that the Coalition Government was sincerely desirous of applying those principles of co-operation and goodwill that, whether in it or out of it, he would do his humble part to help it.

Out-of-Work Donations.—On Tuesday the Ministry of Labour issued the details of its scheme of out-of-work donations, which will come into force on Monday. Out-of-work donation policies will not be issued before that date.

Ex-sailors, soldiers, and airmen will be entitled to out-of-work donation policies, available for 12 months, if they have actually served with the Forces during the present war, and civilian workers will be entitled to out-of-work donation policies, available for six months, if they are British subjects and became "employed contributors" under the National Health Insurance scheme before August 25th, 1918, and in the case of boys and girls between 15 and 16 if they entered employment before that date. Unemployed persons desiring to claim donation should, on and after Monday, attend at an Employment Exchange or Branch Employment Office, taking with them their discharge or other military certificates if they served in his Majesty's Forces during the present war, or their Health Insurance record cards and Health Insurance contribution cards if civilian workers. In the ordinary cases attendance daily or as otherwise directed, between specified hours at the Employment Exchange or Branch Employment Office will be required as a condition of receipt of donation. The rates of payment are:—

	Per week. £	s.	d.
Men over 18	1	4	0
Women over 18	1	0	0
Boys between 15 and 18	0	12	0
Girls between 15 and 18	0	10	0

In the cases of men and women there will be supplementary allowances for dependent children of 6s. a week for the first child under 15 years of age, and 3s. a week for each additional child under that age, and payment in the case of boys and girls is subject to attendance, if required, at a course of instruction under the Board of Education or other central authority. Donation does not become due until after the applicant has been unemployed and has attended at the Exchange for three consecutive working days, and payment will not be made for these three days.

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Institution and Lecture Notes.—Institution of Electrical Engineers (Western Centre).—The second meeting of the session was held at the South Wales Mining Engineers' Institute, Cardiff, on November 11th. Despite the peace or armistice celebrations, the chairman (Mr. H. I. Rogers) had the pleasure of presiding over one of the largest attendances at a meeting held by this Centre. The visit of the President (Mr. C. H. Wordingham), no doubt, accounted for the numerous attendance. The Secretary of the Institution (Mr. P. F. Rowell) was also present.

The President congratulated the Western Centre on its recent acquisition of new territory, and based a lengthy address on the work of the Institution. The work accomplished during the past session was reviewed, and his proposals for the remodelling of the Institution, having regard to the obtaining of a Royal Charter, were listened to with keen interest. He also made a special plea for the Benevolent Fund, and suggested that members, when forwarding their subscriptions for the coming year, should increase them by the sum of one shilling, this sum to be ear-marked for the Benevolent Fund. If this were done, the Fund would benefit by a very substantial amount.

A short discussion ensued on the President's scheme, and a hearty vote of thanks was accorded Mr. Wordingham for his address.

On Tuesday, last week, Mr. A. P. M. Fleming, chairman of the North-Western Centre, delivered his inaugural address, on "The Human Factor in Industry."

Miners' Strike for Electric Lamps.—The demand of the miners employed at the Hucknall Colliery for a supply of electric lamps not having been complied with, about 2,000 miners, enginemen, and firemen struck work on the 12th inst. The grievance is one of two years' standing, and the company's agent states that the company is quite willing to furnish the lamps, but is unable to obtain a supply. The men refused the Coal Controller's suggestion that the matter be referred to the Trades Disputes Board.

Wages (Temporary Regulation) Bill.—This Bill was before the House of Commons in Committee, on Tuesday, and was read a third time. It relates in one of its clauses to the obligation to pay prescribed rates of wages for six months, and it was stated by the Minister of Labour that the general assent of both employers and employed had been secured. The prescribed rate can be altered by an award of an interim Court of Arbitration which is to be established, or by steps taken by the Minister of Labour. Proceedings for offences may be brought before Munitions Tribunals.

Foreign Trade.—The October Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures :—

Imports.	*October*, 1918. £	*Inc. or dec.* £	10 *months*, 1918. *Inc. or dec.* £
Electrical goods ...	117,288	+ 6,016	− 212,910
Machinery	674,993	−239,763	+ 1,737,809
Exports.			
Electrical goods, &c. ...	171,201	− 45,486	− 791,895
Machinery	1,391,597	− 49,997	− 3,057,555

Volunteer Notes.—Royal Engineers (Vols.), London Army Troops Companies.—Headquarters: Balderton Street, Oxford Street, W. 1.

Regimental Orders No. 48, by Lieut.-Colonel C. B. Clay, V.D., Commanding. Monday, November 25th, to Saturday, November 30th.—Drills as usual.

C. Higgins, *Capt.* R.E., *Adjutant.*

Decimal Coinage.—At the meeting of the Court of Common Council of the City of London, last week, the following resolution was unanimously adopted :—"That in the opinion of this Court it is important, in the interests of the trade of the country, that our system of coinage be placed on a decimal basis at the earliest possible moment, and in this connection the Court supports the principle of the Decimal Coinage Bill recently introduced into the House of Lords by Lord Southwark, and now under the consideration of a Royal Commission."

Appointments Vacant.—Assistant electrical superintendent, also A.C. meter tester and repairer (70s.), for the Greenock Corporation Electricity Department; installation inspector, for the Stepney B.C. Electricity Department; technical officer (£1,000), for the Electrical Research Committee; charge engineer, for the Wallasey Corporation Electricity Department; shift engineer (£250 + £35), for the Manchester Corporation Electricity Department; draughtsman for the Battersea B.C. Electricity Department; shift engineer (65s. + 12½ per cent.) for the Leigh (Lancs.) Corporation Electricity Works; fuel and ash superintendent (£281) for the Wolverhampton Borough Electricity Department; electrical instrument maker as instructor to discharged soldiers for the Wimbledon Technical Institute. See our advertisement pages to-day.

Scientific Research.—A Scientific Research Association in the interest of engineering and shipbuilding is to be established by the North-East Coast Institution of Engineering and Shipbuilding. We would draw the special attention of our readers to the important announcement under "Appointments Vacant" (above), regarding the appointment of a technical officer by the Electrical Research Committee of the I.E.E. and the B.E.A.M.A.

Patents and Alien Enemies.—The application to avoid or suspend Patent No. 23,319/07, granted to Hartmann & Braun Akt.-Ges., has been withdrawn by Messrs. Johnson & Phillips, Ltd.

Electric Steel Furnaces.—In the course of his paper, read on the 9th inst., before the Staffordshire Iron and Steel Institute, and briefly referred to in our last issue, Mr. F. J. Moffett stated that at the end of 1917 the electric furnaces installed in the United Kingdom were as follows :—

Héroult	46	varying from	1½ — 10 tons
Greaves-Etchells ...	31	,, ,,	½ — 12½ ,,
Electro-metals ...	27	,, ,,	1½ — 10 ,,
Rennerfelt	8	,, ,,	¾ — 2½ ,,
Stobie	6	,, ,,	5 — 15½ ,,
Other makes ...	22		

Of these 140 furnaces nearly one-half were in the Sheffield and Rotherham district.

It was evident that the arc type of furnace had established its superiority from a commercial point of view. The induction furnace was now very rarely adopted in this country for steel refining.

The standard sizes of furnaces with the transformer capacity and the approximate units per ton of finished steel were thus stated by the author :—

Size.	Transformer capacity.	Units per ton.
25 cwt.	300 kw.	850
2½ tons.	500 ,,	800
5 ,,	800 ,,	750

The decrease in the units per ton does not go on indefinitely; when the capacity of 15 tons is reached, the units per ton appear to reach their minimum value. Sir Robert Hadfield, in a recent account of the fuel and electric power consumption at his works at Sheffield, stated that in 1917 the units per ton used for 31,850 tons of electric steel were 782.

We may add that there are at the present time one or more 25-ton furnaces under construction. The total output of electric steel in this country in 1917 was 110,000 tons.

Every Man to his Métier.—He was explaining how he came to be in the camp kitchen. "I'm a mainsman," he said, "and when I did a trade test I was told to solder a joint. I did it all right, and my papers were marked 'joint well done.' And, blimey, the next thing I knew I was ordered to France *as a first-class cook.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.

Central Station and Tramway Officials.—According to a local report, a proposal to advance the salary of Mr. A. S. Blackman, borough electrical engineer at Sunderland, from £1,000 to £1,200, was opposed, and disapproved by the Council, on the ground that the salary was ample for the position, and that it would not be fair to the ratepayers to make such an increase when the undertaking was not a paying concern.

Mr. A. A. Blackburn, chief engineer and assistant to the general manager of the Belfast City Tramways, has been appointed manager and engineer of the Huddersfield Corporation Tramways. There were 29 applicants.

Mr. W. Clough, manager of the Bury Corporation Tramways since its formation, has tendered his resignation. It was decided to place on record an appreciation of his services in connection with the department. Mr. Clough has resigned in order to take up an important appointment with a large firm of paper makers which has mills in the Bury and other districts. The Tramways Committee is to advertise for a successor at £500 per annum.

Stockton-on-Tees T.C. has declined an application by the electrical engineer, Mr. J. J. Smith, for an increase of salary, but has granted a war bonus of £50 for the year ending March 31st, 1919.

General.—Coun. Dawson is resigning the chairmanship of the Woolwich B.C. Electricity Committee.

On November 2nd, at Manchester, Captain A. E. McConnell, R.E., was married to Christina Isobel, youngest daughter of Mr. Peter Waters, of Old Trafford, Manchester. Captain McConnell is on the export staff of the British Westinghouse Co. He went out with the 2nd Manchesters to Gallipoli, was wounded, invalided home, and given a commission in the R.I.R.'s, is now transferred to the R.E.'s, and is at one of the locomotive depôts in France.

Darwen T.C. has elected Aldermen Carus, Cocker, Eccles, Pickup and Tomlinson, and Councillors Davies, Duxbury, Gibson, Hindle, Ainsworth, Broadbent, Holden, Holgate, Jepson, Pickup and Thornley to serve on the Electricity Committee of the Corporation for the ensuing year.

Mr. Burman has been appointed chairman of the Birmingham Electric Supply Committee. Mr. Lee is the new chairman of the Birmingham Tramways Committee.

Ald. S. G. Kimber, the retiring Sheriff of Southampton, and for six years Chairman of the Electricity Committee, has been elected Mayor.

Ald. G. H. Robinson and Mr. J. Haley have been re-appointed chairman and deputy-chairman of the Bradford

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Electricity Committee, and Ald. Enoch Priestley and Mr. I. F. Akeroyd as chairman and deputy-chairman of the Tramways Committee.

The Hammersmith B.C. Electricity Committee has appointed Coun. Stamper chairman and Coun. Jones vice-chairman.

The Shoreditch B.C. Lighting Committee has re-elected Coun. Major W. Weber chairman and Coun. T. H. Bird vice-chairman.

Mr. W. H. Herod, who has been for 10 years with the London office of the Oerlikon Co., has joined the staff of the engineering department of the General Electric Co., Ltd., 67, Queen Victoria Street, E.C. 4.

Mr. E. C. Kelly, recently publicity manager for Simplex Conduits, Ltd., is resigning the post to take up the representation of *The Engineer* for the Midland district.

Roll of Honour.—In our issue of November 11th we stated that the Military Cross with two bars, won by his son, Flight-Commander Monteagle-Barton, R.A.F., who was killed last February, had been received by Mr. Leonard *Barton*, M.I.E.E., of Wallington. The name was incorrectly printed. It should read *Barlow*, not Barton. Mr. Leonard Barlow is Technical Adviser to the Priority Department.

Private H. Hyman, Manchester Regiment, who has died of wounds, was with the British Westinghouse Co., Ltd., Trafford Park.

Major F. A. Robinson, M.C. (with bar), 10th Tank Battalion, who was formerly in the electric light department of the India-Rubber Co., Silvertown, was killed on November 4th whilst leading an attack at Catillon, near Le Cateau, France. He was the son of Commander F. W. Robinson, of the submarine department of the India-Rubber Co.

Private H. Treacher, Manchester Regt., who has died of wounds, was formerly employed by Messrs. Ward & Goldstone, Salford.

Private J. W. Rady, signaller, who died of pneumonia in Italy, was an employé of Messrs. Connolly Bros., Manchester.

Private G. A. Dickinson, East Lancashire Regiment, has been killed in action, aged 21 years. He was employed by Messrs. Dick, Kerr & Co., of Preston.

Private E. Ferriday, R.N.D., a Military Medallist, who has been killed in action, aged 22, was employed by Messrs. Ferranti, Ltd.

Lance-Corporal H. Bill, R.A.M.C., awarded the Military Medal for conspicuous bravery in the field, was employed by Siemens Bros. Dynamo Works, Stafford.

Cadet G. W. Auden, R.A.F., who has died from septic pneumonia, enlisted whilst training as an electrical engineer at the Derby Technical College.

Sergeant P. Woollett, Sherwood Foresters, who has fallen in action, was on the staff of the Kent Electric Power Co., Ltd., of Chatham.

Private R. Smith, Border Regiment, who has been killed by shell fire, was engaged in the Carlisle Corporation electricity department.

Signaller W. Redshaw, who has fallen in action, was with the Scarborough Electric Supply Co.

Corporal J. J. Hills, R.E., who was an electrician with Mr. W. D. Dickinson, of Bexley Heath, has been awarded the Military Medal for keeping lines of communication intact under heavy fire.

Rifleman A. Ruston, West Yorks. Regiment, who has been killed in action, was formerly in the employ of Messrs. S. Dixon & Son, Leeds.

Obituary.—Mr. E. Russell-Clarke.—We regret to learn of the death of Mr. Edward Russell-Clarke, C.B.E., Technical Adviser to the Intelligence Department of the Admiralty, at the age of 47. The *Times* says that in 1895 he was called to the Bar, and he soon acquired a successful practice in patent and other cases in which there was scope for his remarkable scientific talent. But he was never really content to be simply understanding and expounding scientific apparatus; he wanted to be inventing and improving; and while he was at the Bar he took out many patents, particularly for inventions connected with electricity. But it was in the last four years that he truly found his opportunity, and that the real work of his life was done. At the outbreak of war he gave up his practice at the Bar, and placed himself at the disposal of the Admiralty, and was attached to the Intelligence Department as Technical Adviser. His death was the result of a complete breakdown due to incessant work, from which he had allowed himself no respite since the beginning of the war. He was a close friend of the late Col. Hopkinson.

Mr. H. Hargreaves.—The death occurred recently of Mr. Harry Hargreaves, who was formerly employed on analytical chemistry at Accrington electricity works.

Mr. Llewelyn Preece.—At the funeral service of the late Mr. Llewelyn Preece, held on November 14th, at Christ Church, Victoria Street, the Institution of Electrical Engineers was represented by the following:—Mr. C. H. Wordingham, C.B.E., President; Mr. W. M. Mordey, Mr. Alexander Siemens, Sir John Snell, Mr. J. Swinburne, Past-Presidents; Mr. J. E. Kingsbury, Hon. Treasurer; Mr. L. B. Atkinson, Mr. J. S. Highfield, Mr. A. P. Trotter, Members of Council; Mr. P. F. Rowell, Secretary.

Dr. I. Fujioka.—We learn that Dr. I. Fujioka, M.E., president of the Tokyo Electric Co., and a director of several firms, passed away on March 5th, 1918, of apoplexy. He was a member of the Institution of Electrical Engineers and other societies.

CITY NOTES.

Dick, Kerr and Co., Ltd.

Mr. Claud T. Cayley, presiding at the annual meeting on November 14th, said that the profit for the year under review was not much short of that for the previous year, and in view of the fact that the directors' policy had been gradually to prepare, where possible, for the reconstruction of the business on post-war conditions, no doubt they would consider the year's results satisfactory. The total on the asset side of the balance-sheet was this year over two and a quarter million pounds, which was a record figure so far as the company was concerned. The individual items which made up that total were in the main not widely different to those of last year with the exception of the assets "contracts, due to work, stock of materials, &c.," which was roughly £100,000 more than it was in 1917. That item covered the sums due to the company in respect of their various contracts, together with the stock of material carried in respect of them and so forth, and was naturally bound to fluctuate from year to year. Capital expenditure was some £20,000 less than last year, and he did not doubt that they would fully endorse the conservative policy of which this writing down was evidence. Investments stood at £338,000 odd, as against £341,000 odd in 1917. That decrease, however, was the net result of two large transactions. Last year he reported on the acquisition of the bulk of the "B" preference stock of Willans & Robinson, Ltd., partly by cash and partly by exchange of shares, which they issued for the purpose. This transaction occurred after the close of their financial year, and was, therefore, not reflected in the 1917 accounts. On the other hand, since the last meeting the whole of their holding of United Electric Car Co., Ltd., preference shares had been disposed of, so that the latter transaction largely offset the former. The works had continued to be fully employed, and he was glad to say that during the past few months the demand for certain purely war products having become less urgent, opportunity had been taken to establish a process of gradually changing over, and in that connection it was pleasing to note that the Ministries of Munitions and Reconstruction, remembering perhaps the way in which they threw themselves whole-heartedly into the production of war material in the early days, had given considerable assistance. While, therefore, there must inevitably be a hiatus of disorganisation, they hoped to be able to retain the continuous services of a considerable portion of their workpeople, first of all in the operations necessary to rearrange the factories, and later in standard production, provided raw material was available. The raw material required for the class of machinery in which they specialised was very different from raw material as understood generally by the public. Material such as steel forgings and castings, copper wire, and many other things which were the basis of their manufacture, were the finished article with many other producers, upon which months of work must already have been expended before they arrived at their stores. During the year the work of consolidating into their own organisation those of Willans & Robinson and the United Electric Car Co. had been completed, and the management committee had been strengthened and made still more representative by the appointment of Mr. Davenport and Mr. Bennett from Rugby, and Mr. Conner, an old and trusted member of their staff. An alliance had also been made with Siemens Bros. & Co., Ltd., by which it was thought much economy could be attained through the amalgamation of selling organisations and co-ordination of designs and products so as to avoid overlapping. Siemens and themselves were not competitors in manufacture. They were long established as makers of all kinds of cables, from submarine telegraph to power transmission, dynamo machinery, telephones, instruments, and so on, while they had specialised in apparatus for railways and tramways, steam turbines, and the larger classes of electrical machinery. The two manufacturing organisations dovetailed into each other perfectly, and only small adjustment was required to bring the commercial sides together with material benefit to both. This arrangement was referred to by Mr. Mure Ritchie, the chairman of Siemens Bros., Ltd., in his speech to the shareholders of that company in June last, and it had now been consummated by an exchange of directors, Mr. Mure Ritchie having taken a seat on their board, and he (the speaker) having joined that of Messrs. Siemens. An interesting development which had taken place since the last meeting was the establishment in France and in Japan of companies to exploit their manufacturing rights in connection with apparatus for railways and tramways. It must be gratifying to them to know that Dick-Kerr machinery ranked so highly in these important countries that representative technical and business men were willing to provide the considerable capital required for such undertakings. These companies would also act as their agents in their respective countries, thereby contributing important outlets for the products of their own factories, should there be a surplus available. It was obviously inadvisable to make public the details of their arrangements with those companies, but the terms were considered by the board to be satisfactory. He referred last year to the conviction on the part of those studying the position on their behalf that the after-war demand for their products would be very great. The correctness of that opinion was proved by the demand which already existed for all classes of electrical machinery,

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and especially large-sized steam turbine generating plant, upon which they had specialised for some years. It had further been brought home to the management that the manufacturing capacity of the country for heavy electrical machinery was much below the demand, and that in their own case they must, if they wished to retain the position they held at present, find facilities not only for increased output, but also for the production of individual units larger than their present shops admitted of. Having reached that conclusion, they were faced with the difficulty, if not impossibility, at all events for a long time to come, of extending the works, obtaining the necessary machinery, and building up a strong organisation. It was therefore with pleasure he had to inform them that they had solved the difficulty in a very satisfactory manner. An option agreement had been entered into with the Coventry Ordnance Works, Ltd., who owned an engineering works of modern design and equipment which, although not at present occupied upon electrical work, could very quickly be converted to that purpose. In due course the shareholders would receive full particulars of the proposal, and they would be asked to consent to an exchange of their shares for those of a new company, which, in the event of the offer being accepted, would control both concerns. The Coventry Ordnance Works, Ltd., which was not a public company, had an issued capital of £800,000, and debentures of £600,000. Its proprietors were Messrs. John Brown & Co., Ltd., Messrs. Cammell, Laird & Co., Ltd., and Messrs. Fairfield Shipbuilding & Engineering Co., Ltd. The shops were laid down for the purpose of making heavy armament, were modern both in respect of design and equipment, and could be easily altered for the production of heavy electrical machinery. In addition to the armament business done by the company, they had also a considerable output of non-war material, which it was expected could be materially increased. Full particulars would be sent to the shareholders in due course.

Mr. R. H. Prestwich seconded the motion, which was adopted unanimously.

British Westinghouse Electric and Manufacturing Co., Ltd.

A meeting of preference shareholders of this company was held on Tuesday at Hamilton House, Victoria Embankment, to consider a resolution for modifying their rights to the effect that in future such shares should be entitled *pari passu* with the existing ordinary shares to a non-cumulative preferential dividend at the rate of 8 per cent. per annum. Mr. J. Annan Bryce, M.P., the chairman, presided, and there was a large attendance.

The Chairman, in formally proposing the resolution, explained that the real object of the meeting was to consider a plan for the increase of capital by the sum of five millions. At previous general meetings, and particularly at the last one, the reasons for an increase of capital were emphasised. It was pointed out that large sums would have to be spent on research and experimental work. Their trade was one which, almost more than any other, was undergoing constant and rapid changes, involving very large and difficult problems of development. To meet the constantly changing and increasing demand they were under the continual necessity of altering and adding to their buildings and plant at Manchester. In connection with their associated companies abroad, there were similar needs, which demanded large contributions, and there were, moreover, before them propositions in themselves promising for the extension of their activities into other countries. If they were not prepared to meet these various demands, they might be unable to maintain their present position. The urgency of the necessity for more capital was emphasised by the happily near approach of peace. Germany would strain every nerve to meet by increased production the tremendous claim for reparation and indemnity which every consideration of justice demanded should be imposed on her. In one important respect she had a great advantage over ourselves. Her enterprise had not been saddled during the war with the colossal burdens in the form of income tax and excess profits tax which British enterprise had had to bear. The balance sheet of one of their German competitors, the Allgemeine Electricitäts Gesellschaft, showed that at the end of 1915 they had cash resources of 7 million pounds accumulated for dealing with work after the war, and those resources might have been greatly increased during the three subsequent years. The Allgemeine and its associated companies had together a capital of 50 millions sterling. The organising genius of the Germans would secure that those resources should become available by State credit or otherwise for the vital needs of the country as a whole. Even a Socialist Government would see to that. Do not let them imagine that the Germans would not have a market. Even if the loathing which their bestial methods had inspired prevented their direct access to the markets of the belligerent countries, it would require great ingenuity to prevent their indirect access even to belligerent countries. The neutral markets were open to them, countries in which the capitalist classes had, owing to the war, increased enormously in riches, which they were eager to employ in every kind of industry for which those countries might offer a field. Moreover, the neutral countries themselves wished to take a hand in the electrical industry, for which some of them, notably Sweden, Norway, and Spain were admirably adapted by their command of water power. Then there was America. The years of the war before she entered it gave her gigantic profits in which her subsequent expenditure, lavish though it had been, had not yet made any considerable hole. From being a debtor she was now a creditor country. Her technical knowledge was of the best, the keenness and energy of her manufacturers immense, and the productive power of her workmen unsurpassed. There they had what they were up against:—Germany fully equipped and desperate, the neutrals rich and eager, America able, rich, and determined. Here, too, they had able and powerful competitors, some of whom, such as Dick, Kerr & Co., and the General Electric Co., had lately effected amalgamations and secured large increases of capital. They would admit that he need say no more about the necessity imposed upon them to follow their example. Roughly, there were three ways in which additional capital might be arranged in their case, and all of them had been carefully considered. First, it might be put in ahead of the preference shares in the form of debentures. Secondly, it might be made to run *pari passu* with the existing preference shares, and thirdly, it might be put in behind them. The last was the course which the board had thought most convenient. What the meeting was principally concerned with was the effect on the preference shares. It was proposed that instead of being entitled to 15 per cent. and a quarter of the surplus after the ordinary shares had received 30 per cent., and the deferred shares 7½ per cent., they should receive only 8 per cent. It was further proposed that in a liquidation the shares should rank only for £2 instead of as at present for £5, and both in this respect and as regarded dividend, *pari passu* with the existing ordinary shares. The preference shares were therefore to give up two substantial advantages, and it might be asked what was the *quid pro quo*. The answer to that was best seen by a consideration of the alternatives. They could not go on as they were. Not only could they not provide for expansion, but it was highly doubtful whether they could continue to pay a 7½ per cent. dividend. Given that fresh capital was required, it was plain that to obtain it sufficient inducement must be held out. It was quite certain that, under present prospects, no one would put in fresh capital behind preference shares entitled to 15 per cent., a further quarter of surplus, and £5 on a liquidation, and on the best information they had been able to get, both now, and at the time the control was transferred from America, the directors did not think that fresh capital could be induced to come in behind the preference shares on better terms than those now proposed. It might be asked, as there was no provision for the 8 per cent. being cumulative, what prospect was there that it would be paid? The answer was that a regular 8 per cent. was practically assured by the putting in of a large amount of money behind the preference shares, money which would increase the earning power of the company, and which would not be put in unless the subscribers saw their way to a fair return upon it. Contemplating, as it did, a large expansion of the business, the board was asking for an increase of 5 millions. Naturally, it did not propose to issue all that sum at once, but it did see its way to use a minimum of one million, and possibly two millions within a year, and it undertook to have issued and subscribed one million as a minimum and two millions if required during that period. It saw its way to procure those sums at such intervals as might be necessary during that period. Under those circumstances, it considered that the preference shareholders might feel sure of getting their 8 per cent. regularly. With regard to the reduction of the right on a liquidation to £2 instead of £5, there was the very substantial *quid pro quo* of the greatly enhanced value of the security produced by the putting in of so large a sum as even one or two millions, a sum which in the future would in all probability be largely increased. Considering the alternatives, capital could be put in ahead of the existing preference shares only in the form of debentures. The existing debenture stock of £1,241,353 was raised early in the company's history when money was cheap, at 4 per cent., but in the present condition of the money market, and with two other series of debentures in front of it, a third series, as that would have to be, could be placed only at a very high rate of interest. It was evident that that method would not only injuriously affect the return on the preference shares, but would, especially if the issue were large, seriously imperil their security. The board accordingly did not entertain that method. The second alternative, that of an issue of shares *pari passu* with the existing preference shares, was seriously considered, but finally was discarded owing to the various difficulties which would have arisen in connection with the other classes of shares. He was satisfied that the scheme now before them was preferable. It was the intention of the directors to give deserving employés, whether members of the staff or workmen, the opportunity of subscribing, a step which they would no doubt approve as tending to identify them with the prosperity of the company. If it were decided to offer the new shares to existing preference shareholders, the directors would probably be induced to give preference in allocation to such as had been of service in the past or might be useful in the future.

Sir Ernest Hiley formally seconded the resolution.

Mr. Herbert Smith said that while agreeing that expansion of the capital appeared to be desirable, he thought the board ought to bear in mind the danger of too rapid or too reckless an expansion. He thought the best way to get fresh capital was by the issue of ordinary shares, but the question was

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whether the ordinary share capital which it was proposed to issue could not be placed on terms which would be more favourable to the existing preference shareholders. He thought it a great pity that the board should have started to evolve their scheme without having called into consultation some of the important interests represented at that meeting. At the eleventh hour they had to discuss proposals which might have been made the subject of agreement if they had been called into consultation earlier. Two points called for strong criticism. In the first place, they were asked to give up a very substantial part of their rights with the prospect of large sums of money being brought in behind them. Supposing that money was not brought in, the preference shareholders would have given up their birthright and got nothing for it. He suggested that whatever decisions they arrived at they should be based upon the principle that the variation in their rights should synchronise with, and be contingent upon, some very sensible proportion of the new ordinary capital being placed. In the second place, he found that in the city there was a very strong view that whatever arrangements were made with the preference shareholders they should hold some right of conversion. He strongly appealed to the board to adjourn the meeting in order that the scheme might be looked into by a committee on behalf of the preference shareholders.

Mr. E. Birks, Mr. Varley, and other speakers strongly supported an adjournment.

Sir Ernest Hiley said that the Metropolitan Carriage Co. came into the concern in 1917 as industrialists, and Messrs. Vickers had come in in the same position since. It was patent that an increase of capital was necessary if the company was to carry on and expand, and take the place it ought to in the electrical industry of the country. That capital could only be raised by the issue of debentures or ordinary shares. They could bring in fresh capital, but they were not going to do so if they had got preference shares with 15 per cent. dividend in front of them. He wanted to emphasise that they would want an extra million of money very soon—probably two millions before 12 months were up. The shares would be issued, and after being offered to the workpeople and to those who had helped the company in the past, if they were not taken up the Metropolitan Carriage Co. would see that what were left were taken up at par. As to a conference between the board and certain people who were representing the preference shareholders, such a meeting had been arranged for Thursday, when Mr. Smith, Mr. Robert Fleming, and Mr. Robert Benson were going to meet Mr. Dudley Docker, and he had no doubt that some satisfactory arrangement would be made there. Although the board had sufficient proxies to carry the scheme, they had no desire to rush it, and, personally, he saw no objection to an adjournment, as suggested by Mr. Smith.

Eventually the meeting was adjourned until Monday, on the understanding that in the meantime the suggested conference should take place.

Drake and Gorham, Ltd.

Presiding at the annual meeting on November 13th, Mr. B. M. Drake said that the year's profit of £18,781 compared with £11,395 for the previous year, and constituted a record, their best year previously being £16,327 in 1903. The profit on turnover worked out at under 6 per cent., so that they could not be accused of profiteering, but as excess profits duty was exacted without regard to the rate of profits realised they would probably have to pay a considerable sum which they would have been glad to conserve for meeting the needs of after-war trade. He referred last year to the power station already erected for one of the most important chemical manufacturing companies, and to negotiations then in progress for similar work on a larger scale. He was pleased to say that they had since been busily engaged on an equipment for an output of 10,000 kw., which would be larger than many of the town supply stations in this country. As every modern device was being fitted to produce economical working, he was hopeful that this station would compare favourably with any in the kingdom. Another generating set of 1,000 kw. was also being added to the earlier station. They had also been entrusted by the Admiralty with important work concerning which he might say more in the future. They were lighting aerodromes in various parts of the country, and were busy with power and lighting contracts in a number of industrial factories. Their Manchester branch had continued its prosperity, and the managers were to be congratulated on the results shown. The wholesale merchanting department, which was conducted as a separate business, had again advanced in turnover, and an important order had been obtained for electrical supplies to meet the needs of our American Allies in France. The new works were found in every respect to be an improvement on those previously occupied, and the staff were busy with switchboard work of all kinds and various war appliances. In regard to the future, he was optimistic, especially if the recommendations of the Electrical Trades Committee (on which he had the pleasure of serving) were accepted by the Government and acted upon without further delay. In the published report it was shown that an annual saving of 100 million pounds could be effected in this country if electric power was universally adopted—a sum sufficient to pay the interest on 2,000 millions of war stock. With electricity "on tap" throughout the country there must needs be a demand for the services of those who had had the necessary training and experience to show manufacturers how to utilise the current to the best advantage. In this connection they were preparing a scheme of guarantees which would relieve large users from all anxiety as to the saving they would be able to affect.

Nairobi Electric Power and Lighting Co., Ltd.—Sir A. Mayo-Robson, presiding at the annual meeting, said that the sale of current produced a trifle less revenue than in the previous year. Salaries and wages showed a considerable increase. The balance to net revenue was £8,021, as against £8,013, and seeing that they were not in a position to increase the price of their commodity, but had heavy increase in expenses, the result was satisfactory. They were still carrying on under the difficulties that all in like circumstances had been experiencing. Though the war was now happily ended, it must continue to exercise a deterrent effect upon new commercial developments for some time to come.

Amazon Telegraph Co., Ltd.—Gross revenue for year ended June 30th, 1918, £80,455; working expenses £31,598. After providing for income tax, depreciation of investments, and debenture interest, and putting £17,000 to general reserve, a dividend of 4½ per cent., less tax, is paid, carrying forward £6,842. The managing director, Mr. F. E. Nosworthy, who has been at Para and Rio de Janeiro on the company's business during the whole of the past financial year, has now returned.

Oriental Telephone & Electric Co., Ltd.—At an extraordinary meeting called for Wednesday, it was proposed to pass a resolution declaring that £1 6s. per ordinary share—being part of the moneys resulting from the conversion into money and collection of certain capital assets, and being surplus money, notwithstanding the distribution of which there will still remain assets sufficient to answer in full the whole of the liabilities and paid-up share capital—be appropriated as capital among the holders of the ordinary shares.

British Ever-Ready Co., Ltd.—Ten per cent. on the preference for the half-year ended September; interim dividend of 7½ per cent. on the ordinary.

Indian Electric Supply and Traction Co., Ltd.—Interim dividend of 2½ per cent.

STOCKS AND SHARES.

Tuesday Evening.

All markets round the Stock Exchange underwent a sharp reaction within a few days of the signing of the armistice. Free sales of stock encountered little fresh buying, and directly the downward tendency manifested itself, there came a rush to realise. On top of this, the close approach of a General Election was announced. This conjured up visions of the Labour Party showing unexpected strength at the polls, and at once affected the Home Railway stocks. It has, moreover, the invariable influence of keeping capital away from the Stock Exchange until the political excitement shall be overpast. People—investors and speculators alike—affirm their intention of keeping resources as liquid as possible for the rest of the year, and so the Stock Exchange languishes in reaction following upon the buoyancy and good business that ruled just before the armistice was signed.

Nevertheless, there are competent judges who think that the fall has already made sufficient progress to attract buyers on the look-out for cheap stock, and a turn upwards before Christmas would occasion no particular surprise.

In the minor slump that has taken place, Home Railway stocks, as already indicated, have occupied a front seat. Undergrounds suffered with the rest. The mysterious rise in Metropolitan Consolidated, which caused surprise to many of us, turns out to have no special backing, and the price came down with a run. The deferred dividend stock also gave way. Districts had their advance some weeks ago, and part of this has now been shed. The income bonds and shares of the Underground Co. have gone back materially from the best. East Londons keep tolerably steady, but the whole market is dull and heavy, in striking contrast to the brightness prevailing a week or two ago.

Electric lighting shares hold with conspicuous strength their recent gains. The market is one of the very few round the Stock Exchange that has not been touched by what the financial scribe loves to call the general malaise. In spite of the fact that electric lighting shares were put up so suddenly, further advances have occurred, and demand is still keen, although perhaps rather less eager than it was in the early days of this month. Quotations show up exceedingly well throughout the list.

In the after-war problems now under discussion, it is as fitting as it is natural that attention should turn to the question of electric power and supply. The recommendations of the Committee that was appointed to consider this many-sided

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subject have assumed a practical aspect denied them while the war was being waged. Now, they are receiving attentive consideration as coming within the pale of practical politics, and they are big with possibilities which no longer appear to be purely academic. We observe a note of anxiety in some quarter lest the development of the national scheme should profit private purses instead of being utilised for the common benefit.

South American Tramways issues are also exceptional in their resistance to the depression amongst Stock Exchange markets. So far as the Argentine companies are concerned this improvement is due to the legitimate hope of coal once more becoming available for operations. That the southern half of the American continent should be badly off for coal is somewhat astonishing, but the fact remains, and companies dependent upon coal for their working have had a thin time during the war because of the lack of ships to take it there. But now Anglo-Argentine Tramways shares are steadily advancing, and the Brazilian group has gone back, despite the favourable movements of the rate of exchange. Mexicans have again improved, and British Columbians are better.

British Westinghouse preference are flat on the proposed reduction in their dividend. Telegraph Constructions are £1 down. Other manufacturing shares keep steady. The rubber market is firm, and armaments have moved hardly at all. Marconis have again given way, in sympathy with other shares of semi-speculative character. Americans eased off to 31s., though Marines remain fairly firm at 3½. The list of cable companies' issues is quiet. Investment in these, as in high-class stocks as a whole, is checked by the political uncertainties, and also by an idea that money rates may stiffen up appreciably when the terms of the armistice are carried out, and the door is opened wide for Peace to enter.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Nov. 18, 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6⅞	+ ⅛	£7 5 6
Charing Cross Ordinary	5	4	3½	—	5 14 4
do. do. do. 4½ Pref.	4½	4½	3⅜	—	6 13 4
Chelsea	3	5	8⅛	+ ⅛	6 18 0
City of London	8	8	13½	—	5 18 6
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
County of London	7	7	11⅛	+ ⅛	6 5 7
do. do. 6 per cent. Pref.	6	6	10⅛	+ ⅛	5 18 5
Kensington Ordinary	6	7	5⅞	+ ⅛	6 7 3
London Electric	Nil	Nil	1⅜	—	Nil
do. do. 6 per cent. Pref.	4	5	4	+ ⅛	6 5 0
Metropolitan	3	4	3½	—	6 3 1
do. 4½ per cent. Pref.	4½	4½	3⅝	—	6 18 6
St. James' and Pall Mall	8	9	7⅛	+ ⅛	6 6 4
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	7⅛	+ ⅛	6 6 4
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	99	—	6 1 0
do. Def.	1½	1½	23⅜	—	6 8 6
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	15⅜	— ⅛	*5 1 7
Eastern Tel. Ord.	8	8	161½	—	*4 19 1
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 5
do. do. Pref.	6	6	10⅝	—	5 14 3
Great Northern Tel.	24	22	84	—	6 9 5
Indo-European	13	13	58½	—	5 11 0
Marconi	15	20	4½	— ⅛	4 9 0
Oriental Telephone Ord.	10	10	8½	—	2 17 2
United R. Plate Tel.	8	8	7⅞	—	*5 5 0
West India and Panama	6d.	1/3	1⅜	—	*3 12 6
Western Telegraph	8	8	16½	— ⅛	*4 15 7
Home Rails.					
Central London Ord. Assented	4	4	65½	—	6 2 2
Metropolitan	—	1	26½	—3⅜	3 15 6
do. District	Nil	Nil	24½	—2	Nil
Underground Electric Ordinary	Nil	Nil	8⅜	+ ⅛	Nil
do. do. "A"	Nil	Nil	8/9	—9d.	Nil
do. do. Income	6	4	88½	—2½	*4 10 5
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅜	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	4⅜	+ ⅛	—
do. do. 2nd Pref.	5½	—	3⅜	—	—
do. do. 5 Deb.	5	5	77½	—	6 9 0
Brazil Tractions	—	—	57	— 3	—
Bombay Electric Pref.	6	6	10⅜	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	66	— ½	7 11 5
do. do. Preferred	Nil	Nil	48½	+1	Nil
do. do. Deferred	Nil	Nil	46⅜	+1	Nil
do. do. Deb.	4½	4½	68	+1	6 17 3
Mexico Trams 5 per cent. Bonds	Nil	Nil	67	—	Nil
do. 6 per cent. Bonds	Nil	Nil	68	+2	Nil
Mexican Light Common	Nil	Nil	40	+2½	Nil
do. Pref.	Nil	Nil	50	—	Nil
do. 1st Bonds	Nil	Nil	72	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅜	—	4 2 4
British Aluminium Ord.	10	10	1⅞	—	5 12 4
British Insulated Ord.	20	20	2½	—	4 9 0
British Westinghouse Pref.	7½	7½	2⅛	+ ⅛	6 3 0
Callenders	20	25	9½	—	6 8 0
do. 5 Pref.	5	5	5½	—	—
Castner-Kellner	22	20	3⅝	—	5 10 4
Edison-Swan, "A"	—	—	⅜	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	10	1⅛	—	7 12 6
Gen. Elec. Pref.	6	6	10⅜	—	6 2 4
do. Ord.	10	10	18	—	*5 11 1
Henley	25	25	2½	—	5 11 ½
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	—	*5 14 3
Telegraph Con.	20	20	48	—1	*4 19 0

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, November 20th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£100	..
a Ammonia, Muriate (large crystal)	"	£77	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£48	..
a Copper Sulphate	"	£60	£2 dec.
a Potash, Chlorate	per lb.	1/4	..
a " Perchlorate	"	2/-	..
a Shellac	per cwt.	£17 10/-	..
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	"	£34	..
a " Lump	"	£26	..
a Soda, Chlorate	per lb.	1/1	..
a " Crystals	per ton	170/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c " Tubes (solid drawn)	"	..	..
c " Wire, basis	"	..	..
c Copper Tubes (solid drawn)	"	1/8½ to 1/9	..
g " Bars (best selected)	per ton	£161	..
g " Sheet	"	£161	..
g " Rod	"	£161	..
d " (Electrolytic) Bars	"	£137	..
d " " Sheets	"	£161	..
d " " Wire Rods	"	£145	..
d " " H.C. Wire	per lb.	1/5½	..
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/6	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	2/10	1½d. inc.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£37	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	9d. to 4/6	..
e " " " medium	"	5/- to 10/-	..
e " " " large	"	12/6 to 25-/& up.	..
d Silicium Bronze Wire	per lb.	1/10	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	..	..
n " Wire, Nos. 1 to 16	per lb.	5/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Electric Construction Co., Ltd.—Interim dividends in respect of the year ending March 31st, 1919, at the rate of 7 per cent. per annum on the preference shares, less income tax, and at the rate of 6 per cent. per annum on the ordinary shares, less tax.

Adelaide Electric Supply Co., Ltd.—Final dividend of 7 per cent., free of British income-tax, on the ordinary shares, making 12 per cent. for the year.

Melbourne Electric Supply Co., Ltd.—Final dividend of 5 per cent., free of British income-tax, on the consolidated ordinary stock, making 10 per cent. for the year.

Ministry of Munitions.—In the House of Commons on Tuesday, Mr. Kellaway, moving the second reading of the Ministry of Munitions Bill, said that in carrying out its work the Ministry had been compelled to issue orders controlling the production, supply, and the price of certain materials. Now the necessity for these orders had greatly diminished, if it had not entirely passed away, and the problem was to get back the country's industries as rapidly and effectively as possible. Whilst it was true that certain raw materials and articles were no longer immediately necessary for the purposes for which the Ministry was established, these were in urgent demand for purposes of peace production. Indeed, the demand greatly exceeded the supply. For instance, so far as building bricks were concerned, he was informed that the supply was equal to only 50 per cent. of the demand. That applied to other articles. Such being the case, unless there was some form of control the result would be chaos, and the prices charged to the consumer would be greatly in excess of those prevailing under the orders of the Ministry now in existence. The result would be that there could be no restraining of profiteering. There was no desire on the part of the Ministry to continue in existence a moment longer than was necessary in the interests of industry. There was nothing in the Bill which extended the powers of the Ministry. All it was intended to do was to enable them to bridge over the interregnum. The Bill was read a third time.

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HIGH-PRESSURE CONVERTERS.

By J. HUMPHREY.

The use of high-pressure direct current on electric railways, notably in America, has given rise to new problems in connection with the construction and operation of converters. The first 1,200- and 1,500-volt converter plants consisted of two 600- or 750-volt rotaries, connected in series, and apart from being liberally insulated did not differ from ordinary machines. Rotary converters are now built, however, for pressures up to 1,500 volts, but only for 25 and 33 cycles. When the alternating current is drawn from 60-cycle systems, as on the Chicago, Milwaukee, and St. Paul Railroad, the current is converted by means of motor-generators; but it is obviously preferable, in the interests of efficiency, to avoid the use of motor-generators if possible. With a 25 or 33-cycle supply and a track pressure of not more than 1,500 volts, conversion can be effected, and is effected, by rotary converters designed for the pressure named.

The main difficulty with machines of this sort is that of avoiding flashing over at the brushes when short-circuits occur on the line. Even ordinary 600-volt rotaries are not, of course, entirely immune from this fault; indeed, the early 600-volt rotaries were very troublesome in this respect, especially those working at a periodicity of 60 cycles. The use of commutating poles has done much to improve operation as far as sparking is concerned, and on high-voltage machines they are very essential, owing to the high voltage between commutator segments and the high commutator speeds, but commutating poles will not prevent flashing over when shorts occur in close proximity to the machines. At high loads saturation of the commutating poles and distorting influences prevent the desired commutating field being attained, and, with sudden changes of load, the changes in the field strength cannot be synchronised. The strength and distribution of the flux emanating from the commutating poles, at times of heavy overloads, do not by any means conform to the requirements necessary to obtain sparkless operation. Experiments have been conducted with a view to making the commutating field respond to rapid and severe current fluctuations, such as those which arise from bad short-circuits, and one of the most important conclusions arrived at is that when the commutating pole windings have shunts connected in parallel with them, such shunts must possess inductance as well as resistance. But, in any case, flashing over cannot be avoided, or even diminished to any appreciable extent, with the aid of commutating poles. With ordinary machines controlled with ordinary circuit-breakers, the best remedy is to avoid the use of short feeders, for it is perfectly clear that the greater the resistance of the feeder circuits the smaller will be the short-circuit currents. In many cases where car sheds have been fed in the immediate vicinity of substations, very bad flashing has been experienced when short-circuit occurred outside, but by cutting out the shortest feeders the trouble has been greatly diminished. Serious consideration has also been given to the question of introducing reactances in feeder circuits to prevent the current rising to a value greater than about ten times the normal value before the circuit-breaker opens; but a study of this matter has shown that the practice is not, as a rule, desirable, on account of the cost of the coils and the space they occupy, and, further, on account of the inductive kick, which would have a tendency to maintain an arc across the contacts of circuit-breakers. On the whole, it is preferable to limit the current by means of a resistance normally short-circuited by a quick-acting circuit-breaker, which, when it opens, first connects the resistance in series with the machine and then opens the circuit entirely. Another scheme, which does not, however, appear to have made any appreciable headway, is to make the circuit-breaker automatically insert resistance in the field circuit, so that at times of short-circuits the voltage of the machine is reduced.

Recent investigations prove conclusively that this flashing-over trouble, most pronounced in the case of machines working at high voltages, can be considerably reduced if the circuit be interrupted with a high-speed breaker. The more rapidly the breaker opens the higher may be the current, which will not cause flashing between brush spindles. Ordinary circuit-breakers are much too sluggish in their action to avoid flashing under ordinary short-circuit conditions, although, if the feeders have sufficient resistance to limit the current to the critical value, flashing over may only occur on rare occasions. Recent tests, carried out by the General Electric Co. of U.S.A., have shown that with specially constructed circuit-breakers, operating in about 0·005 of a second, 60-cycle rotaries can be short-circuited without flashing over; but in order to secure complete immunity from the trouble, under the most adverse conditions, it has been found advisable to fit the brush spindles of converters with special barriers and arc-quenching devices. If the arc formed between two commutator segments is not blown out, as they pass from under the brushes and from one set of brushes to the next, and all the following segments have similar arcs formed between them, the arc will form a short-circuit between positive and negative brush spindles, and it therefore follows that the time taken for the circuit-breaker to open should not exceed the time corresponding to one-half of a complete alternating cycle. But even with circuit-breakers capable of opening at this rapid rate a flash-over may occur owing to the vapour formed by the arc being blown across the commutator by windage or by an increase in the periodicity, when the circuit-breaker will no longer operate with the requisite speed. A circuit-breaker capable of being satisfactory in this connection must open within 0·007 of a second, in order adequately to protect converters working at ordinary periodicities, and the design of such circuit-breakers has proved a somewhat difficult task. Series blow-out coils have had to be used instead of shunt coils, because the latter will not establish the blow-out field quickly enough. The strength of the blow-out coil field, moreover, must be many times greater than that of a coil belonging to a circuit-breaker operating at normal rate, whilst the moving parts must be as light as possible, consistent with strength. Furthermore, experiments indicate that in order to avoid flashing at the converter brushes, the circuit-breakers should first insert resistance in the circuit, and afterwards completely open the circuit, but the resistance should not reduce the current to too low a value.

When a circuit-breaker completely opens the circuit in a single operation, the tendency for converters to flash over is greater than when the breaker first introduces resistance, and it has therefore been deemed advisable to make these high-speed breakers insert resistance before the circuit is finally broken. Investigations have also indicated that converter circuits can be broken at the desired rate with the aid of silver fuses; but, owing to the trouble of replacing them, the employment of high-speed breakers is preferable. The type of breaker which seems to have given the best results with high-pressure machines has two operating coils, a hold-on coil, and an opposing coil in series with the main circuit; when the current becomes excessive, as the result of a short, the ampere-turns of the series coil greatly exceed those of the hold-on coil, and the breaker flies open. High-speed circuit-breakers of this description greatly minimise the risk of rotary converters and other converters flashing over, although in the absence of barriers between brush spindles complete immunity from the trouble cannot be ensured. But if the converters are fitted with proper barriers and controlled with high-speed breakers flashing over is not likely to occur, even under the most adverse conditions; as, for instance, when short-circuits occur in close proximity to the machines. Special barriers have recently been designed with a view to dissipating the arc and so preventing it extending between brush spindles. These barriers consist of boxes made of fire-proof insulating material and fitting closely round each set of brushes, and so that there is only a very small clearance between the lower end and the commutator, whilst on the side of each box towards which the commutator rotates is a slanting fire-proof scoop, also made of insulating material. The lower end of each scoop, like the lower end of each box, is very close to the commutator, and on each scoop are mounted two metal screens, about one inch apart, one screen having a coarse mesh and other a fine mesh, the function of these screens being to act as

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arc coolers. When a short-circuit occurs, the scoops pick up the arc from the commutator and deflect it on to the metal screens, which cool and extinguish the arc, and, consequently, flashing between brush spindles is eliminated. Tests have shown conclusively that when converters are fitted with barriers and these arc-quenching screens, and are controlled with high-speed circuit-breakers, complete protection is secured, and that it is impossible to make a machine flash over, even under the most adverse conditions.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Siemens Vacuum Arrester.

We have received from Messrs. Siemens Brothers & Co., Ltd., Woolwich, London, S.E. 18, an illustrated descriptive pamphlet (V. 535) dealing with the Siemens vacuum arrester, and the following particulars will show briefly the advantages claimed of this form of arrester.

The enclosure of the opposing conductors in a partial vacuum causes them to break down reliably at about 300 volts (R.M.S. value of alternating potential), and thus all dangerous voltages are removed from the line. The vacuum is designed to carry a current sufficiently great, and of sufficient duration, to blow fuses having a capacity higher than those usually employed either in telephone or telegraph work. An insulation resistance of approximately 3,000 megohms is maintained right up to the point of breakdown. When heavy discharges occur the electrodes do not become welded together, nor have they to be renewed after discharge. This is due to the relatively large separation permitted by the use of a vacuum chamber. A damaged arrester can be immediately replaced by

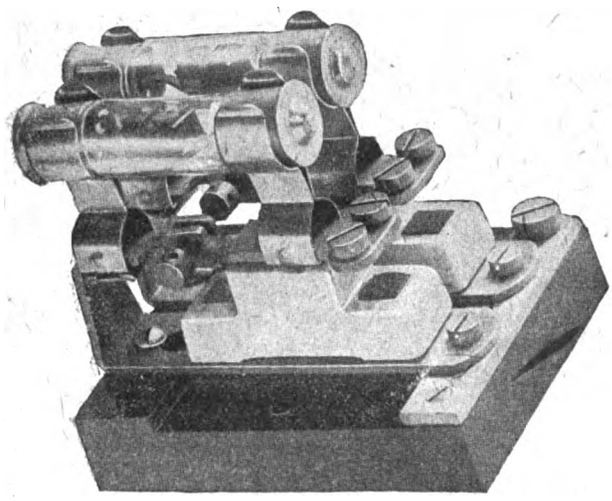


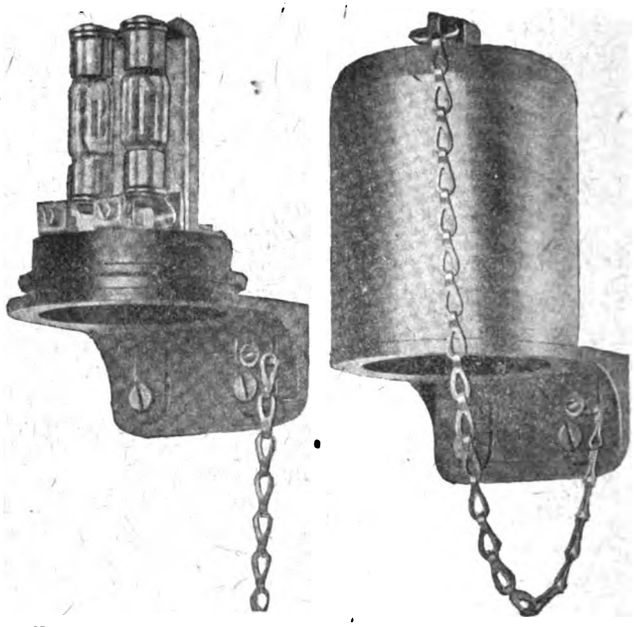
Fig 1.—Metallic-Circuit Vacuum Protector, Indoor Pattern.

withdrawing the damaged vacuum tube and inserting a new one. Being contained in a hermetically-sealed vacuum chamber, the protector, besides being highly sensitive, is also dust, damp, and insect proof.

The foregoing recital of the functions performed by the vacuum arrester has related primarily to the protection afforded to apparatus and its users against high potential discharges only, but there remains the question of damage which may result from currents of abnormal size. Protection from the latter may be guarded against by the use of fuses so proportioned as to operate when currents of more than a predetermined strength flow in the circuit. When the route of a telephone or telegraph line is one which is entirely remote from any possible contact with high-tension circuits, it is customary to use lightning arresters only, but owing to the rapid increase in electric traction, lighting and power transmission circuits, such remoteness is becoming quite exceptional, and thus it is now the general practice to install both lightning arresters and fuses in order to provide adequate protection to both the apparatus and the users of telephone and telegraph circuits.

Where both arresters and fuses are fitted, the general method of connecting the protective devices is to bring the line wires through fuses to the vacuum arresters. With this arrangement, presuming the fuses to be correctly proportioned, high potentials are removed from the lines without blowing the fuses, unless the current flowing through the circuit is in excess of the predetermined strength, in which case the fuses blow, and thereby disconnect the line. As a further precaution against "sneak currents" (*i.e.*, small currents which would not operate the fuse, but which, if allowed to flow for a considerable time, would burn out the apparatus), it is often necessary to fit a heat coil, which is then located on the apparatus side of the arrester.

Fig. 1 illustrates a suitable piece of apparatus for indoor use, and figs. 2 and 3 show the same arrangement mounted in a weather-proof case for fitting outside a building.



Figs. 2 and 3.—Metallic-Circuit Vacuum Protector, Outdoor Pattern, with and without Cover.

It is a matter of opinion whether protective devices should be fitted in weather-proof cases on the terminal pole, or whether they should be installed inside the building, as near as possible to the point of entry of the line wires. Probably the selection of position would be governed by local conditions, and the pamphlet gives particulars of apparatus designed for use in either position.

A New Distribution Pole Fixture.

There has always been a need for an economical and substantial distribution-pole fixture of neat appearance, which will firmly grip the pole without weakening it. Such a fixture has been invented and patented by F. M. Simpson, Montreal, says the *Canadian Electrical News*, and the accompanying illustration (fig. 4) shows the use of this device on concrete poles in Toronto. The fixtures or cross-arms with accommodation for insulators are made of

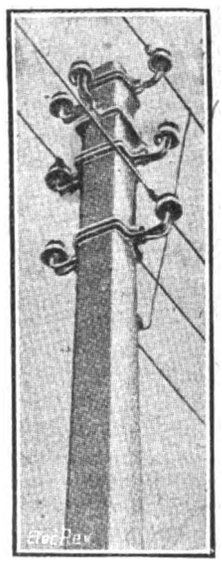


Fig. 4.—Distribution Pole, showing Fixtures.

steel channels, hot galvanised and rust-proof. The attachment portion of the arm, which is really the patented feature of the device, is in the form of an adjustable collar with the heads of the clamping bolts held by the flanges of the channel, making spring washers or lock nuts unnecessary, to prevent creeping. The use of a wrench is all that is required to make the fixture absolutely rigid. The channel sections afford sufficient spring-giving tension to meet weather conditions. The pole grip

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is especially adaptable to concrete and metal poles, as these are generally uniform in size. Its use on wooden poles makes the cutting of a gain unnecessary, as the web of the channel bites into the pole and holds the cross arm without the aid of drift bolts or coach screws. Fixtures having the same principle of pole attachment are made in several forms for two and three wire circuits, and for carrying strand wire supporting cable. The fixtures are being made in Hamilton, Canada, by the Acme Stamping and Tool Works.

Colliery Transformers.

The use of transformers in collieries having extensive underground workings, permits important economies to be realised in the cost of in-bye cables, by allowing the high-tension supply to be brought close to the working face, with consequent saving of copper. We have received from Messrs. Johnson & Phillips, Ltd, Charlton, S.E. 7, a newly published leaflet (No. T 1/47, Sept., 1918) dealing with such transformers which have been specially designed for colliery work. They are made in standard units of a convenient size, any number of which can be connected together,

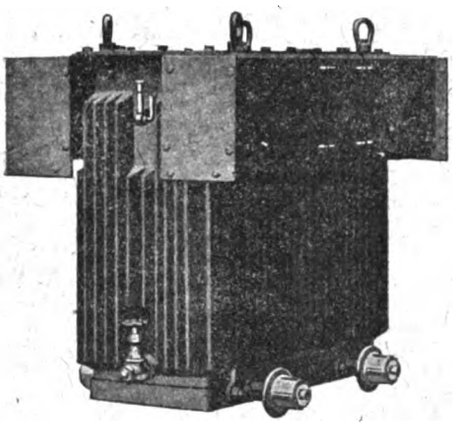

Fig. 5.—J. & P. Colliery Transformer.

for use in parallel, through the bus-bar chambers on each side, as shown in fig. 5, with covers fitted. As will be seen, they are provided with flanged wheels to run on the colliery tracks. Their portability, convenient size, and the ease of extending a working unit, render them particularly suitable for use in mines, where space and particularly head room is generally very limited. The transformers are, of course, of the oil-immersed type; oil-level gauges and draw-off cocks are fitted as shown.

Two Handy Tools.

We illustrate below (figs. 6 and 7) two handy home-made tools which we feel sure will be found useful by those who may have occasion to use such devices from time to time.

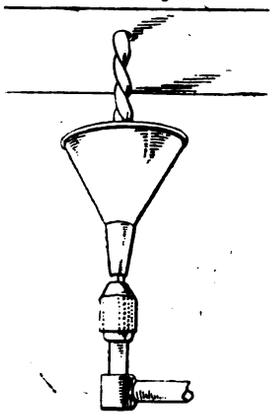

Fig. 6.—Chip Guard for Overhead Drilling.

Fig. 7.—Hand Device for Bending Pipe or Conduit.

Both devices are quite simple and easy to make, the illustrations both being self-explanatory. Referring to fig. 7, it may be mentioned that the wheel is slightly grooved to prevent slipping sideways.—*Power.*

Ellison's Motor-Ampere Calculator.

We have received from Messrs. Geo. Ellison, 25, Victoria Street, Westminster, a device which is intended to save time in connection with the installation of electric motors. We have grown accustomed to talking of the use of electric power in industry, and we are apt to overlook that in every instance the motors have to be handled by the electrical-power contractor, who, in addition to fixing the motor, must also arrange the correct size of the cable with which to supply it. The Ellison ampere-calculator is intended to relieve them of the trouble of constantly working out the current required for the motors they are installing and the nearest size of cable suitable for use in connecting up with the power circuit. The calculator is simplicity itself. It comprises a chart which reads in horse-power up to 100 and in amperes up to 200. The horse-power is read off in vertical lines and the amperes in horizontal lines. The centre of the chart is occupied by four arcs reading in voltages from 1 to 600 one-phase D.C., two-phase, and three-phase circuits respectively. Pivoted at the left-hand bottom corner is a narrow strip of celluloid, which sweeps over the whole of the diagram and which can be moved so that its left-hand edge, when placed against the voltage of the motor, gives a reading of the amperes where it intercepts the horse-power line. At the left-hand of the chart is a column containing figures which give the nearest standard V.I.R. cable, S.W.G., I.E.E., rating to the current shown in the column immediately adjoining. The calculator measures 14 in. deep by 12 in. wide, and can either be hung on the wall or stood on the desk. It is finished in best washable gelatine and has every appearance of being built to withstand hard usage.

THE INDUSTRIAL DEVELOPMENT OF INDIA.

This was the subject of an address delivered to the members of the Eighty Club by Mr. Alfred Dickinson, M.Inst.C.E., of which we have received a copy, profusely illustrated with excellent reproductions of views of the Tata Hydro-electric Power Supply Undertaking which were shown at the meeting. The installation was described in our issues of May 7th and 14th, 1915. Mr. Dickinson stated that if this country was to participate in the development of the industries of India, it must be understood that India's political sentiment and commercial intelligence were such that the Indian was willing to join us in partnership, but would not accept us in a higher capacity. We must be prepared to be fellow-workers and friends, and we must not be more modest about our good qualities than our competitors were in their claims. It was absolutely essential to raise the status of the working population, and labour honestly rendered should be encouraged by being honestly paid for. The development of any civilised country must perforce be carried out by the men of the country; future development, therefore, very largely depended on the treatment meted out to the Indian business man by the Government official. Cheap power supply was one of the important essentials in the development of industry.

Mr. Dickinson then described the Tata hydroelectric scheme, which differed from all other such projects in that the valleys in which vast quantities of water were now stored were, before the construction of the dams, dry valleys; three lakes had been created, having a surface area of 5,700 acres. The success of the scheme was due to the natural features of the district, which not only provided these capacious valleys for storage, but also a site for a forebay 1,735 ft. above the valley in which the power house was built, and requiring a pipe line only 2½ miles long. The station was designed for 108,000 H.P., of which 67,500 H.P. was at work. The power was transmitted to Bombay, 43 miles, at 100,000 volts. So satisfactory had been the supply afforded by this undertaking that a similar plant was being installed in the same district, the Andhra Valley Power Supply, and contracts had been entered into for 50,000 H.P. at ½d. per unit.

The necessity for cheap power was as pressing here as in India or any other country. So long as the present restrictions remained it would be impossible to give the consumer really cheap power. The generation of electrical energy in the future must be on a vastly larger scale than in the past, and its production would form only part of a multiplicity of processes—more in the nature of a by-product than a main product. In order to secure this, the producer of the future must become a general manufacturer, producing many chemical combinations, such as fertilisers, dyes, disinfectants, medicines, oils, &c. He might even become a producer of steel and other metals.

Reverting to the development of India, Mr. Dickinson urged that the Government should undertake a complete investigation of the possible sources of water power in that country, making the information available for public use. As the result of investigations made at the expense of Messrs. Tata, Sons & Co., Bombay, it could now be demonstrated that by damming a valley in the Western Ghats, water from the Koyna River could be stored so as to provide about 300,000 H.P. continuously, on sound commercial lines. This, in his opinion, was a discovery of the highest importance to the whole of the East; it was equivalent to supplying to industries during the normal working hours of 3,600 per annum no less than 730,000 H.P., at, say, ½d. per H.P.-hour. This should give to India the greatest industrial impulse she was ever likely to receive from any single discovery.

The price of coal throughout the world was rising faster than the interest on capital, tending to reduce the disparity in capital cost between water-power and steam-power.

The output of the Tata Iron & Steel Works, since its opening in 1912, had grown to 200,000 tons per annum, and extensions now in hand would raise the output capacity to 1,000,000 tons. There had been in Great Britain a great want of appreciation of the possibilities of industrial development in India; but the educated Indian realised those possibilities. An Industrial Bank had been established to finance existing and new industries, with a

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capital of £8,000,000, and should prove of the greatest possible service to Indian industrial development. During the war American and Japanese manufacturers had made rapid strides towards securing for their products the Indian market. Since impartial British rule had so stabilised the country as to make it practicable for its industrial resources now to be developed, it was surely not asking from the Indian too much in return that he should give preferential treatment to British manufacturers.

In a paper read before the Institution of Civil Engineers on Tuesday last, Mr. R. B. Joyner, C.I.E., M.Inst.C.E., described the Tata hydro-electric works, with special reference to the hydraulic features of the undertaking. The works described take advantage of the very heavy rainfall on the precipitous edge of the Western Ghats, about 2,000 feet above, and about 40 miles from, Bombay. As the rain falls only during three or four months of the year, and the water-courses are dry all the rest of the year, it was necessary to store water sufficient to give about 100,000 H.P. for ten or twelve hours a day during about nine months of the year. The combined available capacities of the storage lakes are about 10,100 million cubic feet, whilst the water required to give 100,000 H.P. ex turbines for nine months, allowing for the great loss by evaporation and by soakage, and for friction in the pipes and turbines, is 6,700 million cubic feet. The excess capacity is given owing to the very variable amounts of the monsoon rains, so as to carry on the balances in years of excessive rainfall to make up for the occasional short monsoons.

The works are notable for the following reasons: They are the largest of the many similar hydro-electric works which have been constructed during the past 10 or 20 years, taking into consideration the great head used, combined with the large discharge of water. The first is equal to about five times the height of St. Paul's Cross, and the latter is greater than the summer flow of the river Thames during five months. They are also the first works to store water for power use during about three-fourths of the year. One of the masonry dams, taking the exposed face area, is probably the largest yet constructed. The works are probably unique, considering the very heavy rainfall and the very steep rocky slopes, giving the greatest discharge perhaps ever recorded. The catchment-area of the two lakes is only 16½ square miles, while of this the full lake area is about 7½ square miles.

The works described are the first to be undertaken of a number of similar works proposed by the author, he having shown that it is financially possible in India to store water for use during eight or nine months of the year, and give power at a much cheaper cost than by the use of coal, oil, or spirit from vegetable products; likewise cheaper than power from the wind, sun, or tides. Not only that, but the water after use is available for irrigation, so valuable in a country without a drop of rain for a large part of the year. This would ensure the growth of the raw materials required for finished products for which the country is now so dependent upon other countries. It would also supply the factory workers or others with food and drink, and help to prevent famines, besides doing much to regularise the rainfall. Such power would provide electric traction for raw materials to, and finished products from, the factories, as well as light for them and neighbouring towns, produce fertilisers, and give the great heat required for the smelting of ores. Many industries would then be self-contained, and India could compete with Europe, America, or Japan for its finished products, and would become less dependent upon its agriculture, which the varying seasons render somewhat capricious.

Mr. Joyner was the designer of the work, and as hydraulic consulting engineer superintended the construction; Mr. Alfred Dickinson, M.Inst.C.E., was the general consulting engineer for the undertaking, including the electrical work, and Mr. B. D. Richards, B.Sc., M.Inst.C.E., was the resident engineer.

The total cost of the work described in the paper will be £942,000 when complete, in addition to the cost of land, engineering, administration, &c.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

17,985. "Securing an electro-deposited tip on a propeller blade." R. H. Bunkitt. November 4th.

17,995. "Detection of varying magnetic field." F. O. Hunt. November 4th.

18,011. "Vacuum breakers for liquid condensers." British Westinghouse Electric & Manufacturing Co. November 4th. (U.S.A., November 6th, 1917.)

18,013. "Removable electric fuse carriers." W. T. Henley's Telegraph Works Co. & W. H. Nicholls. November 4th.

18,025. "Magneto-electric ignition machines." Scintilla. November 4th. (Germany, November 2nd, 1917.)

18,033. "Telephone transmitters." A. McNally. November 4th.

18,044. "Ignition devices for internal-combustion engines." C. Weiss. November 4th.

18,046. "Telegraphy." T. B. Dixon. November 4th. (U.S.A., November 3rd, 1917.)

18,048. "Frictionless electric switch." G. N. de Seyssel. November 4th.

18,051 "Dynamo-electric machines." H. F. Joel. November 4th.

18,054. "Electric snap switches." Edison Swan Electric Co. & F. Sherrold. November 4th.

18,069. "Electrical meter controllers." W. F. Stamp. November 4th.

18,070 "Electromagnetic wave-transmission and reception arrangements." P. P. Eckersley. November 4th.

18,071-2. "Electromagnetic wave-transmitting and receiving systems." P. P. Eckersley. November 4th.

18,073. "Electromagnetic wave-transmitting and receiving systems." P. P. Eckersley & R. Whiddington. November 4th.

18,074. "Electromagnetic wave navigational systems." J. Robinson. November 4th.

18,075. "Electromagnetic wave navigational arrangements." J. Robinson. November 4th.

18,076. "Electromagnetic wave navigational arrangements." J. Murray and J. Robinson. November 4th.

18,077. "Electromagnetic wave-reception arrangements." J. Robinson. November 4th.

18,078. "Electromagnetic wave-signalling systems." N. Lea. November 4th.

18,079. "Electrical socket connections." H. J. Pool. November 4th.

18,080. "Braided electrical conductors." R. Whiddington. November 4th.

18,081. "Electromagnetic wave-signalling systems." R. Whiddington. November 4th.

18,082. "Electromagnetic transmission of sound." R. Whiddington. November 4th.

18,084. "Vibrating contacts." A. J. Roberts. November 4th.

18,086. "Electrical ignition for internal-combustion engines." W. Pickard. November 5th.

18,088. "Electrical signalling systems for motor vehicles." Nailik Motor Signal Co. & J. P. Ogden. November 5th.

18,089. "Magneto ignition machines, and mechanism for driving same." F. H. Bramley. November 5th.

18,101. "Electric concertina-accordion." N. W., M. Holt. November 5th.

18,108 "Aeronautical dynamos." G. E. Mortley. November 5th.

18,115. "Magnetic devices for drawing cog in mesh on electric machines." R. H. Lane. November 5th.

18,135. "Electrolysis of chlorides of alkaline metals." Norsk Alkali Aktieselskabet. November 5th. (Norway, December 13th, 1917.)

18,146. "Sparking plugs and their manufacture." K. E. L. Guinness. November 5th.

18,154. "Renewable filament and standard electric incandescent lamp." L. P. Morinan & A. B. Whitefield. November 6th.

18,155. "Self-cleaning sparking plug." A. W. Nicholas. November 6th.

18,207-8. "Rotating magnets of magneto-electric ignition apparatus." Scintilla. November 6th. (Germany, November 6th, 1917.)

18,209. "Dynamo-electric machines." Enclosed Motor Co. & P. A. H. Mossay. November 6th.

18,212. "Electric lampholders." H. Mansell. November 6th.

18,216. "Equitable cyclic distribution of monophase charge at phases of polyphase feed circuit." F. B. Bassanesi & U. Magini. November 6th.

18,249. "Ignition magnetos for internal-combustion engines." H. W. F. Ireland & H. Lucas. November 7th.

18,252. "Protection of alternating-current electrical machinery." E. P. Hollis. November 7th.

18,259. "Radio-telephonic apparatus." M. Latour. November 7th. (France, November 30th, 1916.)

18,306. "Spark-obtaining means for internal-combustion engines." H. Bowker, W. H. Marston & S. H. Sershall. November 8th.

18,319. "Means for indicating position of buttons of electric bells or switches." H. D. Hakben. November 8th.

18,321. "Automatic regulating systems for dynamo-electric machines." British Thomson-Houston Co. (General Electric Co., U.S.A.) November 8th.

18,338. "Switch-type incandescent lampholders." N. Collins. November 8th.

18,339. "Electrodes." J. H. Garbett. November 8th.

18,353. "Collection of electric current by electrically-propelled vehicles from overhead conductors." E. M. Munro. November 9th.

18,358. "X-ray photography." G. S. Whitefield. November 9th.

18,370. "Renewal of filaments in metal-filament electric lamps." S. Coxon & W. A. Williams. November 9th.

18,395. "Telephone receivers." S. G. Brown. November 9th.

18,396. "Electrical welding." T. E. Murray. November 9th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

10,106. Ignition magnetos for four-cylinder internal-combustion engines. R. A. Persin & H. A. Lefevre. July 12th, 1916. (108,476.)

13,637. Method of and means for electrically producing a gas suitable for use in internal-combustion engines and for other purposes. T. McClelland. September 24th, 1917. (119,885.)

14,908. Electromagnetic friction brakes more especially intended for the driving and change-speed gear of motor road vehicles. G. Pollard and Menco-Elma Syndicate. October 15th, 1917. (119,897.)

14,999. Protective devices for electrical cables or cable networks. F. F. P. Bisacre and Metz & McLellan. October 16th, 1917. (119,906.)

15,556. Guards for electric heat radiators, gas fires, and the like. A. F. Berry. October 25th, 1917. (119,922.)

15,932. Incandescent electric lamps. R. Butler. November 2nd, 1917. (119,928.)

16,286. Terminal connectors for electrical conductors. O. Zimmerman. November 7th, 1917. (119,932.)

16,516. Jointed arms or brackets for carrying incandescent electric lamps or incandescent gas lamps. H. C. Tofield. November 10th, 1917. (Cognate application 7,356/18.) (119,934.)

16,708. Protective devices for alternating-current electric systems. A. E. McColl. November 14th, 1917. (Patent of addition not granted.) (119,937.)

16,727. Apparatus for filling receptacles with liquid. H. Dean and Chloride Electrical Storage Co. November 14th, 1917. (119,938.)

16,892. Illuminating devices. British Thomson-Houston Co. & H. C. Wheat. November 16th, 1917. (119,939.)

17,224. Dynamo-electric machines. H. Lucas, C. L. Breeden & H. L. Cape. November 22nd, 1917. (119,942.)

1918.

79. Arrangements for securing electric contact in overhead trolleys for tramcars and other electrically-driven vehicles. A. C. Franklin. July 2nd, 1918. (119,958.)

395. Sparking plugs and the like, such as used for igniting gaseous matter in combustible engines. G. H. Ward. January 8th, 1918. (119,962.)

809. Electric welding systems. British Thomson-Houston Co. (General Electric Co., U.S.A.) January 14th, 1918. (119,780.)

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THE

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NATIONAL ELECTRICITY SUPPLY.

THE proposals for the organisation of electricity supply on a national basis have been brought into the forefront by the references to this subject in the election addresses of the Prime Minister and Mr. Churchill; in our last issue we published figures issued by the Ministry of Munitions, showing the enormous increase in the output of electrical energy during the war, and in the capacity of the generating plant installed, and there is good reason for believing that the demand will continue to increase at a rapid rate. It is evident, therefore, that the formulation of a definite policy in this matter is a question of the utmost urgency, and it is to be regretted that, owing to the approaching election, it will not be possible to make any material progress with the scheme before next year. However, there is no reason why preparations should not be made in advance by the departments chiefly concerned, so that no avoidable delay shall be incurred when the time comes for Parliamentary action. The longer the matter is allowed to drift, the more difficult it will be to devise a satisfactory scheme and to remedy the defects of the existing system—or, rather, lack of system; moreover, it is desirable that definite orders for new plant shall be placed as soon as possible, not only in order that the plant may be put in operation at the earliest moment, but also to enable manufacturers to maintain and increase their production so as to provide employment for their present workpeople and those who will soon be released from their military duties.

In this connection we draw attention to the statement adopted by a number of municipalities in the North-Eastern area, an abstract of which appears elsewhere in this issue. This statement was referred to at a recent meeting, but could not be included in our report, as it had not then been submitted to the Government Departments concerned; it will be noted that while the signatories include several important local authorities, there are some notable abstentions, including Sunderland and Darlington.

While the municipalities which subscribe to this statement nominally accept the main principle of the national scheme, it is but lip-service; apparently they accept it on the condition that it leaves them where they are, and hamstrings the North-East Coast companies, towards whom the statement is instinct with jealousy and suspicion. In fact, the statement revives in the acutest form the old animosity displayed by municipalities towards companies, which elsewhere has been dying out; it exhibits the parochial spirit in its narrowest phase, and is wholly out of sympathy with the broad national view of the question which is set forth in the report of the Board of Trade Committee. Let it be granted that in the undisguised partiality of the Coal Conservation Report for company control—a most regrettable indiscretion—municipalities generally have just ground for complaint, while in the laudation of the Tyneside companies' efficiency the North-Eastern municipalities in particular see King Charles's head: after making due allowance for the influence of these factors, the residue of the statement still savours of the parish pump. Instead of a small and efficient body of five expert Commissioners, these municipalities advocate "a sufficiency of members of independent judgment and general experience," presumably another of those debating societies of which we have already far too many; the delimitation of electrical districts and the constitution of District Boards are similarly to be settled "by direct Parliamentary action after preliminary local inquiries"—the old circumlocution system, therefore, to be perpetuated; existing stations are to be free to extend their plant *ad lib.*—a condition fatal to the national scheme; municipalities are

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to be allowed to make profits—a principle which Parliament long ago set its face against; no relaxation of the rating system or of the municipal veto on overhead mains is to be admitted. Thus these municipalities, situated in an area where private enterprise and initiative have had free play in expanding the use of electricity and utilising waste heat, to the great advantage of the residents in the district (the worst that they can say of the service is that the charges of the supply companies "approximate very closely to those of comparable municipal undertakings"), stand fast for the old and discredited fads of the beginning of the century, and close their eyes to the lessons of the war and the fact that the times have changed, though they have not. They do condescend to express approval of one item in the Power Supply Committee's report—the recommendation that, in the national interest, generating stations and main transmission lines should, as a general rule, be publicly owned—but they tack on to their avowal a proposal that companies generating electricity should have no representation whatever on the District Electricity Boards!

We hold no brief for either side; there should, indeed, be no "sides" in this matter, and our sole aim is to promote the best interests of the nation as a whole. That to perpetuate the existing system would be to invite disaster is generally agreed, even amongst municipal authorities—as was abundantly proved at the Conferences of the I.M.E.A. and the M.T.A. this year. But all this rhetorical declamation against companies and so-called "trusts" emphatically does not make for the public welfare; it reveals a pitifully narrow-minded spirit, and an utter inability to take a long view of this extremely important subject. That the proposals of the Board of Trade Committee are open to improvement in many respects is beyond question; but no good will be done by adopting the policy outlined in this reactionary statement.

The Coming Election.

In ordinary times this Journal has nothing to do with Politics, as that word is generally understood. But we are not living in ordinary times. In our opinion, there never has been a time when a General Election was fraught with greater possibilities for good or evil, for security or for chaos, than is that which is to be fought next month. We stand with those who are utterly sick of the Party spirit in government, and who hold that nothing is more essential for the well-being of the nation as a whole than united action for "the furtherance of the general good." We do not say this simply because we believe in either Mr. Lloyd George or Mr. Bonar Law, though we hold that without their co-operative leadership the war might have been lost to the Allies; we say it because it is necessary to have stability at the helm during what will be a vital period—indeed, a great crisis. In the manifesto which the leaders of the Coalition have issued—we observe that it is not signed by Labour representatives, presumably because Labour has by vote withdrawn them—it is stated, and surely there will be few to disagree, that the tasks directly arising out of the war "can only be surmounted by the good sense, the patriotism, and the forbearance of our people." "The unity of the nation . . . must not be relaxed if the many anxious problems . . . are to be handled with insight, courage, and promptitude" for the "furtherance of the general good." It may be possible to reduce the burden of armaments and to release, "by successive and progressive stages," the Labour and Capital of the Empire for the arts of peace. The Coalition will endeavour to further a fruitful mutual understanding between the associated peoples. Profiting by the experience of war it recognises, as industrial experts have long done, that increased production must necessarily be the basis of all schemes for the improvement of the conditions of the people. It upbraids us for our past lack of organisation or wasteful organisation, and we need not inquire now how far the culpability in that connection lies at the door of the politician. It desires to promote scientific farming in the interests of food production, and we trust that it will not cold-shoulder those who advocate electrical methods. It is pledged by this manifesto systematically to improve the transport facilities of the agricultural areas, a matter so often discussed by those who long ago saw the need for light railways. It considers it premature to prescribe a permanent fiscal policy until the country has returned to normal industrial conditions, but it recognises that one of the lessons most clearly taught by the war is the danger of being dependent upon other countries for vital supplies on which the life of the nation may depend. "It is the intention, therefore, of the Government to preserve and sustain, where necessary, these key industries in the way which experience and examination may prove to be best adapted for the purpose." Further, "if production is to be maintained at the highest limit at home security must be given against the unfair competition to which our industries may be subjected by the dumping of goods produced abroad and sold on our market below the actual cost of production." It promises the liberation of industry from Government control at the earliest possible moment. Other measures promised are "the development and control in the best interests of the State of the economical production of power and light and of the railways and the means of communication. An improvement of the Consular Service is foreshadowed, and the establishment of regular machinery for "consultation with representative trade and industrial organisations on matters affecting their interest and prosperity." In these ways output will be increased, new markets opened out, and great economies effected in industrial production. There are many other matters covered in the manifesto, but the points we have selected commend themselves to us as a journal concerned with the stability and development of British industry and anxious for the well-being of all who engage therein.

Merited Recognition.

The *argumentum ad hominem* may be the hoariest of fallacies, but its logical shortcomings have not prevented its being a determining factor in many an argumentative bout. In actual practical affairs, too, the "personal factor" is often by no means negligible. Even if matters be of the weightiest, the personal element can be trusted to crop up somewhere or other. We are reminded of this by a suggestion in the Board of Trade Electric Power Committee's Report. The wise provision in question runs as follows:—

> **Although under our proposals and the development which may be expected to flow from them, there should be new and improved openings for engineers and other officials, we think provision should be made by which District Electricity Boards may provide compensation for displaced engineers and other officials in cases of hardship.**

This cash payment by way of compensation for loss of office is just and right. But the electric supply industry is in a specially unique position, and a glance at the facts will, perhaps, suggest that certain of the engineers and others displaced by the new scheme merit a recognition that is hardly satisfied by cash alone. The unique position of the industry at the moment rests on the fact that the industry itself has been practically contemporary with the engineers and others who are now in charge of the undertakings—the industry and themselves having started life together, so to speak. This means that the development of the industry from its elementary stage, some 30 years ago, to its present assured position among the industries, is, in a great measure, due to their initiative and guidance. They have a connection and tie more intimate than a purely monetary one. There is, therefore, a certain amount of call for permanent recognition of such services, and a particularly fitting opportunity will occur when the Board of Trade scheme is put into operation. There are certain of the new Orders or Honours which have recently been constituted which might very fittingly be bestowed in this direction, as marking services rendered in developing scientifically, practically, and financially what has proved itself to be a "key," or even more than a "key," industry. If we regard the most important development of the industry as taking place, say, from 1900 or thereabouts, when the bulk of Provisional Orders were being granted, we shall find that a large proportion of the important company engineers or managers have had control of their undertakings from about that time.

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The same applies proportionately to the leading municipal engineers, although in some cases here, perhaps, the engineer has changed from one undertaking to another during this period; but this, of course, does not affect the case. Returning, therefore, to the "personal factor" which we have already mentioned, it would certainly appear that the whole atmosphere which the Board of Trade scheme will bring about will be felt by all parties concerned to be the more genial if it is known that the Government is entering into negotiations in a friendly and appreciative mood towards those who have borne the "burden and heat of the day," rather than that it will come along in the *rôle* of a willy-nilly autocrat, a procedure which, in the circumstances, the scattering of largesse will not deprive of acerbity.

Work-Producing Schemes.

In pre-war years the months of November and December were a period of great activity in the depositing of Private Bills for Parliamentary consideration. Promoters had their schemes well in mind long before that time, of course, but after allowing for a fair percentage of the proposals to fall through, or to be turned down on various grounds, one could generally gauge from the lists that appeared in the *London Gazette* the probable effect upon certain departments of industry a little later. No doubt many public authorities already know what they want to do, and private parties, too, have numerous projects waiting which had to be deferred until the end of the war was at hand. If the works which have been held up can be proceeded with in a short time, they should greatly assist the nation in the work of industrial reconstruction. There is a vast amount of work in arrears for the execution of which no Parliamentary powers will be needed, but in respect of others to which this does not apply, the Chairman of Committees in the House of Lords is prepared to give them favourable consideration, though the time is later than usual. It is intimated in the *Times* that he will adopt this course in respect of late Private Bills, that is, Bills not deposited in December in accordance with Standing Orders, "for which urgency can be claimed owing to the Armistice and the prospect of Peace." Those who are directly interested in this matter should make application early in the new Parliament for leave to introduce their Bills, thus giving due time for their consideration.

The Patent Laws.

In this issue we conclude a full abstract of the report of a Committee appointed by the Council of the I.E.E. to consider the Bill introduced into Parliament by the Board of Trade to amend the Patent Laws. The Committee is to be congratulated on the striking success of its labours, in that the report was accepted almost in its entirety as embodying the views of the bulk of the scientific and engineering world, and its recommendations, communicated to the Board of Trade last month by a representative deputation, will consequently carry far greater weight with the authorities than a collection of reports submitted by individual societies, and, naturally, lacking the elements of co-ordination and cohesion. Our law-makers, unfortunately, look upon such questions from a point of view far removed from that of the industrial world, and it is exceedingly difficult to induce them to take effective action in the direction of the reforms that are so urgently needed; but we hope that, with this powerful lever, it will be possible to obtain at least a fair proportion of the amendments which were put forward by the deputation from the technical conference.

In March last we commented on the terms of the Patent Bill, which was then apparently about to come before Parliament, though subsequent events prevented its consideration; we are pleased to note that practically all the suggestions we then advanced are closely in harmony with those which are discussed, of course, at far greater length in the report. In view of the extent and variety of the changes that are called for, it was, perhaps, not wholly a matter for regret that the Bill made no further progress, and that the way is open for an entirely new and much better Bill to be drawn up. But a regrettable loss of time has been incurred, and we hope that the Board of Trade will see to it that the new Bill is introduced—and carried through—as quickly as possible, for British industry urgently needs every assistance that can be afforded to it, and the sooner the gates are opened wide for the encouragement of invention, the better will be our prospects of developing our industries of all kinds.

Amongst the leading features of the report are the demand for a prolongation of the lives of patents, equal to the dead period of the war; the recommendation that revocation on the ground of non-working shall be abolished, the provision for the granting of compulsory licences being improved; that the restrictions on patenting articles in connection with food, surgery, &c., which obviously would be a bar to progress, shall be cut out of the Bill; that the term of a patent shall be increased to 16 years, and that the periods of provisional protection and for accepting the complete specification after filing shall be extended—a very desirable reform; that the interests of the patentee shall be protected as against the Crown; that the renewal fees shall be reduced from their present excessive values by 50 per cent., to a total of £47 10s., with further reductions to follow if the revenue of the Patent Office still shows a large surplus; and that a new tribunal be set up to deal exclusively with patent cases. With all these proposals we cordially agree, though in some respects we would go further than the Committee.

One omission we note—there appears to be no reference to the desirability of instituting similar or identical rules and procedure throughout the Empire. But this is obviously not a matter that can be dealt with in a Bill. Let us first set in order our own procedure; afterwards the adoption of a homogeneous Imperial patent system may become the subject of negotiation with the Dominion authorities. That an inventor who desires to protect his inventions throughout the united British Empire should have to take out—and pay for—some 40 patents is an anomaly of which the absurdity is manifest.

Transport Facilities.

The report of the Select Committee on Transport, which has just been issued, is a document of exceptional interest, in view of the conditions which have obtained in this connection during the past four years. Under the stress of a national emergency, the whole of our internal transport facilities have been brought under State control, and have been administered by boards of experts dealing respectively with railways, canals, and roads. The result has been, says the Committee, that our railway service has been more successful than that of any other belligerent country, and has dealt efficiently with an enormous volume of traffic, while the canals have been enabled to render great assistance to the railways. We give an abstract of the report elsewhere in this issue, from which it will be seen that the keynote of its contents is *unity of control*. Whether this be exercised by the State or by a large joint-stock concern owning the railways is considered of little consequence; "the essential conditions are that there should be single ownership and single management."

Although, as the report shows, this conclusion has been put forward by various bodies which have previously inquired into the subject, it has never carried anything like the force that it does now. The experiment has been tried, public opinion has set strongly towards State intervention in this and other departments of the public service, and the time is approaching when momentous decisions will have to be formed as to future policy. We have never felt favourably disposed towards State ownership of the public services, in view of the abundant proofs of the fact that it invariably leads to loss of efficiency and economy; but we have fully recognised the advantages of unity of control, whether the subject be telegraphs, telephones, railways, electricity supply, or any other public service, and, as the Committee points out, the tendency in this direction is to be observed in all branches of industry. The question is too big to be discussed in the few lines at our disposal; but we think it desirable that the position should be clearly appreciated and considered by our readers.

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A SPANISH HYDRO-ELECTRIC UNDERTAKING.

[From our Special Correspondent in Spain.]

It requires no little courage to establish hydro-electric plant in a coal-mining district, to transmit energy over 50 miles, and yet hope to compete with steam-driven plant during wartime in the north of Spain, but such audacity is now showing successful results. The company "Saltos de Agua de Somiedo" (founded with local capital) has just published an account of the installation and starting-up of its central station.

The ideal of the company is to regulate the flow of the rivers El Valle and Saliencia (province of Asturias) by means of dams, and to obtain two waterfalls of 582 and 245 metres head respectively, giving approximately 20,000 H.P., and driving six Pelton wheels of 3,300 H.P. each. The six wheels are to be placed in one power-house, three-phase energy being transmitted to Oviedo, 46 kilometres distant, and to Gijón, 71 kilometres, at a pressure of 53,000 volts. It has not been possible to install this scheme in its entirety, but two turbo-generator sets of 3,300 H.P. each have already been put in operation, and are now working successfully.

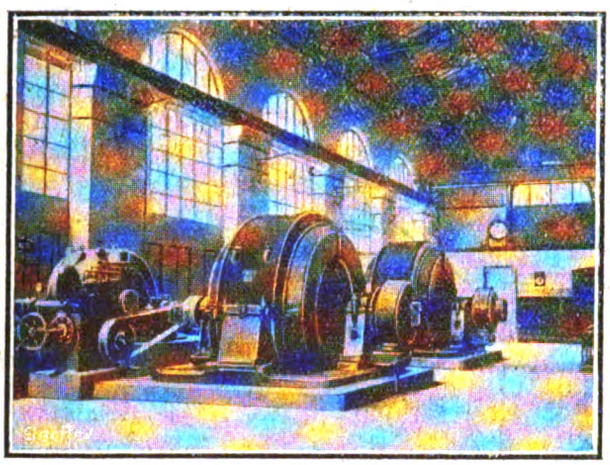

FIG. 1.—INTERIOR OF POWER HOUSE SHOWING ALTERNATORS.

FIG. 2.—EL VALLE DAM.

The Asturian mountains give rapid falls, and rains are more abundant in the province than in any other part of Spain—about 50 in. per annum. Otherwise hydro-electric energy, transmitted over long distances, could not hope to compete with thermal stations situated at the pit's mouth. The watershed covers an area of about 50,000 square kilometres, and, in addition, there is an influx of underground waters from the neighbouring province of León. The river El Valle falls 1 kilometre in 11, and the river Saliencia 1 in 14, near the site of the power house. The question of water supply has received very close attention there, there being data available and records taken since 1851, and special measurements since 1909, all of which showed greatly in favour of a hydraulic plant, as against steam power.

The first work undertaken by the company—the building of the El Valle dam (fig. 2)—took place under very severe conditions, the country being so rough and mountainous that the pioneers often worked at the risk of their lives. It was necessary to build houses for workmen in desolate and almost inaccessible places. There were no roads. These had to be made before serious work could be started, and all supplies, light and heavy, had to be transported over 60 kilometres, most of it very rough travelling. The works completed up to the date of the report are the dam and pool on the river El Valle, and various canals and pipe-lines between the river and the power house. Also, the power house building is completed.

One pipe-line of Siemens-Martin steel-plate tube is installed. This pipe has a diameter of 800 mm. where it leaves the pool, which is reduced to 650, 600, and 550 mm. respectively in the first, second, and third parts of its length. The thickness of the plate varies from 6 mm. to 21 mm.

This piping was supplied by the Mannesmann Tube Works, Düsseldorf. The contract for manufacture and erecting was signed in March, 1914. Owing to the war there were difficulties in getting the piping made and delivered, but the company persevered, and in May, 1916, the piping arrived at a Spanish port. The writers of the report naïvely say, "The receipt of the piping can be considered as a miracle, worthy of being recorded."

FIG. 3.—POWER HOUSE AND SURROUNDINGS.

The two water-turbines now installed (fig. 1) are of the Pelton-wheel type, and were constructed and supplied by Escher Wyss, of Zurich. Each wheel is operated by a single jet, with needle regulation and jet deflector, controlled by a "Universal" governor. The turbines are built to develop 3,228 H.P. each, with an effective head of 550 metres and a consumption of 550 litres of water per second. (A head of 550 metres is roughly equivalent to a pressure of 770 lb. per sq. in.) The manufacturers guaranteed

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a minimum efficiency of 81 per cent. at full load, 82 per cent. and 78 per cent. at three-quarter and half load respectively. The contract for the supply of these two turbines was signed in February, 1914, and delivery was promised within 12 months. In spite of the war, the machinery was only a few weeks late.

All the electrical material in the central station was supplied by the Spanish branch of the Brown, Boveri Co. Its principal components are:—2 alternators and exciters, 2 step-up transformers, switchboards and accessories, and line-protective devices. The two alternators (fig. 1) are each capable of developing 2,260 KW. at a power factor of 0.7, and are rated at 3,230 K.V.A. Current is 3-phase, 50 periods, at a pressure of 5,300 volts. The exciter is mounted on an extension of the generator shaft. Bearings are automatic-oiling and water cooled. The generators are rigidly coupled to the turbine shafts. The overall efficiencies guaranteed by the makers are:—

	Full load.	Half load.
At unity power factor ...	95.5 p.c.	93 p.c.
At 0.7 power factor ...	93.0 p.c.	90 p.c.

The maximum excitation absorbs 27.5 KW. at 110 volts. The machines can sustain a momentary overspeed up to 1,080 R.P.M. (80 per cent. above normal) without danger.

The two step-up transformers, 5,300/53,000 volts, are each of 3,150 K.V.A. capacity. They are oil-immersed, and the oil is cooled by being continually pumped through a coil submerged in a small canal, through which fresh water is continually running. The transformers have also an exterior water-cooling device. The guaranteed efficiencies are:—

	Full load.	Half load.
At unity power factor ...	98.4 p.c.	98.2 p.c.
At 0.8 power factor ...	98.0 p.c.	97.8 p.c.

Copper losses amount to 30 KW., and total losses to 51 KW.

The switchboard is of the "pulpit" type, and is installed in the generator room. From this switchboard the whole central station is controlled, including the small D.C. motors which regulate the speed of the water turbines, and also those which operate the H.T. switchgear. Current for these motors is taken from the machine exciters.

The transmission lines are carried on steel lattice-work poles throughout (fig. 6). Two lines (6 wires)

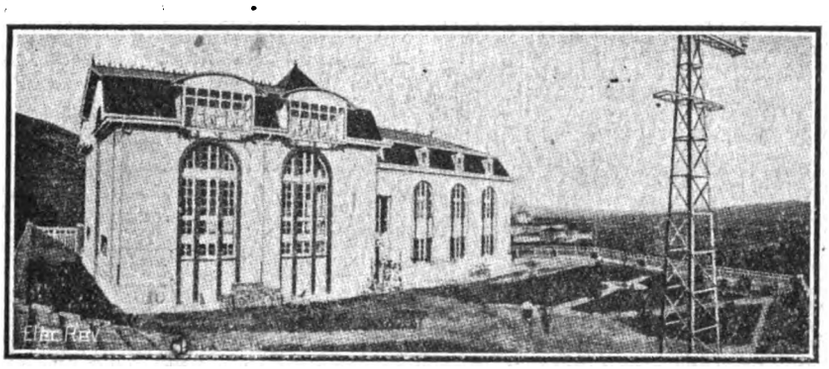

FIG 4.—SUB-STATION AT OVIEDO.

are run on each pole forming a regular hexagon of 7 ft. 2 in. between opposite sides. An earthed wire of galvanised steel is carried on a spur at the top of each pole, for protection against lightning, &c. All the wire for transmission lines was supplied by the "Sociedad Industrial Asturiana," and it is worthy of note that this company faithfully fulfilled its contract to supply some 85 tons of copper wire at 2.32 pesetas per kilogram, although the market price, by reason of the war, had reached about three times that figure before the line was installed. The insulators are all of Spanish manufacture, and were tested up to 110,000 volts before erection.

All material supplied up to the time of writing has been put to severe test, and has been working satisfactorily and without breakdown. The object of the company is solely to help in the industrial development of the district, and to make possible the existence of big industries which need power in considerable quantities and at low cost. To this

FIG. 5.—POWER HOUSE SHOWING PIPE LINE.

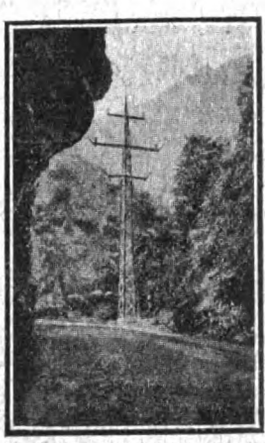

FIG. 6.—LATTICE-WORK POLE AT SOMIEDO.

end, it has signed agreements to supply cheap power to several subsidiary distributing companies for a period of 20 years, and has also contracted to supply 2,000 H.P. to the steel works at Gijón. With the advent of normal times the total 20,000 H.P. available will be utilised.

AUXILIARY OIL FIRING OF BOILERS.

BY A. F. BAILLIE.

THE subject of auxiliary firing of boilers had been almost entirely neglected until in the early years of this century a French engineer called attention to its possibilities. Supplementing the ordinary coal-fired burners with auxiliary oil-fuel burners was shown by him to possess many advantages, notably the facility with which a large increase in the power of boilers might be obtained at will. He further demonstrated that the combustion of the petroleum in the same furnace with the coal did not in any way prejudicially affect the combustion of the latter fuel, but, on the contrary, by the introduction of jets of petroleum into the furnace the conditions and efficiency of combustion were greatly improved, due to the more complete mixing and almost perfect combustion of all the gases present. In other words, the oil burners enable those gases produced from the burning coal to be consumed and turned into working heat, which, in the absence of such oil burners, would pass away unconsumed to the shaft or chimney stack. Subsequent work with auxiliary firing as above described has confirmed the conclusion of this pioneer, and auxiliary firing has been adopted in locomotives, naval vessels, power stations, and in other plants where a peak load is frequently encountered.

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The important point is that the use of a supplementary oil burner in a coal furnace greatly improves the combustion of the latter fuel. It has been established by careful tests that when a constant rate of coal burned per square foot of grate area was maintained for many hours, the addition of 40 per cent. of oil increased the total evaporation by over 100 per cent., and at the same time increased the evaporation obtained per lb. of fuel burned by 35 per cent.

Several evaporative trials were made on the same boiler of a French warship comparing the results obtained with the coal firing and mixed or auxiliary firing. The results were as follows:—

1. *With coal only.*—18.8 lb. of coal were consumed per sq. ft. of grate area per hour, the quantity of water evaporated per lb. of coal being only 9.05 lb.

2. *Mixed Firing—45 per cent. oil.*—When 21.3 lb. of mixed fuel, consisting of 45 per cent. petroleum and 55 per cent. coal, were burned per sq. ft. of grate area per hour, the evaporation was 11.35 lb. of water, showing an evaporative increase of 25 per cent. over that of coal, as in No. 1.

3. *Mixed Firing—64 per cent. oil.*—In the third test 21.7 lb. of mixed fuel were burned per sq. ft. of grate area per hour, in the proportion of 64 per cent. of oil and 36 per cent. of coal. The result was that 14.12 lb. of water were evaporated, showing an evaporative increase of 56 per cent. over that of coal, as in No. 1.

These tests were distinctly encouraging, and should have served as a basis for further work along these lines in industrial plants, but the industrial application of the question of auxiliary firing was not commercially developed until about four years ago, when power-station engineers commenced to take a keen interest in the subject. They found that when using auxiliary firing, the poorer classes of coal could be quite satisfactorily burned which could not be used alone. This is accounted for by the fact that the inferior coal tends to cake on the links of the chain-grate stokers, thereby preventing the quantity of air necessary to complete combustion from being drawn through the bars, and resulting in a smouldering mass of fuel which travelled slowly along the bars, and was dumped into the ash-pit only partly consumed. This so-called "ash" on investigation was found to contain a very high percentage of unconsumed coal. Consequently it was found that in using inferior fuel a very much larger quantity was used per hour to maintain a given evaporation than was consumed when high-class coal was used.

As above stated, the use of fuel oil provided the way out of this difficulty, and enabled power-station engineers to use inferior coal, in conjunction with oil burners, with complete efficiency. The reason advanced for the improvement effected by the use of auxiliary oil burners in such cases is that the combustible gases rising from the coal-fuel bed were quickly ignited by the oil burners, causing the top of this mass to become much more incandescent, and thereby tending to draw through the coal sufficient air to complete its combustion.

Sufficient interest was taken in this theory for a large London power-station engineer to give his sanction for tests to be carried out under one of his coal-fired "Stirling" water-tube boilers. One burner was introduced into each side of the boiler, approximately about 25 per cent. from the back of the grate, the burners being opposite one another. The fuel oil was stored in an overhead tank, capable of holding three or four days' supply. The oil gravitated to the burners, which were of the "Kermode" steam-jet type, operating with steam as an atomising agent at a pressure of about 25 lb. per sq. in.

The first test was carried out on coal only, burning a nutty slack having a calorific value of 10,400 B.TH.U., and a boiler efficiency of 69.25 per cent. was obtained. The temperature of the combustion chamber was 2,648 deg. F., and of the uptake 660 deg. F.

The last of a series of experimental mixed-burning tests was carried out on a nutty slack having a calorific value of 10,300 B.TH.U., and Mexican fuel oil having a calorific value of 18,750 B.TH.U. A boiler efficiency of 74 per cent. was obtained, and the temperature of the combustion chamber was 2,850 deg. F., and of the uptake 628 deg. F. The ratio of coal to oil on a B.TH.U. basis was 8 per cent., and on a weight basis 4.96 per cent.

Assuming coal at 20s. 10d. per ton and oil at 50s. per ton (pre-war figures), the cost per ton of water evaporated using coal only was 2.8s., and by using the above-mentioned percentage of coal and fuel oil 2.62s., showing a monetary saving of 6 per cent.

The results, therefore, of the tests above enumerated establish the following advantages for mixed firing:—

1. A large increase in boiler output above normal rating can be quickly obtained.

2. The evaporation is much more flexible than that of coal firing.

3. A saving in cost of fuel is shown even when the cost of oil is two and a half times that of coal.

These advantages are sufficient to justify power-station engineers in considering the adoption of this method of firing in the super-power stations of the future.

INDUSTRIAL UNREST: A DIAGNOSIS AND SOME SUGGESTIONS.

By ANDREW STEWART, M.I.E.E.

A MILITARY peace has been achieved, but it would appear that industrial peace, no less desirable, cannot be reckoned upon with any degree of certainty. The age-long battle between the "haves" and the "have nots" is entering upon another phase, and Capital and Labour, who are really co-operators in the industrial world, view each other with suspicion and distrust. Each attributes to the other vices which neither possesses, and the Socialistic Hymn of Hate is sung every Sunday by students in Socialist Sunday schools, and at adult gatherings, with a vim and enthusiasm which demands our admiration, even if it does not meet with our approval.

The workers have become suspicious, jealous of their rights, in many cases oblivious to their duties, determined to wring from their employers every advantage they can obtain, regardless of economic results. They suspect, not only their employers, but their own leaders, their organisations have become the seat of anarchy, they elect leaders and then flout them, repudiating the agreements they make with as little hesitation as a German statesman of the old style would display in breaking a treaty. They demand the control of productive industry, yet display inability to control themselves.

There are many reasons for this. Discontent of a kind is not undesirable; in so far as it is evidence of a healthy desire for progress and the improvement of the condition of the people, it is very much to be desired. The industrial unrest of to-day is not a healthy desire for prosperity by the exercise of self-control, self-denial, and education, which are the chief routes to success, but a desire to pull down the structure which supports civilisation as we know it, and substitute a new organisation, largely untried, but which, in the few cases where it has been tried, failed to achieve the results which were anticipated, and if applied on a large scale would cause the collapse of the wealth-pro-

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ducing organisation of society, and labour would go with it.

The causes which have led to this discontent are various; the chief cause appears to be the discovery that high wages do not make the working man happy. He has discovered that high wages mean high cost of commodities, and he is probably no better off with high wages than with low wages. He denounces the profiteer as the cause of these high costs, oblivious of the fact that almost everybody engaged in the production and handling of the goods he requires gets about twice the pre-war wage. Moreover, the working classes have been particularly successful in this particular form of profiteering—not that they are to be blamed for taking opportunity by the hand, but they are unfair in blaming the capitalist for the result. What the working man seems to want is high wages and low costs. An object of this kind stands fairly high up in the list of things difficult to accomplish!

Another, and more serious cause, is the absence of the amenities of life. The working man is to a large extent dependent upon external things to divert him from the drab monotony of his working life. His home life does not supply it, sometimes it is more sordid than the worst workshop, and we have to thank the unimaginative utilitarians who planned the working-class districts of East London, Manchester, Leeds, Glasgow, and similar cities, for their contribution to the social unrest of the twentieth century.

After the normal necessities of life are met, a certain amount of money usually remains, and this the workman applies to the amelioration of his environment. How this is applied depends on his taste, which is largely the product of his training and education. He may in a few cases buy pictures or books and devote some of his time to self-improvement; more likely he spends his spare time following the fortunes, or misfortunes, of his favourite horse, or discussing the prospects of the local football team in the cup final. These diversions have been impossible for a long time past, and even the great international competition, now happily finished, lasted long enough, and demanded so many other sacrifices, that it no longer stirred his enthusiasm.

Under these conditions the ground is prepared to receive the seeds of political and economic discontent. Vendors of political nostrums assure the workman that he is poor because the rich man has what really belongs to the worker, and a great deal more even less accurate information is cleverly distributed. Such teaching is as great a menace to civilisation as German "Kultur," yet no effort is made to counteract it. By the worker, unused to the dialectical subtleties of the demagogue, these arguments are readily accepted at their face value. They appeal to his prejudices and class instincts, and the man whose mates would consider him as quite incapable of judging impartially on the merits of a local football team, is often accepted as an authority on the vastly more complex subjects of politics and economics. Though many of labours' demands are reasonable, and every far-seeing employer recognises that some reforms are even overdue, the difficulty is that labour's political effort is towards an unhealthy extreme. The younger men in the workshops display contempt for the advice of the older and more experienced men. These younger men are the class from whom the Bolshevist element is largely recruited. They are a minority, but active and enterprising, and may exert considerable influence on labour's policy.

Legislation influenced by this element would prove a serious menace. Bolshevism, which is the antithesis of Tsarism, is class oppression from the bottom up, just as Tsarism operated from the top down. Tyranny turned upside down is no remedy for social inequality, and labour can never undertake the direction and control of capitalistic enterprise, which is after all a highly specialised form of industry, and vital to labour. Unfortunately no effort is made to counteract these tendencies. It is everybody's business to do so, and that is probably the reason why nobody does it.

Labour, on the other hand, is vocal, its case is well put, although it represents a minority of the population, it is the best managed of all political parties, and is effective because of its homogeneity.

During the war we have seen propaganda achieve results which the sword could not accomplish; it was no less effective because it was silent. Labour realises this, but where is the Capitalistic propaganda? Who is to direct and organise the campaign for a square deal between capital and labour, or is the capitalist case to go by default?

There is a substantial substratum of working-class opinion, largely found in the engineering and allied industries, anxious for fair play. These level-headed workers know instinctively, apart from the examples they see around them, that all classes co-operate in the production of wealth, yet they get few opportunities of learning the basis on which this co-operation depends. They rely for information on sources not at all friendly to the other sections which make up civilised society, and they, too, ultimately become, if not active agents of aggressive socialism, at least lukewarm supporters. Why should this potential stabilising element in public opinion be allowed to drift into the camp of the extremists?

If the seething cauldron of civilisation boils over, it may be due more to the apathy and neglect of the classes than to the greed of the masses.

THE USE OF HIGH-PRESSURE AND HIGH-TEMPERATURE STEAM IN LARGE POWER STATIONS.

On Thursday evening last week, Mr. J. H. Shaw, A.M.I.E.E., read his paper (an abstract of which appeared in our issue of July 19th, 1918) before the Institution of Electrical Engineers.

Mr. J. S. Highfield, in opening the discussion, said that the subject chosen by the author was an important one. Many difficulties would be met with which would have to be overcome. The chief of these would be a metallurgical one; much trouble would be encountered in connection with boiler tubing and plates, and the turbine blading. There was yet much to be learned about the composition of the metal of which those plates and blades were made and their behaviour after being subjected to high temperatures. The latter question was a most difficult one, and more knowledge on the subject would be of much practical value.

Mr. Arthur H. Ellis criticised the figures for steam consumption given by the author. A figure of about 11.5 lb. was more likely to be correct, and we should have to go a long way yet before we reached the figures given in the paper. He thought that for the purposes of tests and comparisons the operating figures and data of the boiler and turbine should be given together, and not separately, as recommended by the author. The metallurgical difficulties that would be met with were many. Only that week he had seen some studs which had been subjected to high temperature steam, and they had become extremely brittle. It only needed the slightest tap with a hammer to break them. That was a very important matter, and the sooner we knew more about it the better. The author stated that "the overall efficiency of the boiler-house plant was assumed to be 77.5 per cent., which should be obtained with modern boiler control." Such a statement was very misleading; that figure was much too high, and he did not think there were many boiler-house plants which could show more than 65 per cent. efficiency. He urged that more attention should be given to boiler-house plant. If proper attention was given in that direction operating results could be greatly improved. He thought that instead of considering what radical changes could be made, such as higher pressures and temperatures, it would serve a better purpose if engineers devoted more attention to improving present conditions. If a boiler could be built which consumed a much smaller amount of fuel per lb. evaporated it would be of far greater value than the results of raising temperatures and pressures would be.

Mr. Napier Prentice said that he was not prepared to discuss the paper, but if his advice were asked for, he would say: "Don't use steam." He thought the best way out

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of the difficulty would be the utilisation of a Humphrey pump and water turbine working under an artificial head. The water turbine was a much more simple machine than the steam turbine, and he thought that by some such scheme the problem would be much more satisfactorily solved.

Mr. P. V. McMahon said that whenever steam was used the old problem of throwing away large amounts of the heat of evaporation still remained. He thought that the best way out of the difficulty would be by the use of a gas engine, or some such scheme as outlined by the previous speaker. Who could compare the Diesel with the steam engine? He thought that the development of the heat engine rather than the steam engine was the proper line along which to advance.

Major A. M. Taylor congratulated the author on a very valuable paper; he thought the author had not done sufficient justice to the cause for which he pleaded. He would attempt to show, by a profit and loss account taking the author's own figures (foot of colmuns 4 and 10 of schedule I.), that financially it would not be successful unless a load factor of nearly 100 per cent. could be realised.

In the "creditor" column he would put the figure obtained by taking (50 per cent. L.F./100 per cent. L.F.) × £4,800 = £2,400 (for a 50 per cent. load factor).

In the "debtor" column he would put:—

1. Shortened life, from, say, 15 years to 10 years, and consequently increased depreciation from, say, 7½ per cent. to 10 per cent. per annum. Take the capital cost of boilers, pipework, turbines (excluding cooling towers and condensers) at, say, £5 per annum = £100,000 total cost. Thus, 2½ per cent. extra depreciation on that meant £2,500 per annum.

2. Increased radiation losses (standing). Take 10 per cent. on 6,200 tons of coal at 10s. = £310 per annum.

3. Ditto on turbo losses 10 per cent. on 15,000 tons = £750 per annum. Total "debtor" account = £3,560 per annum (2,500+310+750).

There was thus a *loss* of £1,160 per annum. With a better load factor there would be undoubtedly a saving; but on the two columns of schedule I. selected by the author one would not get a saving till nearly 100 per cent. load factor had been reached. Had he (Major Taylor) placed the extra depreciation at too high a figure? Even if only 1½ per cent. additional depreciation were taken—corresponding to a reduction in life of from, say, 15 years to 13 years—the Dr. and Cr. accounts only just balanced at 50 per cent. load factor. He was sure nobody would dare say that 1½ per cent. extra depreciation was too much to allow. He wished to ask why the author had not compared, say, column 1 with column 12 of schedule I? It seemed as though in comparing only columns (4 and 10) he had not sufficiently stated his case. If the engineering difficulties *could* be overcome up to column 10, might we not hope that they could also be overcome up to column 11, at least? It was not clear why the author had given, in fig. 1, an entropy diagram for only 100 lb. pressure and without any superheat, and then in fig. 2 a jump to 350 lb. pressure and 300 deg. superheat. The author seemed there to be overstating the case just as much as he had understated it in schedule I.

He submitted that fig. 1 should have been got out for the conditions of column 1 of schedule I., and then a visual representation would have been possible of the gain in available heat between column 1 and column 2. It was disappointing that the gain between fig. 2 and fig. 3 was so small—it did not encourage one very much to face the difficulties of the increased pressure.

Mr. G. Partridge said that in his opinion the metallurgical problems would be the most difficult ones met with: that matter should have much more attention given to it. In his own case he knew of some pipe flanges which became crystallised and so brittle that the slightest tap was sufficient to break them. The boiler feed water would also have to receive more attention; in his own case one Babcock boiler dealt with the whole of the water before it passed to the rest of the boilers, which were used simply as evaporators. He had found that such an arrangement gave very good results, and in Holland also, where it had been tried, he believed the results were satisfactory. Such an arrangement saved much trouble, time, and expense.

Mr. W. R. Cooper said that it would have been better had the author given results in thermal units instead of in lb. of coal. Results expressed in that manner were misleading at the present time when coal was of such a low grade and contained so much ash. It was common knowledge that the operating figures of the Connor Creek power station, U.S., showed such results as 20,040 thermal units per kw.-hour over the year, and that was without superheat and with a load factor of 40 or 50 per cent. The saving in coal as shown by the author was comparatively small.

Mr. E. T. Williams said he found nothing in the paper to justify the adoption of extra high pressures; he thought it would be risky to adopt high pressure and high temperature at the same time, and the problem would have to be dealt with with caution. He said that better lines along which to proceed would be the burning of gas, tar, or tar oil under the boilers. The author had not made enough of capital charges; maintenance charges also would be higher when higher pressures were used, and a matter that would have to be guarded against was the consideration of results of special tests as against actual working experiments. He thought the whole question was too large a one to be dealt with except by the country as a whole.

Mr. P. F. Allen agreed with Major Taylor's remarks on the financial side of the paper. With regard to the metallurgical problems, much more had been done during the war in that direction than was generally known, and when those results became known it would be seen that much knowledge had been gained in the last four years. At sea, working conditions of boilers were very much worse than those on land, but in spite of that, he did not know that any great difficulties had been experienced at sea as a result of the use of higher pressures and temperatures. He agreed with previous speakers that when considering efficiencies both the turbine and the boiler should be considered as one unit, and not separately, as recommended by the author. The burning of oil and gas under the boilers would give greater opportunities for improvement than would the use of coal or oil engines. The latter would mean slower speeds, which, in turn, necessitated more expensive electrical machinery and lower voltages. All those items should not be lost sight of.

The Author, replying briefly, said there appeared to be some misconception about the paper. He had not set out to justify the adoption of higher pressures and temperatures, all he had attempted to do was to draw up a fair balance sheet. There were advantages and disadvantages to be considered, and he had attempted to put the case fairly for and against. Regarding the financial questions that had been raised he maintained that in the future all units would be much larger than at present, and therefore the capital cost of plant working at 300 lb. pressure would not be greater than that of similar plant working at 200 lb. He agreed with Mr. Williams that it was questionable whether it would be advisable to adopt both high pressures and high temperatures at the same time.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Burleigh Totally-enclosed Motor.*

The design of totally-enclosed motors is a most interesting matter to engineers. Many devices have from time to time been proposed for increasing the output from a given size of motor frame, or, what amounts to the same thing, for lessening the material required for a given output. A device patented by Mr. J. W. Burleigh, for heat dissipating means

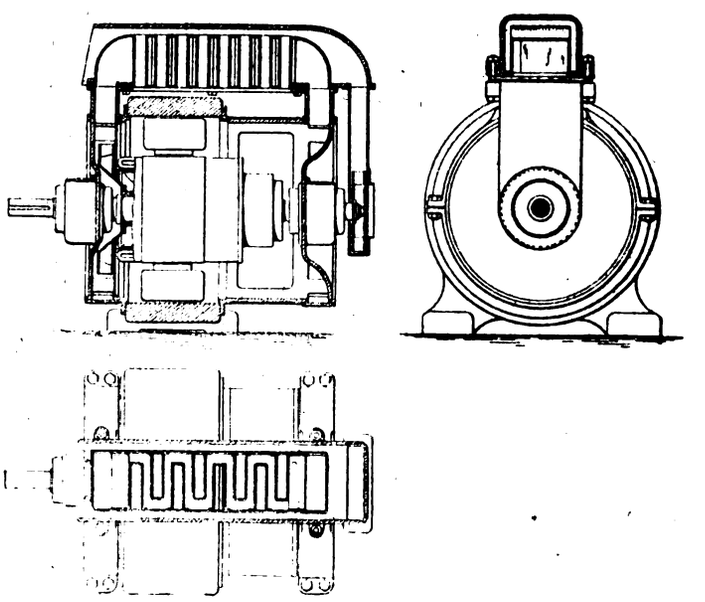

Fig. 1.—The Burleigh Totally-enclosed Motor.

used in conjunction with totally-enclosed motors, presents several features not heretofore found in this class of machinery.

The invention provides, external to the machine, heat dissipating means comprising a radiator through which the air contained within the machine is circulated, as by a fan, and a protective casing through which fluid external to the machine flows for cooling the radiator. The radiator consists of a casing in communication with the enclosing casing of the machine, and provided with walls to form a sinuous or

* Patent specification No. 118,392.

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zig-zag path for the air to be cooled. A protective casing for the radiator provides paths along the sides and top of the latter for the flow of a cooling liquid. The walls within the radiator are hollow, and are in communication with the interior of the protective casing, and provide through the radiator a path for the cooling fluid transverse to the path of flow of the heated air therethrough. A fan is mounted on one end of the armature spindle, by means of which the heated air contained within the machine is forced through the radiator, and a pump mounted on the other end of the armature spindle pumps the cooling liquid through the protective casing. Lastly, the whole heat dissipating means are carried by a casing which is mounted on seatings on the end bearing brackets, and is adjustable thereon around the machine.

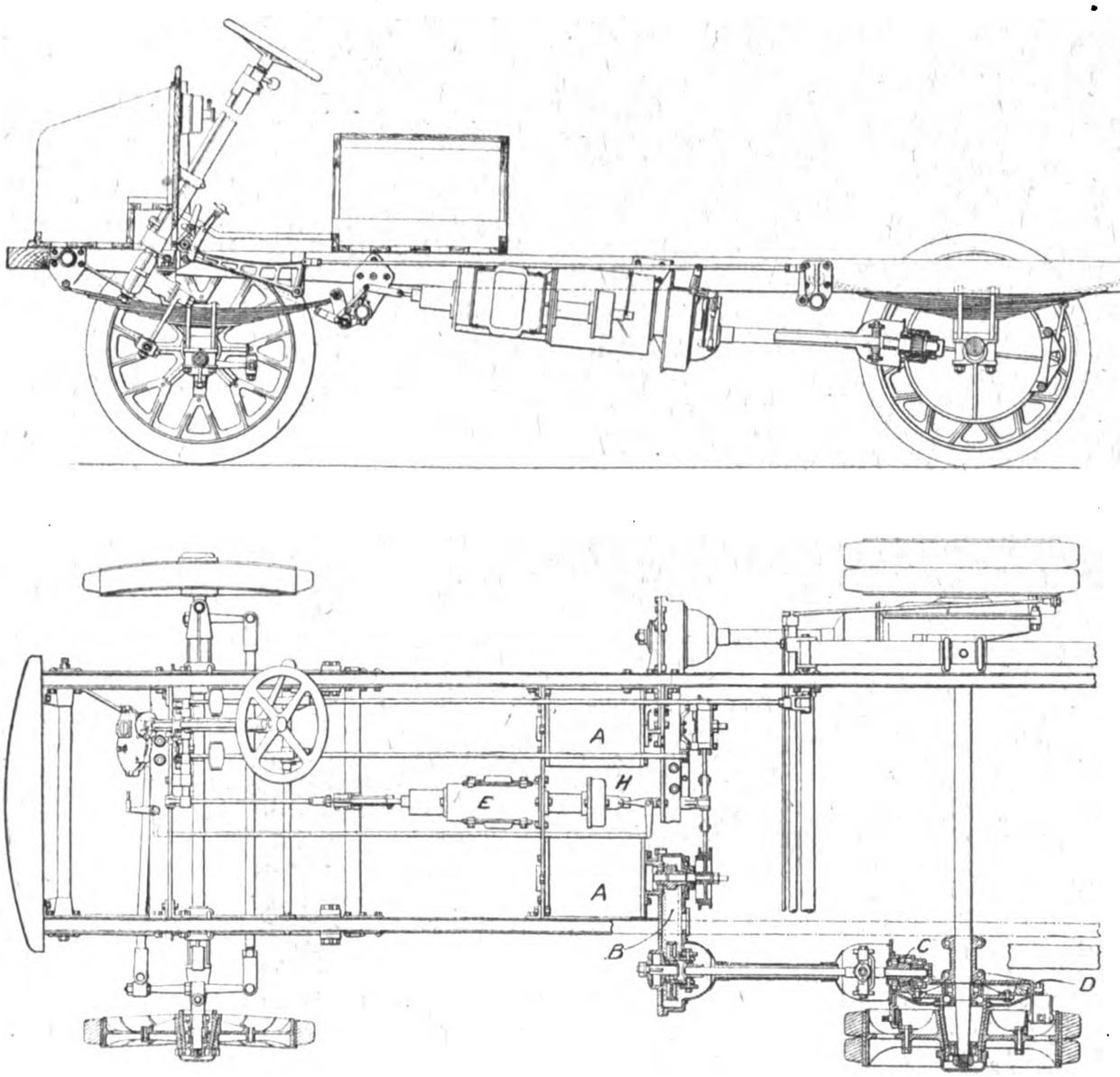
The radiator is arranged to present a very large surface to the cooling air, which is forced by the fan between its top and sides and the U-shaped cover. This system of cooling totally-enclosed motors, in many cases, it is claimed, permits of the present in the cooling air, it does not mix with the air within the machine, hence the motor frame cannot become a dirt trap as sometimes happens in the case of ordinary pipe-ventilated motors.

It is claimed that the use of a heat dissipator, as described, will greatly reduce the constructional cost of totally-enclosed dynamo-electric machinery. The small cost of attaching this heat dissipator to standard motors will, it is believed, make its use popular with manufacturers. We understand that machines of this type will shortly be placed on the market.

Further information relating to these machines can be obtained from the patentee, Mr. J. W. Burleigh, "Homecroft," Highbridge Road, Burnham, Somerset.

A New Edison Industrial Electric Vehicle.

An interesting new design of industrial electric motor vehicle has recently been produced by Edison Accumulators, Ltd., Duke Street, St. James's, London, W. As will be seen from the accompanying illustrations, which show the



Figs. 2 and 3.—Elevation and Plan of Edison Industrial Electric Vehicle.

full output, as a ventilated machine, being taken without undue rise of temperature; even with high speeds (and consequently greater iron losses) the output will be reduced by a small percentage only. Furthermore, it is stated that this heat dissipating means is so effective that its dimensions can be so reduced that the appearance of the motor with this attachment is neither bulky nor cumbersome.

By a simple arrangement the whole cooling system can be rotated around or about the motor frame for the purpose of location. This facility for allowing the portion having the greatest radial dimension to be placed in almost any position usually enables a machine of this type to occupy the same position as one of the ordinary open type.

From a brief consideration of the type of motor here referred to, it will be seen that it can be adapted to an improved type of pipe-ventilated motor by attaching an inlet pipe only to the casing of the fan, and leading it to a supply of cool air. The great advantage of this arrangement is that it does not matter what impurities or moisture happen to be

elevation and plan of the chassis, one of the principal features of the design is the employment of two electric motors each connected to one of the rear road wheels through a separate transmission, thus obviating the use of the usual differential gear. The two motors, A, A, are located about the middle of the chassis, one on each side of the frame, they being connected by chain gearing B to longitudinal propeller shafts—each provided with double universal joints—the final drive being by short shafts C and bevel pinions to bevel wheels D secured to the rear road wheels. The motors employed are of a fairly high-speed type, the transmission system adopted being such as to secure two speed reductions between them and the road wheels, one reduction being obtained in the chain gearing and the second through the bevel gear, the total reduction being 14 to 1. The chain gearing, the propeller shafts, and the bevel gear are entirely enclosed, and so protected from wet and dirt. The controller E is located just in front of and between the motors, it being secured to the cross-plate supporting the latter. In

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this way it is claimed that the usual long wiring between the controller E—the latter is operated by a level below the steering wheel—is avoided, with a consequent reduction of internal resistance and possible leakage. To the rear of the controller is a reversing switch H, by means of which the motors can be reversed, the controller giving an equal number of forward and backward speeds to the vehicle. The controller and reversing switch are controlled mechanically. A point of interest is the location of the battery, partly in a compartment under the driver's seat and partly under the bonnet in front of the dashboard, as indicated in fig. 2, an arrangement which renders the Edison cells easily accessible for watering and cleaning and also of locating the whole weight of the battery on top of the chassis instead of being underslung. Brakes are provided on both the back road wheels and also on rearward extensions of the spindles of the motors.

REVIEWS.

Electric Motors and Control Systems. A Treatise on Electric Traction Motors and their Control. By A. T. Dover, A.M.I.E.E. Pp. xvi + 372; figs. 315. London: Sir Isaac Pitman & Sons, Ltd. Price 16s. net.

Mr. Dover has already been responsible for a book entitled "Electric Traction" which treated of the application of electric power to tramways and railways. His present book is a companion to his first one, advancing to a consideration of traction motors and the modes of controlling them. This separate method of treatment is well advised, and within the limits set by the author for the subject of the present book he has a great deal to say, every word of which makes attractive reading.

The book contains ten chapters, the first of which relates to general considerations, and the next three to a discussion of the construction and characteristics of continuous-current, single-phase, and polyphase traction motors respectively. Chapter five is devoted to the testing of traction motors, and four chapters to the control of continuous-current tramway and railway motors, and single-phase and three-phase railway motors. A further chapter treats of the calculation of the resistance sections for continuous-current motor starters.

The author's way of handling his subject is to devote the first portion of each chapter to a recital of the theory of the particular kind of machine under review, and then to examine in detail the construction of machines of the latest types which have actually been put to service in the largest electric traction schemes.

Different authors have their own methods of explaining the theory of electrical machinery, and none is more difficult of treatment than that of alternating current motors, which puts severely to the test the author's ability to bring home to minds not of the same state of advancement as his own on the subject, the salient features of the conditions underlying the operation of the plant. Out of this test Mr. Dover emerges with credit, and his explanations, while not beneath the electric traction intellect of major calibre, convey the lessons to less advanced minds with the greatest lucidity.

Perhaps the most interesting sections of the book are those dealing with polyphase traction motors and their control; and it is not too much to say that to the engineer engaged upon ordinary industrial work, the high developments of the traction motor for speed control will come as a revelation. The ordinary industrial electrical engineer, for instance, fights shy of many of the solutions of speed adjustment of the polyphase motor; but in traction work, not one but two of the permissible expedients for the achievement of this object are regularly embodied in the same motor. The combination of pole-changing and cascade control has been carried to a high pitch of development.

A feature of the book is the large number of figures illustrating the latest practice in motors and control gear. The diagrams are very clearly arranged. Perhaps no diagram can be so complicated as one of the electric train control, but no one interested can fail to be able to follow out even the most complicated diagram appearing in the book. The author has evidently been ably seconded by the various manufacturers to whom he has applied for assistance in the way of illustrations and information.

It is a great misfortune that more British material is not available on which authors of books on electric traction can draw. In pre-war days such a book would not have appeared without a very free sprinkling of illustrations of practice from what are now enemy countries; and the author has had to forgo, not quite, but almost entirely, such sources of information. But the American, Swiss, Italian, and the few British companies engaged upon electric traction have been of no small assistance to him. The illustrations of their practice, which appear in the book, will contribute largely to the education of British engineers as to what can be done in electric traction.

Particularly fortunate has the author been in his publishers. The production of half-tone blocks—a matter on which the reviewer can speak very feelingly—is highly creditable, taking into consideration the class of paper which can be used in text books, and with the few exceptions where the blocks have evidently been drawn from technical papers which employ a quality of paper permitting a higher screen of block than can be carried by the paper on which the text of the book is produced, the half-tone illustrations are beyond reproach. The printing, too, and the general arrangement are ideal.

Books of this description tend to pall upon the reader after the perusal of a few pages, but the lucidity of composition, combined with attractiveness of make-up and printing, render the book one in which the interest never flags—even of the engineer not specialising in electric traction work.

From errors, and illustrations of obsolete practice so common in books of this description, the present treatise appears to be particularly free. Perhaps, however, it may be permissible to point out, in the section relating to control of tramway motors, certain illustrations, including figs. 182 and 165, in which wooden supports for the contact fingers in a controller are employed. The illustrations presumably are of American origin. The reviewer is aware that wood enters into the construction of control gear much more in America than in this country. But with the exception of steel works service, electric traction imposes conditions more severe than any other application known to the electrical engineer, and the details of the construction of plant are therefore of very great importance. Nevertheless, with a controller for even ordinary industrial service, the reviewer would never permit a construction to be used in any plant for which he was responsible similar to that appearing in the illustrations mentioned. Micanised steel bars are British practice, and wood is prohibited; and in the details of the construction of such plant British electrical firms have no superiors. It may be, of course, that the illustrations are not quite up-to-date practice for the firms mentioned in connection with them. The point is commended to the author's consideration.—E. P. H.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Smooth v. Undercut Commutators.

The satisfactory working of the commutator will vary very much according to the locality and working of the machine.

I find that for machines which can be kept free from dust accumulation, and also a chemically charged atmosphere, undercut commutators work perfectly satisfactorily, provided that the undercut depth is not more than 1/16 in. or 3/32 in., then the slight accumulation of carbon dust in the interspaces can be periodically cleared.

The use of an insulating paste is by no means equivalent to the use of mica, since with overheating it has a tendency to become loose, and if it does not fall out, causes brush "jumping," and consequently sparking, and blistering of the face edge of the copper segments. Should the motor possibly become over-oiled—due to negligence or unskilled labour—the paste proves a good oil absorbent, and the adhesion of the metallic particles abstracted from the segments, or carbon from the brushes, develops short-circuits with all their concomitant evils.

For motors operating within a dusty locality, or chemically charged atmosphere, a perfectly smooth surface is preferable, since the dust particles deposited around, and the action of gases, are constant sources of commutation trouble.

Further correspondence on this subject would be most useful both to designers and users of electrical machines.

S. Hughes.

St. Georges, *November 20th*, 1918.

Motor Problems.

Several engineers have expressed their regret that your leaderettes of August 2nd and 23rd on the above subject have not met with a better response from designers or makers.

A solitary letter on the A.C. motor confirms your remark that the machine you describe is still in the future.

You deal with the rise in pressure which takes place when the field of a motor is suddenly strengthened and the armature has considerable inertia. That this will happen is clear from theoretical considerations, and is confirmed by several breakdowns traced to this cause. Additional evidence is found on page 251 of last year's Proceedings, A.I.E.E.

"Trouble may also result from increasing the field strength of a motor when it is disconnected from the line. For example, a 400- to 1,600-R.P.M. motor is operating at its maximum speed. If the controller disconnects the motor armature from the line, and at the same time increases the field strength to its maximum value, the voltage across the brushes of the motor will rise to something over three times normal

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voltage, unless the armature is slowed down very quickly. It can readily be seen that a 500-volt motor, having over 1,700 volts across its brushes, is apt to flash across at some part of its insulation, and ultimately be damaged. This rise of voltage has actually been observed, and care must be taken not to manipulate the shunt field so as to cause it."

I gather from the letters of your correspondents that although there may be something or other among their products that can be adapted, it is a problem which is new to them.

The Igranic Co. suggests a form of contactor gear which, although relatively cheap, would cost as much as the motor. The vibrating relay on some forms of control which I have examined does not appear to be free from faults.

May I, with due deference to the Igranic Co., suggest an alternative which can be found in their lists and in those of at least one other maker? That is, an ordinary plain type of starter or drum controller, with a separate shunt regulator having one of those simple devices which automatically short circuits the shunt resistance when the motor stops, and necessitates moving the handle to full field position before re-inserting the resistance. This device would appear to meet the editorial requirements of cheapness and simplicity. It has more than one handle, but certainly not so many as the locomotive.

There must be a number of readers interested in the subject, and this letter is written in the hope that they may be induced to give their views.

Ernest F. Butler.

London, N.W.4, *November 18th*, 1918.

[We were very much interested to learn that the motor problem to which we drew attention had also cropped up in the United States, as long as a year or more ago; the passage quoted had escaped our notice. With regard to Mr. Butler's proposal, this, of course, does not pretend to be a solution to our problem, but we agree that it is the next best thing to a solution, and we took it into consideration when we wrote the articles referred to. Our objection to it was the use of two handles, which seemed inevitable.

We suggest that as over-voltage is the phenomenon to guard against, over-voltage should be the means by which protection is secured. A high-resistance relay, for instance, connected across the brushes, and adjusted to act when the P.D. across its terminals reaches 50 per cent. above normal, can be used to insert resistance into the field circuit; the same relay could also be adjusted to open again when the P.D. had fallen to 50 per cent. below normal, cutting out the resistance, and leaving the machine ready for restarting. —EDS. ELEC. REV.]

Hospitality to Oversea Soldiers.

At this time of rejoicing every one of us desires to express gratitude to those who have helped to protect our homes. Thousands of oversea troops will be on leave over Christmas, and unable to mingle with their own folk at home. I desire to appeal to your readers on behalf of the Rotary Club of London to open their homes to one, or preferably two, of these boys. All imaginary difficulties are surmounted. The characters of the guests are vouched for, the railway fares are paid, they will have their food ration books, and if the hostess has servant difficulties, nothing gives the guests greater pleasure than to assist, as they were accustomed to do in their own homes. We have to bear in mind that to them even a humble home is as a palace compared to the average hut or canteen.

Will those of your readers who can help, please communicate with me by return?

Trusting that this appeal to my fellow countrymen will not be in vain.

Jno. T. Mould.

147, Queen Victoria Street, E.C.4,
November 21st, 1918.

[We have received a similar letter from Mr. Joseph Meech, of 49, Queen Victoria Street, E.C.4.—EDS. ELEC. REV.]

Static Charge on Motor Vehicles.

I am writing to ask if any of your readers can explain a rather peculiar electrical phenomenon which I experienced a few days ago. The company I am attached to comprises Ford vanettes and a few 30-cwt. lorries. We were moving from one position to another, and our road lay across several miles of desert. The day was particularly hot (approximately 110 deg. F. in the shade) when the ignition system of several of the Ford cars failed.

Upon making a minute inspection, I found everything as it should be, but, on standing on the ground and touching any part of the chassis framework, a very perceptible spark was seen, heard, and felt between the finger and the car. The engines were stationary, and there were no batteries or accumulators fitted to any of the cars. So severe was the shock felt that the two mechanics I had with me could not be induced to go near the cars.

The only explanation I can offer is based upon the fact that a fairly strong wind was blowing at the time, which was heavily laden with dust. This dust, in my opinion, was charged with a certain amount of electricity, which caused in some mysterious manner an accumulation of static electricity to be set up in the metal chassis of the cars, which interfered with the regular ignition system. When the wind dropped the cars started almost on the first turn of the engine. The only effect the disturbance had on the lorries fitted with magnetos (Dixies) was to cause considerable misfiring.

If I remember rightly, I believe something of a similar nature occurred in America some years ago, when an electrical disturbance caused the total failure of the whole of the telephone system. I should be glad to have the opinions of some of your readers.

O. W. Bowmaker, M/S. 567,
Sergeant Electrician.

Mesopotamia E.F., *September 7th*, 1918.

[The static charge is readily explained by the dust storm, the dry rubber tires being good insulators. Why the charge should interfere with the ignition system is not easy to understand. Some years ago a somewhat similar occurrence was reported from New York.—EDS. ELEC. REV.]

A Scientific Basis for Costs.

Probably most people have felt that many of the present discussions on large *versus* small stations lose their value owing to the fact that there is no scientific basis by which to compare their costs. The existing tables, valuable as they are, do not really enable us to compare one station with another, as the conditions are so different. One station may have the same coal costs as another, and yet be using twice as much coal, the difference arising from the rate at which the coal is purchased. Then we have not sufficiently made it clear in our tables that generation costs are only part of the total costs of supply. The cost of distribution may be of far greater importance.

It is very desirable that a scientific basis should be evolved by which the real efficiencies of electricity stations could be accurately compared without reference to such accidental items as the rate of wages, the price of coal, and the rate of interest and sinking funds. Some stations pay more than twice as much into sinking funds as others, and this prejudices their results in the eyes of the inexpert public. The expert should have a means for eliminating anything of that kind when he makes comparisons. We might, for instance, take the ratio of the thermal units of the fuel to the thermal units in the electrical energy delivered by the station to the feeders. Labour might be reckoned as if paid at a standard rate. Careful consideration would evolve a scheme of comparison which would be both equitable and useful for the purposes of the present discussion, and also for many other purposes.

Having obtained a basis by which the generating costs per unit might be arrived at, we need then to arrive at the distribution costs, made up of the whole of the charges involved, such as labour, transforming losses, cable losses, and by no means least, interest and sinking fund charges. It would be found that in many cases the cost of distribution is far more important than, say, coal costs. As has been shown by Mr. Pearce and Mr. Fedden, it may pay to place a station at a situation which is not particularly favourable rather than go further away for an ideal site. This important fact, however, does not have the place in our tables of costs that it should have. If distribution costs were set out in costs tables as a separate item, just as fuel costs are, it would throw a great light on the reason why some stations do well while others do badly. It would also clear up many obscure points in the discussions relating to the super-power stations. Just whether it proved that they are desirable or whether it showed that a multitude of small stations is better, should be carefully kept out of sight until the end. What we want now is a clear and accurate statement of facts without bias to one opinion or the other.

Some years ago I proposed the term "distribution factor" for the distribution costs per unit sold. The idea did not then receive much attention, but the time now seems opportune for the revival of the idea.

North Shields, *November 23rd*, 1918. **C. Turnbull.**

Close-of-War Matters.

Perhaps you would kindly allow me the hospitality of your columns to mention two points which I think might be of interest in connection with the close of the war, and in respect of which inquiries are being made. The first point is with regard to demobilisation. It will be of interest to electric supply companies to know that my committee has taken the matter up with the authorities, so as to ensure that the electric supply industry is placed among those "key industries" which are entitled to priority in regard to the return of their men in the Army, as we are certainly justified in claiming that among the first men to come back should be those who have left important posts in the electric supply industry.

A further point is in regard to the restrictions placed by the Ministry of Munitions on new connections for the supply of electricity. My committee has taken this matter up with the Ministry of Munitions in order to get the removal of these

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restrictions directly the situation permits. It will be seen from the following letters that we have had the full sympathy of the department, and that the Director of Electric Power Supply has taken what steps he could to assist us in this matter.

[COPY.]

Ministry of Munitions of War,
8, Northumberland Avenue,
November 14th, 1918.

T. W. Cole, Esq.,
Provincial Electric Supply Committee
of the United Kingdom.

COAL ECONOMY AND NEW BUSINESS.

Sir,

I am directed to refer to your letter of the 14th inst., and to say that while we are all anxious to relax restrictions as early as possible, the Coal Controller considers it necessary to adhere strictly to the rationing scheme under the Household Fuel and Lighting Order.

I have, however, already addressed a letter to him on the question of policy, and am hopeful that before long some definite and favourable pronouncement may be possible. In the meantime the present practice should continue.

I am, Sir,
Your obedient Servant,
(Signed) ARNOLD B. GRIDLEY,
Director of Electric Power Supply.

[COPY.]

Ministry of Munitions of War,
8, Northumberland Avenue,
November 21st, 1918.

T. W. Cole, Esq.,
Provincial Electric Supply Committee
of the United Kingdom.

COAL ECONOMY AND NEW BUSINESS.

Sir,

With further reference to my letter of the 14th inst., I have to inform you that I have now had a letter from the Coal Controller, in which he states that he regrets that until the coal situation improves, it is impossible for him to agree to any relaxation of the present restrictions.

You will no doubt have observed that this has been recently announced by him in the Press.

You may, however, rest assured that as soon as circumstances admit of restrictions being modified or withdrawn, this will be done, and the electricity undertakings notified accordingly.

I am, Sir,
Your obedient Servant,
(Signed) ARNOLD B. GRIDLEY,
Director of Electric Power Supply.

T. W. Cole,
Secretary,
Prov. Elec. Supply Committee.

London, E.C. 2, *November 22nd*, 1918.

Technical Assistants.

Owing to the cessation of hostilities and the consequent demobilisation of a large number of men who have served their country in the Services and in munition factories, it is expected that large numbers of the members of this Institution will be available for the filling of vacancies in the technical and administrative departments of engineering firms.

The bringing together of suitably qualified men and appropriate vacancies is a subject which has always engaged the attention of the Institution, and for many years past has been one of the features of its activities.

In this capacity of intermediary the Institution holds a unique position in being able to draw upon all sections of the engineering profession, the membership not being restricted to any one class.

At a time like this, when the engineering activities of the country are undergoing far-reaching alterations, with the consequent changing over of a large number of technically-trained men, it will undoubtedly be of value to both employers and employés to know of this feature of the Institution's work. I shall be glad to aid any of your readers who may be in want of technically-trained assistants, and who may care to communicate on the subject with me.

Herbert G. Riddle,
Secretary,
Junior Institution of Engineers.

Westminster, *November 25th*, 1918.

The Characteristics of the Commutator Ampere-hour Meter.

In connection with Mr. G. W. Stubbings's interesting article on the mathematics of these meters, there is a point in his first paragraph which requires a little amplification.

He states that the commutator meter has not been found to be entirely suitable for accurate registration on small loads, and that for these requirements the mercury type meter still holds its own.

As the largest manufacturers of commutator meters in this country, we are able to state definitely that this is not the case. The field where the commutator meter is more than anywhere else suitable is the small load; the reason is that while it *may* be the case that on, say, 1/20th of full load a mercury meter may be more accurate than a commutator meter, this depends on what the full-load current of the meter happens to be—thus, of two meters, one of each type, each intended for a normal full-load current of 100 amps., we should be inclined to agree that at a load of 5 amps. the mercury meter would have the smaller error.

The situation, however, is reversed in the small sizes. The point of low load where the mercury meter ceases to be accurate, is set approximately at a certain figure, because the current can only pass once through the motor. In the case, however, of the commutator meter, the current passes a very large number of times through the magnetic field, as these meters are wound with a large number of turns in the armature. The armature as a whole is shunted, and by increasing the resistance of the shunt a greater proportion of the line current is caused to pass through the armature. The only limit to this process comes when the shunt resistance is infinity. This would bring the full-load current of the meter equal to the full-load armature current, which is only, of course, a fraction of an ampere, so that such a meter would read accurately down to a very small fraction of same.

It will therefore be appreciated that the commutator ampere-hour meter is the meter *par excellence* for small currents.

The Electrical Apparatus Co., Ltd.,
R. H. BARBOUR, *Director.*

London, S.W., *November 18th*, 1918.

LEGAL.

BATTERIES FOR POCKET LAMPS.—CONTRACT DISPUTE.

AN action came before Mr. Justice Sankey, in the King's Bench Division, on Thursday, November 14th, when plaintiffs, the United Kingdom Lighting Trust, Ltd., of 72, Turnmill Street, London, E.C., sued Mr. S. Davis Nicholls, trading at Bolton and London, in respect of alleged breach of contract and warranty over the sale by the defendant to the plaintiff of 12,000 batteries known as Master Batteries for pocket electric lamps, the contract price being 10s. 6d. a dozen.

The defendant denied liability and breach of warranty.

Counsel for the plaintiffs were Mr. F. A. Greer, K.C., Mr. F. T. Barrington-Ward, and Mr. Du Parc, and the defendant was represented by Mr. F. Phillips.

Mr. GREER, K.C., in opening the plaintiffs' case, explained that the goods in question were bought by the plaintiffs as Master Batteries, and were part of a large shipment from the United States. It was necessary that they should give 4 volts, and there was a guarantee to that effect, extending up to December 24th, 1917. The plaintiffs paid £525 for the goods, and their case was that they were not reasonably fit for the purpose for which they were purchased, were not of merchantable quality, and out of 12,000 delivered to them, no fewer than 11,031 did not give the proper illumination. The plaintiffs, as the defendant knew, had bought for purposes of resale in smaller quantities, and as they had sold at 13s. a dozen, the profit on the resales was 2s. 6d. a dozen. The plaintiffs claimed this loss of profit, as part of the damages, and they claimed there was a warranty that the batteries should give sufficient current for the illumination of pocket electric lamps, and that any pressure less than 4 volts was not sufficient. This order for 12,000 Master Batteries was, he believed, a very small order for the trade, and the plaintiffs' contention was that in the circumstances they were entitled to recover the price they had paid the defendant for the batteries, and damages for the defendant's failure to deliver batteries in accordance with the contract.

In support of his case Mr. GREER called a large number of witnesses.

For the defence, Mr. PHILLIPS said the batteries were sent by defendant to the plaintiffs in the original cases in which they were received, they were not touched in any way, and they had the guarantee upon them, and the defendant was perfectly willing, as his letters stated, to replace faulty batteries. When the batteries came back in the cases, the defendant reported to the people from whom he had bought them, Messrs. Farrant, and certain tests were made in December. It was then found that a very large number were over 4 volts. The guarantee in the trade was not that the money would be returned, but that good batteries would be sent instead; they were always willing to send new batteries, and several times wrote that they would do so.

Evidence was given by Mr. DARLINGTON SIMPSON, of 88, Leadenhall Street, E.C., that he had had a large experience of the battery trade. When the complaints were made, he carried out certain tests and found that 60 per cent. gave 4 volts and over. He tested about 400 out of 9,000, taking them haphazard.

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After other evidence had been called, Mr. Phillips addressed the Court for the defence.

Mr. Justice Sankey, in delivering judgment, said that he was of opinion that the tests of the plaintiffs were accurate, but that those carried out for the defendant were perfunctory, and only covered a very small proportion of the goods. No notes were taken of the defendant's tests, but, on the other hand, he had full and precise information about the plaintiffs' tests. He was satisfied that the goods were not of merchantable quality, and were not reasonably fit for batteries for these pocket electric lamps. Under these circumstances, the plaintiffs were entitled to have their money back, and there must be judgment for the plaintiffs for the amount of the claim under that head, viz., £482 12s. 2d., with costs.

Pintsch Patents for Electric Lamps.

In the Patents Court, on Wednesday last week, the Cosmos Lamp Works, Ltd., applied to the Controller-General of Patents, Mr. Temple Franks, for licence to use three patents —5,026 of 1912; 16,620 of 1914, and 109,298 of 1914—for improvements in tungsten filaments for electric lamps and incidental processes of manufacture. All three patents are in the name of Julius Pintsch, Aktiengesellschaft, of Berlin, though in the case of the first there had been communication from Pintsch to the late Joseph Hubers, of Hubers & Mond.

Mr. Whitehead, appearing on behalf of the applicants, said that the Cosmos Lamp Works, Ltd., were a British company incorporated since the war, with a capital of 50,000 £1 shares, of which 49,955 were owned by the British Westinghouse Co., four were owned by British subjects, and the others by an American citizen. The applicants were the purchasers from the Public Trustee of the Brimsdown Lamp Works, the British name of the German people who owned the three patents in question. The sale to the applicants was a sale of the whole of the Brimsdown works and stock, and the well-known tungsten filament lamp of that name. The two patents, 5,026/1912 and 16,620/1914, were on the schedule of the patents comprised in the sale of the Brimsdown Co.'s stock, &c., as being patents under which they had been manufacturing. The patent No. 5,026/1912 had been worked at the Brimsdown works, and there had also been a good deal of investigation as to No. 16,620/1914. As to 109,298, nothing very substantial had been done—the patent represented merely an addition to No. 16,620/1914. No. 5,026/1912 was a patent for a process for getting ductile filaments of tungsten alloy; these filaments were prepared by squirting a compound of tungsten oxide with thorium oxide. This process had been worked commercially by the Brimsdown works and by the Cosmos Lamp Co. since they bought the business. The real problem had been to get a filament which was ductile throughout its whole length, so that one did not get "disease spots" in the material itself. The difficulty had been felt more especially in the case of filaments which were of substantial thickness. Although many experiments had been made at the Brimsdown lamp works they had never yet succeeded in getting a commercial filament substance which would work at 50 candle power so as to make it a commercial proposition. If one could get a filament which consisted of one crystal one would have accomplished the object in view, but how that was to be done so as to get a good commercial proposition was a question of very great difficulty. No. 5,026/1912 was the process actually worked by the Brimsdown Co., and No. 16,620 was an improvement particularly applicable to the filaments as made by No. 5,026. It was really a further treatment of the filament as it had been obtained by No. 5,026 or by other processes. The applicants urged that they should have an exclusive licence.

On behalf of Dr. Mond, the application for an exclusive licence was opposed, it being said that there were other people who were contemplating putting these patents into practice, and there was no case for the grant of an exclusive licence to the applicants.

Mr. Whitehead, resuming, said that it had been found possible to work No. 5,026/1912 commercially already. A great deal of labour had had to be done at the works in order to prepare the raw materials, and they had succeeded in preparing tungstic acid in a form which was particularly applicable to this process. Since the sale of this business by the Public Trustee, much labour had been expended in investigating this particular process; as a result of their past experience, they thought it would take some considerable time before there was any chance of establishing a commercial success, and they felt that unless they could get the monopoly rights, they would not be able to continue the investigations beyond a very short time.

Evidence was given by Dr. Rabinovitch, works manager of the Cosmos Lamp Works, that prior to the purchase by the company he was the chief research chemist for the Brimsdown Co., and had carried out work on the inventions as disclosed in Patent No. 5,026/1912. He described in technical detail the various experiments, and said that in order to make this a commercial proposition, a large outlay for labour and machinery would be necessary. He put considerable value on the invention if it could be worked for all sizes of filament. These processes could not at present compete with the drawn-wire process.

Mr. Terrell submitted that there was no case for the granting of the exclusive licence to the applicants.

Dr. Albert L. Mond gave evidence that he was a member of the firm of Hubers & Mond, who were agents for Pintsch and the Brimsdown Lamp Works. He helped the Pintsch people to establish their works in this country, and had reason to believe that there were other people who would possibly be desirous of manufacturing under these patents. He had read various articles that had appeared in the technical Press in Germany since 1915, and he could say that it was quite a commercial article in Germany. All the lamps manufactured at Brimsdown were manufactured under Patent No. 5,026.

Some discussion ensued on the question of royalties, and the Controller intimated that the application would be considered.

BUSINESS NOTES.

The Copper Position.—A correspondent writes to the *Financial Times*, stating that he considers that a fall in the price to £70 or under is assumed very much at random. "Surely, in an estimate of that sort the cost of production must to a large extent be considered as the determining factor, and since it is hardly likely that the cost of labour, material, and transport will sensibly decrease for a considerable time to come, the present price of copper does not appear to be liable to depreciate much—in fact, the tendency is more likely to be in the opposite direction; for it seems safe to assume that as soon as the change of the order of things from war to peace pursuits takes effect, it will be found that the demand for copper will equal, if not exceed, the one which the war furnished." To this the editor of our contemporary replies, agreeing that copper, like other base metals, will probably eventually settle down on a basis nominally higher than its pre-war average, but he repeats his opinion that "'for a time' during the possibly prolonged transition period from war to peace conditions, copper may go to an abnormally low price, due to the world's productive capacity having been stimulated since 1914 to far beyond its pre-war record, while naturally the recovery of ordinary trade demand to its old basis, let alone a higher one, must be a gradual process."

In a later issue our contemporary says:—"The cable from the Queensland directorate of the Mount Morgan Gold Mining Co. is confirmation of the fears we recently expressed as to the outlook for copper during the transition from war to peace conditions in the world's markets and trade. Although the board of the company advises that work at the mine is progressing normally, the declaration of the usual quarterly dividend of 1s. per share is indefinitely postponed, 'in view of the uncertainty of disposal of copper after the end of the year.' The Mount Morgan's report recently to hand by mail, stated that the British Munitions Department had contracted to take the whole Australian output of refined copper (less local requirements) up to June 30th, 1918. The price payable for the Mount Morgan's electrolytic product was £108 per ton. It would seem, however, that the contract must have contained a clause allowing for its termination or a modification of prices on the arrival of peace. The copper outlook in general depends, of course, mainly on the United States market. There an effort is being made to maintain the current high fixed quotations until the end of this year, but it would seem that after that there must be a drastic "cut" in the interests of trades dependent on cheap copper for their activities. At the least, war insurance and any saving in ocean freights must come off current export prices."

Rathenau's Million.—The *Times* states that it is reported from Berlin that Herr Walter Rathenau, president of the Allgemeine Elektrizitäts-Gesellschaft, has placed at the disposal of the German Treasury his entire private fortune, estimated at £1,000,000. Does he intend this as a nucleus of the War Chest for the "next war," which he said must not start "a year too soon"? We look forward to a report of his next speech to the shareholders of the A.E.G. Tirpitz has shaved his beard. Has Rathenau changed his mind—or his spots?

Demobilisation of Labour.—In reply to Parliamentary questions concerning men and women who had received notice to leave their employment with munitions factories and controlled firms, it was stated that the Ministry had issued instructions that, except in extreme cases, contracts were not to be cancelled abruptly, and that full consideration was to be given to the interests of the workpeople.

The general fear of wholesale discharges from Woolwich Arsenal has led to the sinking of differences between the various Trades Unions, and a Joint Committee of Delegates of organisations representing skilled and unskilled workers of all grades has been formed with a view to inducing the Government to avoid discharges by utilising the machinery and whole war-time *personnel* of the Royal Arsenal on the manufacture of State requirements other than munitions.—*Daily Telegraph.*

The End of the War.—As the result of an amendment proposed in the Lords in the "Termination of the War" Bill, it is provided that the date of termination, which is to be fixed by Order in Council, is to be as nearly as may be the date of the exchange or deposit of the Peace ratification. This will be for the purposes of contracts, deeds, or other instruments, except where the context otherwise requires.

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Agencies Wanted.—H.M. Trade Commissioner in Australia reports that an agent in Melbourne desires agencies for Victoria and Tasmania for United Kingdom manufacturers of electric motors for driving light machines and general motor accessories, British magnetos, &c. References No. 349.

The office of H.M. Trade Commissioner in New Zealand reports the receipt of the following inquiry :—An electrical engineer and electrician at Wellington desires to get into touch with United Kingdom manufacturers of electrical plant and supplies. Reference No. 354. Particulars from Department of Commercial Intelligence, 73, Basinghall Street, E.C.

Some references to Belgian and Dutch electrical agencies will be found in our "Notes" to-day.

Returning to Peace Industries.—Sir Charles Macara, in a communication to the Press, gives his views on the present situation. We make the following extracts :—

"Skilful management is quite as essential, or, indeed, even more essential, in emerging from war as in entering upon it. Given this, I believe we are on the threshold of a great future in industry. But there are problems to be solved in the industrial field and large armies to manœuvre into a safe position. We have to transfer men from their posts in the fighting Forces to their industrial posts ; and to do this, if we do not employ those who have spent their lives at the head of the great organisations of Capital and Labour controlling the staple industries of the country, we shall repeat, if not intensify, the errors that were made at the outbreak of war. In these industrial manœuvres I hope our leaders of industry will be the general officers commanding. . . . . The men who lead the organisations of Capital and Labour should closely co-operate with the demobilisation authorities. . . . . But we must help our returned Forces to realise that the delicate mechanism of the world's commerce must, under our modern system of industrialism, take some time to settle down after the violent struggle of the last four years, and what we now have to consider is how to emerge successfully from the fearful dislocation that has resulted from the war. It must be realised that all foodstuffs, raw materials in stock or in process—indeed, stock of all kinds—have been produced under abnormal conditions, and changes in the values must of necessity be gradual if we are not to be involved in serious financial disturbance. . . . I am strongly in favour of permanently raising the standard of living of the working classes, and I believe this can be done by an agreement between all the nations, and in this way alone. I always like to point to what has been done, and much has already been accomplished by international co-operation which in times past would have been considered utopian. I give it as my firm conviction, from a large experience of both national and international trade, that if the nations of the world would only fully realise their interdependence, and organised Capital and Labour were to work together in developing the undeveloped resources of the world, which, in my opinion, would give omple employment to all, the appalling waste caused by this world-wide war may be made up in a much shorter time than is generally believed."

Works War Savings.—The second annual meeting of the Faraday Works War Savings Association (Messrs. Gent & Co., Ltd.) was held on Monday, November 18th. Mr. Hardy Parsons, the managing director, presided. Reports by the officers showed that the Association had more than doubled its takings during the second 12 months of its existence, the total sum actually being £2,752. Mr. S. Ellicock, O.B.E., secretary of the Leicestershire Local Committee, congratulated the Association on its success, and urged a continuance of the war savings support.

Engineering Reconstruction : New Fields.—The Ministry of Reconstruction, in No. 5 of its series of pamphlets on "Reconstruction Problems," deals with the subject of new fields for British engineering. It gives particulars of the Committee which, under the chairmanship of the Hon. H. D. McLaren, M.P., considered the outlook, &c., for new engineering industries for making employment for available labour and machinery. The Committee set up Branch Committees to deal with the different sections of those industries, and some particulars of the work of these sections appear in the booklet. In regard to the electrical apparatus section, it is stated that this Branch Committee has so wide a field to work in that it is not yet in a position to report the full results of its investigations. "There appears to be no doubt, however, that in a very large number of trades connected with the manufacture of electrical apparatus there is room for British development. The whole question will be dealt with in a later publication by the Ministry of Reconstruction."

New British Industries.—This afternoon (Friday), at 3 o'clock, in the Conference Room of the Hotel Metropole, Mr. Kellaway, Parliamentary and Financial Secretary to the Ministry of Munitions, will address a meeting of the Industrial Reconstruction Council on "Developments in British Industry During the War."

Exhibition of Foreign-Made Goods from South America.—A large range of samples of foreign-made goods, including general hardware, tools, electrical goods, enamelled goods, &c., have recently been received from various parts of South and Central America. Arrangements have been made by the Department, with the co-operation of the Birmingham Chamber of Commerce, for them to be exhibited at 95, New Street, Birmingham, on Wednesday, Thursday, and Friday, November 27th, 28th, and 29th. The Exhibition will be open from 10 a.m. to 6 p.m. daily. Admission will be confined to manufacturers and shippers. The *Board of Trade Journal* says that invitations are being issued by the Department.

The Ministry of Supply.—As already stated here, a Ministry of Supply for the public service generally is to be developed out of the existing organisation of the Ministry of Munitions. The duty of disposing of all surplus Government property will be undertaken by the Ministry of Munitions pending the completion of the arrangements for organising the new Ministry.

Foreign Trade Representatives.—According to the *Daily Mail*, Sir A. Steel Maitland, of the Overseas Trade Department, says that one of the new commercial diplomatic officials started for Belgium last Saturday. "We have a man temporarily in Morocco. Another is ready to start for the Balkans. Posts for Russia, South America, China, Japan, and other places have been arranged. There were only half a dozen commercial attachés connected with diplomatic work, but we are starting with about 30, and hope to increase that to 40, if Treasury sanction is obtained. Men who have seen service at the front are given a preference. There are plenty of opportunities for the best men, and some important posts will yet have to be filled. These new officers are to be embodied in the regular diplomatic service as commercial counsellors and commercial secretaries."

Engineering Hours of Labour.—According to the *Birmingham Daily Post*, the employers in the engineering and shipbuilding trades, affecting two million men, after a conference with a Joint Committee, have agreed to reduce the hours of work from 53 to 47 per week. A ballot is being taken upon the matter in the organised trades. It is estimated that the reduction of hours, which will come into operation in the first week in January, will affect about 30,000 men in Birmingham and district.

The *Leeds Mercury* says that an epoch-making ballot is commencing this week in the engineering and shipbuilding trades of Great Britain. "The employers have offered a 47-hour week without any reduction in wages, as against the present 53 hours. The men's leaders recommend its acceptance. About three million skilled workers will be affected. The end to a prolonged struggle for a shorter working week is on the eve of being realised in the engineering and shipbuilding trades of the country. The negotiations were commenced in 1913, but have been held up during the war. Last week the parties met again in London, when the Union representatives claimed a 44-hour week. The employers, in their reply, stated that the sudden cessation of hostilities called for a readjustment in the working conditions, and, as stated above, replied with the offer of 47 hours per week. The Joint Executive thereupon passed a resolution that the 47-hour week and conditions constituted a reasonable attempt to readjust the working conditions in the shipbuilding and engineering trades, and recommend their acceptance to the members of all the Unions concerned. A uniform ballot paper is being sent out for and against the acceptance of the offer. The papers must all be returned by December 16th, and in the event of a favourable reply the new scale will come into operation on January 1st, 1919."

The following well-known leaders sign the recommendation :—J. T. Brownlie, Amalgamated Society of Engineers ; J. Hill, Boilermakers ; J. Rowan, Electrical Trade Union ; R. H. Coates, United Machine Workers ; W. F. Dawtry, Steam Engine Makers ; J. Thomson, Associated Blacksmiths ; A. Gorman, A.S.E. ; J. Lawson, Amalgamated Carpenters and Joiners ; W. Paterson, Amalgamated Carpenters and Joiners ; W. Dawson, United Society of Ironfounders ; A. Wilkie, Shipwrights ; W. Thorne, General Workers ; W. Wentworth, Wood-Cutting Machinists ; F. Smith, general secretary to the Federation.

"The change will mean a reduction of six hours per week in the Manchester area and seven in the Scottish and London provinces. Under the new scheme there will be only one break for meals, and the hours suggested are 7.30 to 5 for five days and 8 to 5.30 and 8 to 12.30."

Restrictions Withdrawn.—More war-time restrictions have been withdrawn since our last issue. The Ministry of Munitions is prepared to release, without special priority permits, stocks of non-ferrous metals, so far as they are available for general industrial purposes. Application should be made to the Controller of Non-Ferrous Materials Supply, Ministry of Munitions, Hotel Victoria, W.C. 2. Permits are no longer necessary for the manufacture or sale of iron and steel wire for the home market, but applications in respect of Colonial and foreign trade must be made to the appropriate Departments. Certain prohibitions in regard to the manufacture of iron and steel and malleable iron are withdrawn.

The A.S.E. and Whitley Committees.—The *Manchester Guardian* states that the Manchester District Committee of the Amalgamated Society of Engineers has decided to instruct the local members to take no part in the formation of Workshop Committees on the lines laid down in the Whitley Report. The Committee is of the opinion that only independent organisation will be of any value.

A Crypto Canteen.—On Wednesday, November 20th, Lady Hugh Grosvenor performed the ceremony of opening a canteen which the Crypto Electrical Co., Ltd., have recently erected for the convenience and comfort of their employés. Mr. Swainson, representing the Y.M.C.A., in whose hands the catering arrangements have been placed, congratulated the company on the excellency of the appointments of the canteen, which at present does not cater for more than 300 meals at one time. The opening ceremony was followed by a concert under the chairmanship of Mr. T. E. Goodyear (chairman of the company), who expressed the hope that many other such entertainments, lectures, &c., for the benefit of all employés, would follow.

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British Trade Marks Applications.—Below is given a summary of the recent applications for British trade marks in connection with the electrical industries :—

Infuselax, No. 384,471, Class 50.—Electrical insulating preparations made of synthetic resin. Thomas Howse, Ltd., Union Works, Union Street, Smethwick, July 24th, 1918. (To be associated.)

Falksley, No. 383,964, Class 6.—Electrically-operated machinery for controlling curtains, lights, and for similar purposes. Flaconbridge & Lewsley, electrical engineers, 114, Mansfield Road, Nottingham, June 18th, 1918.

Cosmos, No. 384,454, Class 8.—Oscillation valves, thermionic valves, amplifiers, and similar devices, all being for use in wireless telegraphy and telephony. The British Westinghouse Electric and Manufacturing Co., Ltd., 2, Norfolk Street, Strand, London, W.C., July 23rd, 1918. (To be associated.)

Phœnix-Bradford (design), No. 384,468.—Electrical machinery of all kinds included in Class 6. Phœnix Dynamo Manufacturing Co., Ltd., Thornbury Works, Bradford Old Road, Bradford, July 24th, 1918.

Formax, No. 382,796, Class 50.—Electrical insulating materials, consisting of fabrics of various kinds, coated or otherwise treated with an insulating medium. George Schultz & Co., Ltd., 10, Arthur Street, London, E.C., April 6th, 1918.

Letter "P" in design, No. 385,225, Class 6.—Electromotors, dynamos, and aircraft. Portholme Aircraft Co., Ltd., St. John's Street, Huntingdon, September 16th, 1918.

Alumel, No. 385,156, Class 8.—Electric Resistance Elements. Hoskins Manufacturing Co., 453, Lawton Avenue, Detroit, U.S.A., September 11th, 1918. (To be associated.)

Silver King, No. 384,322, Class 13.—Sparking plugs for internal combustion engines. Arthur T. Ellis & Harry A. Hands, 129, Castelnau, Barnes, July 16th, 1918.

Mira, No. 385,102, Class 6.—Dynamos. Mortimer A. Codd (trading as the High-Tension Co.), 62-4, Belvedere Road, London, S.E., September 7th, 1918. (To be associated.)

Electric Plant Destroyed.—According to newspaper reports, during a fire in the plating shed at Harland & Wolff's yard at Belfast, on Monday, a "special electric plant" was destroyed.

Disabled Men and Workmen's Compensation Insurance.—Under a scheme, of which particulars were issued by the Home Office on Monday, it is provided that where an employer employs disabled soldiers, sailors or airmen (all men receiving disability pensions are "disabled" men in this connection), the Government will be responsible, through an arrangement with the insurance companies, for any additional losses incurred owing to any greater liability of such disabled men to accident in the course of civil employment.

Trade Announcements.—Messrs. Tredegars, Ltd., announce that, owing to large extension of their business during the past 12 months in London and the provinces, it has been found necessary to enlarge their premises and increase their staff. We understand that they have carried out very big supply contracts for the French and English Governments, and have now in hand contracts recently placed. The wholesale and export department is a separate concern to Tredegars, Ltd., of Brook Street, and is under the entire supervision of their manager, Mr. A. W. J. Bedbrook, and staff.

The London office of Messrs. Richard Garrett & Sons, Ltd., which has hitherto been conducted by Mr. W. J. Marshall, one of the directors, will henceforth be in charge of Mr. G. P. Mair. Mr. Marshall is taking over administrative duties at the works at Leiston, Suffolk.

The Concordia Electric Wire Co., Ltd., have now removed from Cricklewood Lane, London, to Trent Mills, New Sawley, Derbyshire, where they have equipped an extensive modern factory. For the convenience of London and suburban customers, they have opened an office and showroom at 155, Victoria Street, S.W. 1, under the management of Mr. R. W. Belcher, and a stock will be kept there.

Electric Lamps in Italy.—According to a *Daily News* report from Milan, electric lamps have been declared a State monopoly in Italy.

Book Notices.—*Transmission of Heat Through Heavy Building Materials.* By A. H. Barker, B.A., B.Sc., Whit.Sch., and M. Kinoshita, M.Sc. (Lond.). Bulletin No. 2 of the Department of Heating and Ventilating Engineering, University College, University of London.—This is the report of a research carried out for the Research Committee of the Institution of Heating and Ventilating Engineers, with the aid of grants from the Department of Scientific and Industrial Research. The subject offered an almost virgin field—a very large one, too—which might even be described as a trackless waste. New methods had to be devised for conducting the tests, and a great variety of conditions had to be taken into account—an obvious fact when one remembers that the experiments included measurements subject to the kaleidoscopic variations of the atmospheric conditions in our capricious climate. The report details the conditions, describes the methods and the ingenious apparatus evolved by the author and his assistant, and gives details of the results obtained. Mr. Barker provisionally concludes that the generally-accepted coefficients for heat transmission err considerably on the low side; that Rietschel's coefficient for an unplastered brick wall under laboratory conditions is about 10 per cent. low; but that the average mean value of the transmission coefficient of a plain brick wall matchboarded inside is 0·25 (10 per cent. below Rietschel's result). From the data obtained, a series of values of K for different thicknesses of wall is tabulated; it appears that a 9-in. wall, matchboarded, is equivalent to a wall more than 21 in. thick without matchboarding. The experiments are being continued.

"Science Abstracts." Sections A and B. Vol. XXI., Part 10. October 31st, 1918. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

Bankruptcy Proceedings.—James Brockie, mechanical engineer, Forest Hill, Kent.—Application for discharge adjourned *sine die* on October 18th.

Catalogues and Lists.—Messrs. Ward & Goldstone, Sampson Works, Salford, Manchester.—List giving description, with illustrations and prices, of their Izolex replacement fuse, a new type just introduced.

Bastian Electric Co., Ltd., 185, Wardour Street, London, W. 1.—Attractive and useful folder giving illustrations, prices, and brief particulars of a number of types of their "Real Red Heat" electric fires, "Pygmy" heating sets, tube furnaces, drying ovens, hot-plates, &c. Copies of this list, also of a Bastian picture post-card, can be obtained on application.

Non-Ferrous Metal Industry Act.—A further list of licences granted appears in the *London Gazette* for November 26th.

Restrictions Removed.—On and after December 1st, 1918, all restrictions as to the sale or purchase of calcium carbide will be removed, subject to a maximum price to consumers of £40 per ton for quantities of 1 cwt. and over (granulated 10s. per ton extra). No application for the use of this material or returns of stock need be made to the Ministry of Munitions after the above-mentioned date. It is anticipated that supplies are available for all purposes, and will be distributed through the ordinary trade channels, but should the exigencies of the shipbuilding trade demand it, the Government reserves the right to give preferential deliveries.

Liquidations.—A.E.G. Electric Co:, Ltd.—Liquidator, Mr. M. Jenks (without committee of inspection), 6, Old Jewry, E.C. 2, appointed October 19th.

Telephone Co. of Egypt, Ltd.—Winding up voluntarily. Liquidator, Mr. A. W. Wyon, 3, Frederick's Place, E.C. Meeting of creditors, December 9th. Claims by December 11th.

Ilkeston Motor and Electrical Engineering Co., Ltd.—Meeting at Bramley House, Nottingham, on January 1st, 1919, to hear an account of the winding up from the liquidator, Mr. A. Booaer.

Demobilisation Notes.—"One-Man Business" men in the Army will be released on the same basis as other men who have places awaiting their return.

Mr. Harry Dubery, Labour adviser of the National Alliance of Employers and Employed, is visiting France to lecture to the troops on industrial matters in connection with demobilisation. His tour is arranged by the Educational Section of the War Office.—*Times.*

The Trade of Manchester.—The *Financial Times* states that Manchester is to undertake a big publicity campaign to attract trade to the port. The ship canal facilities are to be improved by the erection of new warehouses and the installation of electrical plant.

LIGHTING AND POWER NOTES.

Australia.—Tasmania.—Water Power.—In August last the State Premier stated that the Government's hydro-electric policy was being developed as quickly as possible, and it was proposed to ask Parliament for a further large sum for the purpose. It was also hoped to launch a big scheme on the West Coast. The Government was already committed to large contracts for the supply of power, to meet which it would be necessary to obtain all the power possible from the Great Lake, and also to connect it up with the Arthur Lake. The Minister of Lands stated that, when fully developed, the Great Lake would yield 30,000 H.P., and the Arthur Lake 55,000 H.P. It was proposed to convey power from the Great Lake to Launceston without waiting for the Arthur Lake scheme, and Parliament was to be asked for permission to erect the transmission line. Up to that time the Department had spent £600,000, and it was estimated that the total expenditure would be two or three million pounds. The power available from the Great Lake in August was 7,000 H.P., of which the Electrolytic Zinc Co. used 4,000 H.P., at £3 10s. per H.P.; Hobart City Council, 1,060 H.P., at £4 7s. 6d. per H.P.; and the Hydro-Carbide Works, 3,500 H.P., at £3, less 5s. per H.P. The Department also supplied 58 other power consumers with 1,170 H.P., making a total of 9,700 H.P., exclusive of lighting.—*Industrial Australian.*

Burnham-on-Sea.—Price Increase.—The U.D.C. has decided to raise the price of electricity for lighting, as from December 25th last, to 7d. per unit, with a further advance to 8d., as from September 29th last; and for power to 4d. per unit.

Bury.—Proposed Linking-up.—The Electricity Committee has been in communication with the Lancashire Electric Power Co., with a view to the linking-up of the two systems at Radcliffe, for the purpose of affording the necessary supply for power, until the extensions to the Bury works can be carried out. The matter has been left to the Works Sub-Committee.

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Bradford.—Wages.—In response to applications from the Bradford Corporation Employés' Joint Committee and the National Union of General Workers, for a 10s. per week increase upon the present war bonus rate, the War Wages Committee of the City Council decided on Monday that, as from December 1st, the war wages of those employés not receiving the 12½ per cent. bonus shall be, in the case of men, 30s., and in the case of women 21s. on pre-war rates. This is equivalent to an increase of 5s. to the men and 3s. to the women.

Coventry.—Price Increase.—The Electricity Committee has decided to raise the charge for electricity for lighting by 20 per cent., and for power by 33⅓ per cent., for a period of three months.

Dublin.—L.G.B. Inquiry.—Last week an inquiry was held, by Mr. A. D. Price, into the application of the Corporation for sanction to borrow from the Bank of Ireland such sums as the Board might certify to be necessary for the working of the electricity undertaking from time to time. It was stated to be necessary for the Electricity Committee to have £50,000 or £60,000 at its disposal, upon which it could draw to pay working expenses.

Wages.—A recommendation that the wages of members of the Irish A.E.S.E. employed by the electricity department whose salaries did not exceed £250 per annum be granted the same war bonus as has been granted by the Committee on Production to members of the E.T.U. was defeated at a meeting of the Corporation, and was referred to the E.S. Committee and the Law Agent for a report.

The Port and Docks Board has decided to review the whole question of the use of electricity at the docks, and the engineer is to draw up a report on the matter.

Folkestone.—Price Increase.—The T.C. has appointed a Sub-Committee to consider the advisability of taking action relative to the application of the Electricity Supply Co. to the B. of T. for consent to raise the price of electricity from 7d. to 8d. per unit.

Glasgow.—Dalmarnock Power Station.—Members of the Glasgow Council's Electricity Department some time ago inspected the new power station which is in process of construction at Dalmarnock. In an "Official Note" issued in connection with the visit, to which we are now permitted to refer, it is pointed out that 45 acres of ground in all have been acquired at the site of the station, at a total cost of £63,100. The work for the inlet and outlet water culverts and the foundations was completed at the end of 1916, the total cost being £83,000. The inlet water supply is in duplicate. The previous decision to suspend during the war erection of the superstructure and installation of plant was rescinded in 1916, and contracts were placed for buildings comprising one-half of the generating station, one half of the switch house, two boiler-houses, and complete coal storage. These contracts amounted in all to £120,000. Since April, 1917, orders have been placed for four 18,750-kw. (25,000-h.p.) turbo-alternators and condensing plant, together with eight boilers and accessories necessary for the complete equipment of one boiler house. A contract has also been placed for a complete coal-handling plant. The buildings inspected are laid out as follows:—The turbine room, 230 ft. long by 75 ft. broad, is the main building; on the north side of the turbine room, and at right angles to it, there will be two boiler houses, each to contain eight boilers. On the south side of the turbine room the switch house is being erected. This building will contain the main switchgear as well as 20,000-volt transformers. The coal store covers 2½ acres, and is capable of accommodating 60,000 tons of coal. The walls and half the roof of the first half of the turbine room are completed, and one boiler house is two-thirds completed. The switch house is erected to the ground floor only. Owing to restrictions on the use of steel, reinforced concrete has been used throughout in place of steel girders. Ample railway sidings for the delivery of coal are provided; the coal-handling plant has been designed for the rapid and economical handling of an amount of coal sufficient for the ultimate maximum requirements of the station. The boiler house is a three-storey building; the basement will contain forced-draught fans, and give space for the entry of trucks for the removal of ashes; the first floor will accommodate the boilers and accessories, and the second floor will house economisers and induced-draught fans. The turbine room is a two-storey building, the basement containing condensing plant and the first floor housing the turbo-alternators and accessories. The switch house being a separate building, will enable the operating staff to perform its duties undisturbed by the noise of rotating machinery. A workshop is erected alongside of the first boiler house at the end of the turbine room. The workshop crane will run out over the railway track for the lifting of heavy machinery from the railway into the turbine room, where the turbine-room crane will deal with it. The machinery and accessories on order will cost £860,000.

Harrow.—Street Lighting.—About one-ninth of the street lamps were to be lit at the beginning of this week, the number being curtailed owing to the shortage of labour. No lamps at all have been lit throughout the war.

Lighting Regulations.—By an Order in Council made on Monday, it is provided that Regulation 11, enabling the Home Secretary to make orders with regard to lights, does not disappear. All orders made under it, however, have been cancelled, except the orders relating to lights on vehicles and the Advertisement Lights Order.

India.—Namtu Mines.—The Burma Mines, Ltd., is now erecting at Namtu, Northern Shan States, Burma, a mill for concentrating the lead, silver, and zinc ores of these mines. The mill is being erected under the supervision of American engineers and mechanics, and American machinery is employed throughout. The ore is brought out of the mine through a tunnel 2 miles long, and electric locomotives will be used to haul the mine cars through the tunnel to large storage bins at the portal. The mill will have a capacity of at least 700 tons per day, and is laid out so that its capacity can be extended to 3,000 tons per day. The present 700-ton-a-day plant will cost approximately $1,000,000, of which 3200,000 has already been spent in the U.S. for electrical machinery and supplies. The Burma Mines, Ltd., an operating firm controlled by the Burma Corporation, is by far the largest mining corporation operating in Burma, and the Namtu Mine is one of the largest in the world. Considerable American capital is supposed to be interested. The resident manager and his assistants are Americans, and 33 other American engineers, superintendents, and mechanics are employed at Namtu.

Killarney.—E.L. Charges.—At a meeting of the U.D.C., it was pointed out that the Electricity Company was entitled to charge 10s. per quarter, and it was suggested that if the company persisted in this charge, the Council should exercise its right to purchase the undertaking next July.

Kilmarnock.—Proposed Extensions.—The Director of Electric Power Supply has agreed to the proposed extensions at the Corporation electricity works, including the installation of a 5,000-kw. generator.

Kingston-upon-Thames.—E.L. Failure.—Owing to the failure of the Corporation electricity supply on Tuesday evening, business houses had to close down.

London.—Hampstead.—Loan Sanction.—The L.C.C. Finance Committee has recommended that the application of the Hampstead B.C. for a loan of £8,287 for plant at the electricity works be sanctioned.

Southwark.—Price Increase.—The B.C. is asking for powers to increase the price of electric power from 8d. to 1s. per unit.

Kensington and the E.T.U.—There was an unexpected sequel to the action of the management of the Royal Albert Hall in cancelling the letting of the hall for a Labour Conference which had been arranged for last Saturday night. Mr. Hilton Carter, manager of the hall, stated in a letter that, in view of the demonstrations of a revolutionary character that took place at the meeting there on the 3rd and 14th inst. on the part of Mr. Lansbury's supporters, he did not think his Council would be justified, in its own interests, in allowing the meeting arranged for the 23rd inst. to take place in the Royal Albert Hall. By way of protest, representatives of the Kensington Branch of the Electrical Trades Union, supported by the Central Organisation, at 10 o'clock on Saturday morning removed a paving stone outside the hall and cut off the electricity supply at the main. Mr. W. J. Webb, secretary of the E.T.U., stated that the move was decided on at a special meeting on Friday night. He said that the men of the Kensington and Knightsbridge power station would not allow the main to be re-connected, and if the Albert Hall Council attempted to get it done the whole of the electricity supply in London would be cut off. According to the daily Press, Mr. W. J. Webb is reported to have said that "our men are incensed that the Albert Hall Council should have set itself up as censor of public opinion, and would not allow the Albert Hall to benefit from their labours until the Council was prepared to let them express their opinions on the great questions of the day, just as it permitted the meetings of other recognised political organisations." Eventually, at the request of the Government, the Council of the hall reconsidered its decision, with the result, that members of the E.T.U. proceeded to re-connect the main, and the meeting is to be held to-morrow.

Oswestry.—Fire.—The electric generating station at Park Hall Camp has been destroyed by fire, said to have been caused by overflowing oil coming in contact with heated exhaust pipes.

Somerset.—Electricity in Agriculture.—The report of a committee on rural development has been adopted by the County Council. The report included a scheme for the establishment of electric generating stations at Radstock and Dunball. The committee considered it important to the prosperity of counties like Somerset that a cheap supply of electric power should be available. The small company which supplies Wedmore is of the greatest benefit to the district served, and supplies power for pumping, apple mills, separators, chaff-cutters, &c., on the neighbouring farms.

Stretford.—Proposed Purchase.—The U.D.C. has notified its intention to introduce a Bill next session for the purchase of the undertaking of the Trafford Power and Light Supply Co. within the area of the U.D.C. and the Salford Corporation, and to extend the area of supply so as to include the parish of Davyhulme.

Taunton.—Wages.—The T.C. has deferred consideration of an application of the E.P.E.A. for increased wages for engineers employed by the Council, pending the receipt of further information on the subject from the I.M.E.A.

Electric Cooking.—The Electricity Committee reports that the electric cooking equipment at the National Restaurant is giving every satisfaction, and has proved that more portions can be obtained from a joint cooked by electricity than by any other method.

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TRAMWAY AND RAILWAY NOTES.

Canada.—TORONTO TRAMWAYS.—We learn from the Toronto *Electrical News* that the operating situation on the Toronto system has apparently become unmanageable from the company's standpoint and uncomfortable for the patrons. The plain fact appears to be that the company has not enough employés to man the cars, and has trouble with those it has. Quite recently an effort was initiated to train young women as conductors, but the "Union" threatened to strike, and apparently the management have thought it best to drop the plan. Overcrowding at rush hours, both on the company and city lines, has reached a climax, and there is no evidence of relief in sight. The policy of the city as regards the company is, and always has been, absolutely disjointed, so that the sum total of these spasmodic efforts is to embarrass the company's operations.

Electric Vehicle Progress.—The Southend T.C. proposes to purchase a two-ton Edison wagon for the tramway department, at a cost of £1,242; the Gillingham T.C. is considering the purchase of an electric vehicle for the collection of house refuse.—*Tramway and Railway World.*

London.—COLLISION.—During the fog last week an electric train ran into a London and South-Western steam train at Wimbledon, the locomotive being derailed. Beyond a shaking, the passengers escaped injury. The mishap added to the delay caused by the fog.

L.U.T. FARE INCREASE.—From Monday, December 9th, the fares on the London United Tramway Co.'s services are to be increased to 1d. per mile, with a minimum fare of 1d. This will raise the fares to about double what they are at present.

WAGES.—The Executive Council of the N.U.R. has announced that, in view of the termination of the war, it has decided to withdraw the truce entered into with the railway companies and the Government, and to enter into negotiations with regard to the national programme adopted at the Leicester Conference.

Application is being made for an advance of war wages to women employed in railway shops.

New Zealand.—OTIRA TUNNEL.—The headings of the Otira tunnel were joined in August. The tunnel is 5 miles 25 chains in length, and has been under construction since May, 1908. Owing to scarcity of labour and materials it cannot be completed for another two years. It will be operated electrically.

Richmond.—DERAILMENT.—Traffic on the London and South-Western Railway was considerably delayed, on Monday, between Richmond and St. Margaret's owing to the derailment of a goods engine.

United States.—"SKIP-STOP SYSTEM."—The U.S. Fuel Administration states that the saving of coal in 24 States, during six months' operation of the "skip-stop" system on the street railways, was at the rate of 687,122 tons per annum. Very little complaint has been made against the system, which has increased the speed and improved the service; the saving in electric power consumption was 1 per cent.—*Electrical Review*, Chicago.

Uruguay.—TRAMWAY COMPETITION.—The action brought by the Commercial Electric Tramway Co., of Monte Video, for damages for losses caused through the competition of the State omnibus service, has been decided in favour of the company, and the omnibuses are to be withdrawn. The amount of the damages is to be determined in accordance with the Civil Code.—*Review of the River Plate.*

TELEGRAPH AND TELEPHONE NOTES.

Belgium.—Ordinary private telegrams can now be accepted for the liberated part of Belgium at sender's risk as to delay and censorship.

Cable Censorship.—From an Order in Council made on Monday it appears that the censorship of foreign Press cablegrams is to remain in force until the conclusion of Peace.

China.—The Marconi Wireless Co. has completed an agreement with the Government of China for the erection of wireless stations in different parts of China. The negotiations were carried on and concluded with the knowledge and approval of the British Government. They were undertaken when the authorities at Pekin refused to sign a proposed agreement with a Danish wireless company on the ground that German interests were at the back of it.—*Daily Dispatch.*

Denmark.—The Danish Telegraph Office and the Great Northern Telegraph Co. have granted permission for all British prisoners, both civil and military, to send cables home at 25 per cent. of the ordinary rate.—*Daily Telegraph.*

Russia.—The telegraph apparatus business in Russia before the war was largely in the hands of Messrs. Siemens and Halske. The chief buyers were the Government Telegraph Departments and the railways. The Russian Siemens & Halske Co. has, since the war began, put down a large, well-equipped works at Nijni Novgorod for the manufacture of telegraph and telephone apparatus. The works were hardly in full operation when the reign of anarchy began. The Moscow Telephone Manufacturing Co. had also just equipped works in Moscow for the manufacture of telegraph and telephone apparatus, but as it was at these very works that the Bolshevik Red Guards were first formed for the *coup d'état* of November last year, it is hardly probable that much remains of the works organisation.

The telephone business in Russia is almost entirely in Swedish hands, through the Ericsson companies, which had a very large works in Petrograd, and which also controlled the telephone stations of Petrograd and Moscow, and other large towns. The Moscow telephone system was unquestionably one of the finest in the world, and until January, 1917, it was controlled and managed by Swedish engineers. During the Bolshevik bombardment in November last the entire system was "burnt out" by someone maliciously connecting the 220-volt A.C. mains on the operating boards.—*T. and T. Age.*

Wireless Press Service.—From Sunday next the wireless Press service between London and America will be resumed. Some of the Marconi stations, which have all been under Government control during the war, have now been released, and this will make the new service possible.

CONTRACTS OPEN AND CLOSED.

OPEN.

Bootle.—Corporation. Supply of ½-watt lamp street lighting equipment (4 miles) for tramway routes. Mr. T. D. Clothier, Borough Electrical Engineer.

Enniskillen.—December 1st. Sligo, Leitrim & Northern Counties Railway Co. 12 months' supply of telegraph material. Mr. J. Duff, Secretary.

Manchester.—November 29th. Three-phase, 6,600-volt sub-station switchgear. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Spain.—Tenders have just been invited by the municipal authorities of Pruna (Province of Seville), for the concession for the electric lighting of the town.

Walsall.—December 5th. Electricity Supply Department. One 500-KW. rotary converter equipment. See "Official Notices" November 8th.

CLOSED.

Government Contracts.—The undermentioned contracts have been placed during October, 1918:—

WAR OFFICE.

Cable Drums.—W. Goodyear & Sons, Ltd.; H. Heaton & Sons, Ltd.; W. Makinson & Sons; A. Wiseman.
Generating Sets.—Austin Motor Co. (1914), Ltd.; Keighley Gas & Oil Engine Co., Ltd.
Motors, &c.—E. Brook, Ltd.; Electric Construction Co., Ltd.
Insulating Tape.—British Rubber Manufacturers, Ltd.; Connolly Bros., Ltd.; Hooper's Telegraph & India-Rubber Works, Ltd.; India-Rubber, Gutta-Percha, &c., Co., Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.
Graphite.—Graphite Products, Ltd.
Iron and Steel Wire.—W. Bain & Co., Ltd.; J. Miller & Co. (Liverpool), Ltd.; F. A. Power & Sons; J. Rigby & Sons; Rylands Bros., Ltd.; J. Shipman & Co., Ltd.; Standard Wire Co.; D. F. Taylor & Co., Ltd.

GENERAL POST OFFICE.

Protective Apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.
Telegraphic Apparatus.—Gell Telegraphic Appliance Syndicate, Ltd.
Telephonic Apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.; Peel-Conner Telephone Works, Ltd.; Western Electric Co., Ltd.
Testing Apparatus.—Evershed & Vignoles, Ltd.
Bolts.—Guest, Keen & Nettlefolds, Ltd.
Submarine Cable.—Telegraph Construction & Maintenance Co., Ltd.
Telegraphic and Telephonic Cable.—I. Frankenburg & Sons, Ltd.; W. Geipel and Co., Ltd.; Henley's Telegraph Works Co., Ltd.; New Gutta-Percha Co., Ltd.; Siemens Bros. & Co., Ltd.; Telegraph Construction & Maintenance Co., Ltd.; Western Electric Co., Ltd.
Leclanche Cells.—Siemens Bros & Co., Ltd.
Induction Coils.—Western Electric Co., Ltd.
Switchboard Cords.—London Electric Wire Co. & Smiths, Ltd.
Stoneware Ducts.—Albion Clay Co., Ltd.
Insulators.—Bullers, Ltd.
Laying and completing a line of ducts in Long Acre, Drury Lane, and Great Queen Street, W.C.—G. J. Anderson.
Platinum and Gold-Silver Alloy.—Johnson, Matthey & Co., Ltd.
Cable Distribution Plugs.—British Insulated & Helsby Cables, Ltd.
Insulated Tails.—London Electric Firm.
Telephones.—British L. M. Ericsson Manufacturing Co., Ltd.
Bronze Wire.—F. Smith & Co. (incorporated in the London Electric Wire Co. and Smiths, Ltd.); Shropshire Iron Co., Ltd.
Tinned Copper Wire.—British Insulated & Helsby Cables, Ltd.

H.M. OFFICE OF WORKS.

Engineering Services.—Installation of lift, Treasury Buildings, Whitehall.—Waygood-Otis, Ltd.

INDIA OFFICE.

Cells.—General Electric Co., Ltd.
Copper Plates.—T. Bolton & Sons.
Copper Wire.—Elliott's Metal Co., Ltd.
Dynamos.—J. Stone & Co., Ltd.
Insulators.—Bullers, Ltd.
Wireless Gear.—Marconi's Wireless Telegraph Co., Ltd.

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Belgian Congo.—Messrs. Dick, Kerr & Co., Ltd., have received an order for two 5,000-kw. turbo-alternator sets and condensing plants for the Union Minière du Haut Katanga, who are very large copper producers with extensive mining properties in the Belgian Congo.

The turbines will be of the Willans-Zoelly type, operating on steam at 145 lb. per sq. in. pressure and exhausting into a vacuum of 28 in. (bar. 30 in.), and will carry an overload of 6,250 kw. for two hours. The condensing plants are each designed to deal with 66,000 lb. of exhaust steam per hour and have 10,000 sq. ft. of cooling surface. The turbines will be coupled to Siemens alternators, designed for a normal output of 5,000 kw. at ·9 power factor (5,560 k.v.a.) when supplying three-phase current at 50 cycles and 6,600 volts pressure, and will be capable of carrying overloads of 25 per cent. for two hours, or 50 per cent. momentarily. The ventilating air for these machines will be filtered in dry-air filters of the Premier Co.'s make; the machines will each be fitted with a direct-coupled, 110-volt exciter of the overhung type and will operate in conjunction with an automatic voltage regulator.

Chelmsford.—B. of G. Installing the electric light in the workhouse laundry and the quarters of the master and nurses, £12. Christy Bros. & Co.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, November 29th. At 39, Victoria Street, S.W. At 7.30 p.m. Social evening.

(Sheffield Section).—Friday, November 29th. At the Cutlers' Hall. Presidential address by Dr. P. Longmuir.

Greenock Association of Electrical Engineers.—Saturday, November 30th. Visit to Coats's Observatory, Paisley.

Society of Engineers (Inc.).—Monday, December 2nd. At 5.30 p.m. At Burlington House, Piccadilly, W. Paper on "Notes on Railway High-capacity Wagons' Wheel Axles," by Mr. H. Kelway-Bamber.

Royal Society of Arts.—Monday, December 2nd. At 5 p.m. At John Street, Adelphi, W.C. Cantor lecture on "Physical Chemistry and its Bearing on Chemical and Allied Industries," by Prof. J. C. Philip.

National Association of Supervising Electricians.—Tuesday, December 3rd. At 7 p.m. At St. Bride's Institute, E.C. Paper on "Cable Layouts for Works and Factories," by Mr. A. F. W. Richards.

Roentgen Society.—Tuesday, December 3rd. At 7.30 p.m. Visit to the Radiographic and Electro-Therapeutic Department, King's College Hospital, Denmark Hill, S.E.

Industrial Reconstruction Council.—Tuesday, December 3rd. At 6 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "The Functions of Industrial Councils," introduced by Mr. E. McGegan, of the Ministry of Labour.

Institution of Civil Engineers.—Tuesday, December 3rd. At 5.30 p.m. At Great George Street, S.W. Adjourned discussion on the paper by Mr. R. B. Joyner, on "The Tata Hydro-Electric Power Supply Works, Bombay."

Liverpool Engineering Society.—Wednesday, December 4th. At the Royal Institution, Colquitt Street. At 8 p.m. Paper on "Air Supplies to Boiler Rooms," by Mr. R. W. Allen.

Institution of Electrical Engineers.—Thursday, December 5th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "The Supply of Single-phase Power from Three-phase Systems," by Prof. Miles Walker.

Salford Technical and Engineering Association.—Saturday, December 7th. Visit to the Union Coal Storage Co., Ltd.

London Association of Foremen Engineers.—Saturday, December 7th. At 7 p.m. At the Cannon Street Hotel, E.C. Annual meeting, election of officers, &c.

NOTES.

Erratum.—In the article on "The Grading of Direct-Current Starter Resistances," on p. 484 of our last issue, col. 2, line 16, for "14" read 141 amperes.

Volunteer Notes.—Royal Engineers (Vols.), London Army Troops Companies.—Headquarters: Balderton Street, Oxford Street, W. 1.

Regimental Orders No. 49, by Lieut.-Colonel C. B. Clay, V.D., Commanding. Monday, December 2nd, to Saturday, December 7th.—Drills as usual.

C. Higgins, *Capt.* R.E., *Adjutant.*

The Welfare of the Worker.—The Institute of Hygiene has decided to form an Industrial Council, representative of both capital and labour and medical experts, as a special section of its General Council. The object of this Industrial Council will be to investigate the diseases and disadvantages under which the worker labours, and to prevent them by promoting and spreading a better knowledge of the hygienic measures necessary.

Technical Books for Men on Active Service.—It may be thought that the approach of peace has removed the necessity of sending technical books to our men on active service. This, however, is an entirely mistaken impression; on the contrary, the need is greater than ever, as the time is at hand when our comrades will be returning to civil life, and they wish to prepare themselves as quickly and as thoroughly as possible for the change. They are fully alive to the importance of efficiency, and they do not expect employers to provide them with work simply because they have done their duty so well in the field. Mr. H. Bligh Hill, of the 78th Labour Group, Tanks C.W.S., B.E.F., who appealed to our readers a few weeks ago for technical books, is conducting a lecture course in electrical engineering for the instruction of the men, who are keen on improving their knowledge, and gives practical demonstrations with plant of 1,500 kw. D.C., which is available. From the syllabus of lectures we observe that besides covering a wide range of technology, he is giving a good deal of attention to the mental and psychological aspects of a sound training, and is combining practical operation with theoretical instruction. Any books that our readers have to spare—or to deny themselves of—will be well employed if they are sent to Mr. Hill.

Institution and Lecture Notes.—Royal Society of Arts.—The arrangements for the session include the following:—

Mondays, December 2nd, 9th, and 16th, at 5 p.m. Cantor Lectures: Prof. James C. Philip, O.B.E., M.A., Ph.D., D.Sc., "Physical Chemistry and its Bearing on the Chemical and Allied Industries."

Wednesday, December 4th, 4.30 p.m. B. S. Rowntree, "Housing After the War."

The following papers are to be read after Christmas:—

Sir Dugald Clerk, F.R.S. (subject later).
Sir Herbert Jackson, F.R.S., "Trueman Wood" Lecture.
B. D. Porritt, M.Sc., "The Rubber Industry: Past and Present."
H. Kelway-Bamber, M.V.O., "Railway Transport in the United Kingdom."
W. L. Hichens, "The Wage Problem in Industry."
J. J. Crowley, D.Sc., "The Use of Electricity in Agriculture in Germany."
Sir Frank Heath, K.C.B., "The Government and the Organisation of Scientific Research."
W. L. Lorkin, "Electric Welding and its Applications."
Prof. J. C. McLennan, F.R.S., "Water Powers and Scientific Development in Canada."

The Cantor Lectures on Monday afternoons are:—Prof. J. C. Philip (as above).
Prof. J. A. Fleming, "Scientific Problems of Electric Wave Telegraphy." Three lectures. February 10th, 17th, and 24th.
Prof. W. A. Bone, "Fuel Economy." Three lectures. March 10th, 17th, and 24th.

Juvenile Lectures, Wednesday afternoons, January 1st and 8th:—
Charles R. Darling, "Liquid Drops and Globules." Two lectures.

Electrical Power Engineers' Association.—A representative and enthusiastic gathering of engineers was addressed by the president, Mr. A. L. Lunn, at Cardiff, on Saturday last, and a South Wales Section of the Midland Division of the E.P.E.A. was formed. A Provisional Committee and secretary were elected, and all inquiries should be addressed to the hon. secretary, South Wales Section, Mr. H. W. Jones, "Adper House," Church Village, near Pontypridd, South Wales.

A successful mass meeting was held at the Grand Hotel, Bristol, on Friday evening, November 22nd. Mr. A. J. Ostler (sub-station superintendent, Bristol Corporation) presided. In his address Mr. W. Raymond Jones, the National Secretary, sketched the history of the Association and the work that it had accomplished. He emphasised the necessity of staff engineers being organised in view of the threat of the E.T.U. to get all electrical workers into its ranks. A strong Committee was formed to organise the Bristol and West of England power station engineers. The secretary of the new branch is Mr. F. J. Elliott, 3, Glena Avenue, Knowle, Bristol, who will be glad to have inquiries from prospective members who were unable to attend the Bristol meeting.

The Royal Society.—The Royal Society has awarded the Copley Medal to Prof. H. A. Lorentz, of Leyden, For.Mem.R.S., for his distinguished researches in mathematical physics; the Rumford Medal to Prof. Charles Fabry and Dr. Alfred Perot (jointly) for their contributions to optics; and the Hughes Medal to Mr. Irving Langmuir, of Schenectady, for his researches in molecular physics.

Röntgen Society.—A meeting of the Society will be held on Tuesday next, December 3rd, at 7.30 p.m., at King's College Hospital, Denmark Hill, S.E., when there will be a visit to the Radiographic and Electro-Therapeutic Department. Demonstrations of the apparatus will be given. Members of the Institution of Electrical Engineers are cordially invited to be present.

The Engineering Society, at Bradford, last week, discussed reports on "Electric Power Supply in Great Britain" by the Coal Conservation Sub-Committee and by the Board of Trade Committee. The chairman (Mr. Walter Leach) said it was generally admitted that nothing could contribute more to the successful reorganisation of industry than a plentiful and reasonably-cheap supply of electric power. Prof. Charnock, of the Textile Department of the Technical College, opened the discussion, demonstrating the wasteful nature of the processes involved in power production. The views of successive speakers indicated the feeling that the reports were simply the opinions of the members of the Committees, no evidence being adduced in support, and the reports met with opposition. The discussion was postponed until December 16th, when it is hoped that several electrical authorities will be present.

Last week a lecture, illustrated by lantern slides, on "The Application of Electricity at Douglas Castle Colliery," was delivered by Mr. Robert Crawford, the manager, at the Douglas Hall.

Institution of Electrical Engineers.—At the opening of the meeting on Thursday, last week, the President (Mr. Wordingham) briefly addressed the members on the subject of the collapse of Germany and the vindication of the cause of righteousness and freedom, after which a verse of the National Anthem was sung. A vote of condolence with the relatives of the late Mr. Llewelyn Preece was passed. Mr. J. H. Shaw then read his paper in abstract; the discussion is reported elsewhere in this issue.

Mr. Wordingham raised a question as to the most desirable hour at which to commence the meetings; and it was decided to take a postal vote on the subject.

Mr. Shaw's paper was also discussed at the North-Western Centre on Tuesday last.

Fatality.—The Rotherham Borough Coroner held an inquest, last week, relative to the death of Charles Morris (49), electrician's labourer, who was found dead in the Glasshouse Street sub-station of the Corporation electricity works. The widow stated that she went with her husband's breakfast about 9.30 a.m., and discovered that he was dead. He was bending forward, and his head was apparently held up by something against which he had fallen. The mains engineer stated that the pressure was 3,000 volts alternating. Morris had sufficient technical knowledge to know the danger. The man's dinner was found, and it was supposed that death took place the previous day. A verdict of "Accidental death" was returned.

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British Scientific Instrument Research Association.—This, one of the earliest Associations formed under the scheme of the Department of Scientific and Industrial Research, has secured premises at 26, Russell Square, W.C. 1, where offices and research laboratories will be equipped. The first chairman of the Association was Mr. A. S. Esslemont, whose recent lamented death has been a severe loss to the Association. The Council has elected Mr. H. A. Colefax, K.C., as chairman to fill the vacancy. The vice-chairman is Mr. Conrad Beck, C.B.E., to whose energy and personal influence is largely due the successful formation of the Association. We are informed that almost all the leading optical and scientific instrument manufacturers are members. The Department of Scientific and Industrial Research is represented by Major C. J. Stewart, Capt. F. O. Creagh-Osborne, R.N., C.B., Mr. S. W. Morrison, O.B.E., Col. R. E. Home, D.S.O., R.A., and Mr. Percy Ashley. The Council has recently co-opted as members of its body the Hon. Sir Charles A. Parsons, F.R.S., and Prof. J. W. Nicholson, M.A., D.Sc., F.R.S. Sir Herbert Jackson, K.B.E., F.R.S., F.I.C., has been appointed Director of Research, and Mr. J. W. Williamson, B.Sc., secretary of the Association.

Parliamentary.—*Royal Assent.*—The following Acts have received the Royal Assent:—

Termination of the Present War (Definition) Act, 1918.
Defence of the Realm (Employment Exchanges) Act, 1918.
Wages (Temporary Regulation) Act, 1918.
Ministry of Munitions Act, 1918.
Local Government Board's Provisional Orders Confirmation Acts (Nos. 2, 3, 7, and 8).
Clyde Valley Electrical Power Order Confirmation Act, 1918.
London United Tramways Act, 1918.

Applications for Powers.—The *London Gazette* during the past week has contained notices of application for the following powers:—

Thames Ocean Wharf and Railway.—New company to construct wharf, railways, and other works, electric generating stations, work railways by steam or electricity, supply electrical energy, &c. (Parliamentary agents, Dyson & Co., 23, Abingdon Street, S.W. 1.)

Manchester.—Corporation. Further works in connection with electrical generating station at Davyhulme.

Leeds.—Corporation. Powers to extend the city to include Middleton; tramways and electrical powers.

Chepstow.—Chepstow E.L. and Power Co. Powers to extend its supply to the rural district of Lydney.

Tynemouth.—Corporation. Power to construct and run trolley-vehicle system; agreements with Newcastle-on-Tyne E.S. Co. and Northern Counties Electricity Supply Co. *re* supply of electricity, &c.

Blackpool.—Corporation. Powers to acquire undertaking of Blackpool and Fleetwood Tramroad Co.

Stretford.—U.D.C. Extension of electric supply area; further powers, &c.

Sheffield.—Corporation. Powers for several new tramway sections.

Stockton-on-Tees.—Corporation. Powers to construct and run new tramways, motor-buses, &c.

Middlesbrough.—Corporation. Powers for new tramways, trolley vehicles, purchase of Imperial Tramways; agreements with electric supply companies, &c.

Petrol-Electric Vehicles.—The various systems of transmission which are commonly classified as petrol-electric, but most of which ought more accurately to be described as electric or electromagnetic, may, says the *Commercial Motor*, take a more prominent place in the future than they have yet held. Such systems undoubtedly have considerable advantages in connection with road trains and also in connection with passenger services where frequent stopping and starting is necessary. The smooth acceleration given by an electric transmission affords a reason why its opportunity of becoming popular is to be found particularly in connection with omnibus services rather than with goods-carrying vehicles of normal capacity.

The Batti-Wallahs' Anti-German Propaganda.—To-night at 6.30 o'clock, at the Holborn Restaurant, there will be a dinner of the Batti-Wallahs' Society, after which members will discuss the campaign in favour of boycotting German-made goods upon which it is proposed that the Society shall embark in conjunction with the Merchant Seamen's League. The present outline of the scheme is that with the approval of the League an electrical branch should be formed to organise the industry and act as a second line of defence in the League's campaign against the invasion of British markets by German-made goods. After members have had an opportunity of expressing their views in a quite informal way, a Sub-Committee will be appointed. Those who wish to be present at the dinner should 'phone Mr. A. J. Greenly, the Hon. Entertainment Secretary, "Gerrard 7587"; "Regent 3661."

The E.T.U. and Industrial Councils.—The Manchester *Daily Dispatch* states that a ballot is being taken by the Electrical Trades Union, the United Machine Workers, the Joiners, and semi-skilled and unskilled Unions on a scheme for the formation of a National Joint Industrial Council for the electrical contracting industry. Its object will be to secure the largest possible measure of joint action between employers and workpeople for the development of the industry as a part of national life, and for the improvement of the conditions of all engaged in the industry. Among the more specific objects will be regular considerations of wages, hours, and working conditions, measures for regularising production and employment, consideration of machinery for the settlement of differences, and the establishment of District Councils and Works Committees.

Transport Facilities in the United Kingdom.—The Select Committee on Transport has issued a second report (No. 136; price 3d.), containing important statements of opinion. Dealing first with the subject of the railways, the Committee points out that their history records a continuous process of absorption of small undertakings by larger ones, followed by the amalgamation of the latter, the tendency being towards widening the area of operation under a single management, and putting an end to uneconomical competition. The trend is towards the point where a single system will have been established, and "springs from the natural desire of the men who control the railways of the country to carry on the business of railway management in the most efficient and economical manner. This desire is one with which it is impossible not to sympathise. It appears to be inherent in the conditions in which all large-scale modern businesses are conducted, and it is extremely doubtful whether it can, or should, be resisted." During the war the railways have remained under the management of their own directors, subject to the control of a Railway Executive Committee of 12 general managers, unification of management being thus effected without unification of ownership. The high efficiency witnessed in the working of the railways, in spite of the greatly increased demands of the very large Government traffic and the increased volume of both passenger and goods traffic, is attributed by the Committee to the patriotic exertions of all concerned, and it is stated that the British railway service has been superior to that of any of the other belligerent countries. Evidence was given before the Committee by members of the Railway Executive Committee to the effect that if a policy of unification of management, combined with a pooling of assets of the railway companies, were adopted, it should be possible to give the public better service at less cost. The Committee, therefore, considers it desirable that there should be a unification of ownership as well as of management of the main railway systems; whether the State or one large joint-stock concern owns the railways is regarded as immaterial. This is the only way by which large economies can be effected. Moreover, war conditions and the complete elimination of competition have revolutionised old-established methods of operation, and introduced problems which "seem to require solution by some process of continued unification." Hence the Committee arrives at the conclusion "that the main railway systems of the United Kingdom should be brought under a unified ownership and managed as one system" if the internal transport facilities are to be developed and improved with efficiency and economy, and "with due regard to the interests of the proprietors, the railway staffs, and the general community."

The waterways are unimportant in comparison with the railways, though they possess a total mileage of 4,670 miles, as compared with the railway mileage (first track) of 23,911 miles. During the war they have relieved the railways of a considerable volume of heavy traffic. Further amalgamation of ownership would be advantageous here also. Road transport should be encouraged and extended, especially in agricultural districts, but the Committee has not been able to pursue this subject far.

In Part III of the report the Committee lays stress on the unanimity with which a policy of unification, or, at least, amalgamation, has been advocated by previous Royal Commissions on transport facilities, and considers various methods of organisation, concluding that the organisation of the transport agencies of the country—particularly the railways—cannot be allowed to return to its pre-war position. In Part IV the question of efficient Government supervision and regulation is briefly considered. In Part V it is stated that Mr. A. W. Gattie's company wishes to erect an experimental plant to carry out tests of his system on a practical scale, and the Committee recommends that the company be allowed to raise new capital, amounting to £100,000, for this purpose. The proposals of the Royal Commission on Canals are regarded by the Committee as calling for most convincing evidence of utility before a sum of £38,000,000 is expended on the improvement of property which is at present valued at £6,000,000, but the Committee concludes that outlay on a more modest scale to maintain and improve the existing waterways would be justified. Further inquiry is recommended. In this connection the Committee points out that the national scheme of electricity supply, by profoundly modifying the course of internal coal traffic, will reduce the need for canal transport facilities for coal for power production at inland centres. Part VI deals with the report of a Sub-Committee on Irish waterways and harbours, and recommends immediate inquiry with a view to the speedy execution of a number of valuable improvements, and that the existing unified control should be maintained until new arrangements have been made for the reorganisation of the Irish railways and waterways. The report is accompanied by a number of appendices.

E.T.U. Concert.—The London Station Engineers' Branches of the Electrical Trades Union will hold a concert in aid of their Benevolent Funds, on Thursday, December 5th, at the Surrey Masonic Hall, Camberwell New Road, commencing at 7 p.m.

German Scientists.—Are They Repentant?—An evening paper says that members of the scientific bodies of the Allied countries have been holding a conference in Paris to decide the attitude to be adopted towards German scientists. The utterances of some of them shortly after the war, concerning England and Englishmen, will not soon be forgotten.

Patent Application.—The Universal Turbine Co. has applied for the restoration of Patent No. 614/13 ("Improvements in fluid pressure or steam turbine engines"), granted to Reginald Haddan. Notices of opposition must be filed before January 27th, 1919.

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Openings for British Electrical Trade in Holland.—During the last few weeks we have received communications from several correspondents in Holland and Belgium who have had considerable experience of the electrical business there, and are impressed with the excellent prospects for British electrical manufactures in Holland and the Dutch Colonies. They are disappointed that their previous efforts to induce our firms to establish connections have failed, but they think that now that Germany is thoroughly beaten British manufacturers will be free to enter into engagements. One of our correspondents was for eight years a travelling salesman in electrical lines on behalf of Continental firms, has excellent connections, and knows the requirements of the Dutch market. We shall be pleased to forward letters to him if they are addressed "X," care of The Editor, ELECTRICAL REVIEW.

Our Electrical Duty in Belgium.—Communications reach us from time to time from correspondents who are interested in the future of the electrical industry in Belgium. It appears that while the country was occupied by the enemy, British firms were, more or less naturally, indisposed to make definite arrangements. Probably recent events will have altered that attitude, for we shall require to do all that lies in our power to enable Belgian traders and manufacturers to re-establish their commerce and industry as rapidly as possible. The fear has been expressed to us lately, as it was with considerable force by Belgian electrical men who came to this country soon after the outbreak of war, that Belgium will be driven into the arms of those with whom her people do not desire to trade, unless we are prepared to take a full share in supplying their wants. An alliance between British and Belgian electrical men is greatly to be desired, and the present conditions seem to us to make the time ripe for it. There must be many Belgian electrical engineers and travellers who could efficiently represent British manufacturers there, and we hope that the matter will receive that prompt and serious attention which it deserves.

Appointments Vacant.—Charge engineer, for the Alloa Corporation Electricity Department. See our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Mr. W. C. BENON, engineer and manager of the Kilmarnock Corporation electricity works, having been offered an appointment at St. Helens, the Kilmarnock Town Council has increased his salary to £650 per annum, with a three years' agreement, in order to retain his services.

Accrington Tramways and Electricity Committee recommends the T.C. to increase the salary of Mr. H. PILLING, tramways manager, from £400 to £500 per year.

The Coventry Electricity Committee recommends increases in salary as follows:—Mr. G. TOUGH, engineer and manager, from £900 to £1,050; Mr. W. J. MARSTON, assistant manager, from £400 to £500; Mr. E. V. NEWBOLD, chief clerk and accountant, £325 to £400; Mr. J. R. SUTHERLAND, station superintendent, from £325 to £350. The Salaries Committee, after considering the recommendations, have adjourned the matter for further inquiry.

Out of 114 applicants for the post of burgh electrical engineer at Stirling (£300), three have been selected for further consideration.

General.—According to the *Times*, the Academic Council of the Senate of London University last week reported the resignation by Sir Herbert Jackson, F.R.S., in view of his appointment as Director of the British Scientific Instrument Research Association, of the Daniell Professorship of Chemistry attached to King's College. The Senate conferred upon him the title of "Emeritus Professor of Chemistry in the University of London," and appointed as his successor Lieut.-Colonel A. W. Crossley, C.M.G.

Mr. DONALD MCNICOL, for nine years assistant engineer of the Postal Telegraph Cable Co., New York, on October 21st became editor of the *Telegraph and Telephone Age*, in succession to the late Mr. T. R. Taltavall.

Councillor G. A. HASEMER has been elected chairman, and Councillor W. R. POWER vice-chairman, of the Hackney Electricity Committee.

Alderman J. P. SMITH, chairman of the Barrow T.C. Electricity Committee since 1899, has resigned his membership of the Council after 27 years' service.

According to a daily paper, Signor ALBERTO PIRELLI, of the Italian Ministry of Munitions, has arrived in London from Rome.

On Saturday last at the Simplex Co.'s works in Birmingham, Mr. J. F. AVILA was presented with a weather glass by the workpeople and staff. Mr. T. Birkett, who made the presentation, said that the Simplex manufactures had been well maintained during Mr. Avila's administration throughout the war period. He was now returning to take up his old position as London and South of England manager. Mr. Avila, in replying, said he was convinced that the troubles of peace were not likely to be greater than those of war. He was confident from his experience at the works that they would be able to satisfactorily meet the reconstruction period.

Roll of Honour.—Corporal W. FARQUHARSON, R.E., attached R.N.D., an apprentice with Messrs. Lowdon Bros., electricians, Dundee, has been awarded the Military Medal for maintaining communication and laying lines under heavy shell fire. He was awarded the Meritorious Service Medal in June last.

Gunner G. F. BURSCOUGH, who has been killed in action, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Private J. W. NEILD, King's Liverpool Regiment, who has died in hospital at Warrington from pneumonia, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Lance-Corporal E. J. LOWE, Manchester Regiment, who has died of wounds, was employed by the General Electric Co., Ltd., Manchester.

Private H. ANDREW, R.E., who has died from pneumonia, at Chepstow, was a former employé in the Salford Corporation electricity department.

Staff-Lieutenant BASIL EGERTON COOK, who died of pneumonia at the Officers' Red Cross Hospital, Devizes, Wilts., on November 7th, at the age of 22, joined the Army late in 1915, and received his commission in France early in 1916. He was invalided home late in that year suffering from shell-shock and gas poisoning. Subsequently he received a staff appointment, and was engaged on intelligence work at home and abroad. He was an accomplished linguist, and expert at all matters in connection with wireless telegraphy, being stationed at the Army Wireless Station, Devizes, when he died. He was married at Devizes last June. Before the war he went through various departments at the Peel-Conner Telephone Works, Ltd., Salford, and the General Electric Co., Ltd., Manchester, and when he joined the Army was in the engineering and cable department of Messrs. Charles Macintosh & Co., Ltd., Manchester. He was the eldest son of Mr. W. H. Cook, purchasing agent of the Peel-Conner Telephone Works, Ltd., who has been in the employ of the General Electric Co., Ltd., and its associated companies for upwards of 30 years.

Sapper W. E. WALSH, R.E., who has died from pleurisy at a Birkenhead hospital, was an employé of the old National Telephone Co., at Wakefield and Dewsbury.

Driver B. GOUGH, R.H.A., formerly the electrical engineer at the Brighouse Empire, and later with Messrs. Brookes, Ltd., Halifax, has died of pneumonia in France.

Wireless Operator J. W. SUMMERS, R.A.F., has died in hospital at Rouen from bronchial pneumonia.

Private C. ISITT, who has died in France from bronchial pneumonia, was formerly in the employ of Mr. Dunn, electrical engineer, of Ramsgate.

Sergeant H. EASTWOOD, M.M., who has fallen in action, was on the staff of the Yorkshire Electric Power Co., Ravensthorpe.

Gunner S. SMITH, R.F.A., who has died of wounds and gas poisoning, was on the staff at the Rotherham Corporation electricity works.

Private I. B. TAYLOR, Northumberland Fusiliers, who has died of wounds in Italy, was an electrician in the employ of Messrs. Hudson, Scott & Co., of Carlisle.

Staff-Sergeant J. L. FERGUSON, R.F.A., twice mentioned in dispatches, who was killed on November 4th, was electrical engineer at Oakenshaw Colliery, Wellington, Co. Durham. Previously he was engineer at Bradley shops of the Consett Iron Co.

Obituary.—MR. J. LEACH.—Mr. John Leach, of Darwen, who has died at the early age of 32 years, was manager for Mr. Thomas Barton, electrical engineer, Blackburn.

MR. T. SHELLEY.—The death took place on November 18th of Mr. Thomas Shelley, who was for upwards of 40 years on the staff of the Liverpool Corporation tramways.

MR. W. DITCHFIELD.—The death occurred recently, after a brief illness, at the age of 38 years, of Mr. W. Ditchfield, electrician, of Audley (Cheshire).

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

English Electrical Co., Ltd.—Satisfaction in full on November 4th, 1918, of debenture dated 1910 and 1911, securing £10,000.

S. C. C., Ltd.—Debenture dated November 11th, 1918, to secure £1,750 charged on the company's undertaking and property, present and future, including uncalled capital and goodwill. Holder: Mrs. E. A. Spencer, The Hall, Harmondsworth, Middlesex.

Globe Telegraph & Trust Co., Ltd. (7,465).—Capital, £5,000,000 in £1 shares (250,000 pref.). Return dated July 16th, 1918, 181,127 pref. and 181,127 ord. shares taken up; £438,115 paid; remainder considered as fully paid. Mortgages and charges: Nil.

Cleveland & Durham Electric Power, Ltd. (89,539).—Capital, £700,000 in 350,000 pref. and 350,000 ord. shares of £1 each. Return dated April 11th, 1918. 333,705 pref. and 157,600 ord. shares taken up; £411,003 paid on 331,935 pref. and 79,068 ord.; £80,302 considered as paid on 1,770 pref. and 78,532 ord. Mortgages and charges: £384,900 (including £10,000 issued as collateral security).

General Accessories Co., Ltd. (104,464).—Capital, £3,000 in 1,580 6 per cent. pref., 920 5 per cent. pref., and 500 ord. shares of £1 each. Return dated August 28th, 1917 (filed July 29th, 1918). £1,580 paid; £1,420 considered as paid. Mortgages and charges: Nil.

Ely Gas & Electricity Co., Ltd.—Satisfaction to the extent of £500 on July 31st, 1918, of debentures dated October 1st, 1908, securing £3,900.

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CITY NOTES.

Manáos Tramways and Light Co., Ltd.

Mr. G. Watson, presiding at the annual meeting on November 15th, said that the improvement in the net earnings was chiefly due to the better rate of exchange, viz., 13.1d. as against 12d. Summarising the results of the tramways, lighting, and construction departments, he said that the general conclusion from the figures was that the business had neither developed nor diminished to any appreciable extent. As the company had held its own under unfavourable conditions a certain amount of confidence in its future was reasonable. A number of facts were advanced to give support to such expectations. A contract had been entered into with the Manáos Harbour, Ltd., for the supply of electric light and power to the premises and equipment of the harbour, and this would come into effect as soon as certain auxiliary machinery could be shipped out. The value of stores increased by nearly £3,000, chiefly represented by a substantial stock of wood fuel accumulated during the favourable season. This valuable asset would enable them to keep the cost of current generation at its present low level, irrespective of coal prices, which would probably remain high for a considerable period in remote places like Manáos. They could not expect that the cessation of hostilities would be conducive to an immediate resumption of commercial activities or to a sudden return of pre-war prosperity. Quite to the contrary, districts like the Amazon Valley could not be expected to react before an appreciable lapse of time; the disturbance of trade and industry had been too deep, the effect on the population and their activities too serious, to warrant the hope that conditions would once more become normal without passing through a transitory stage of slow and gradual improvement.

British Westinghouse Electric and Manufacturing Co., Ltd.

The adjourned extraordinary general meeting of the preference shareholders relative to the re-arrangement of the share capital was held on Monday, at Hamilton House. Mr. J. Annan Bryce, M.P., who presided, reminded the meeting that it stood adjourned for the purpose of hearing the result of a conference which took place on Thursday last between the financial group which was supporting the company and certain representatives of the preference shareholders. He said that at the conference, after a long discussion, certain concessions were made by Mr. Dudley Docker as representing the financial group, and following upon that, at a conference between certain of the preference shareholders, it was decided to accept the terms. Those terms would be embodied first of all in one important point by an amendment in the resolution as proposed at the last meeting, and as regarded the other important point in a new Article of Association. The first of the concessions that was made was that the dividend, instead of being 8 per cent. simple, should be 8 per cent. cumulative. The second concession was that there should be a right to conversion from preference shares into ordinary at any time with two years after the first allotment of the new ordinary shares. Those were two very important concessions. One very great objection that was raised by Mr. Herbert Smith at the last meeting was that there was no chance under the scheme as proposed of the preference shareholders ever seeing back the £5 which they originally subscribed for their shares. He should say that at present not more than a quarter of those who held the preference shares were original holders—many had come in since at a very low price, and quite a large number would do extremely well under the arrangement as it stood last week. However, it had now been agreed to alter the scheme so that those who paid a low price as well as those who bought high would for two years after the first issue of the new ordinary shares have the right of conversion at the rate of two new ordinary shares for one old preference share at par. He concluded by formally proposing the resolution as follows:—

That this meeting of the holders of the preference shares of the company consents that, as and from the passing by a separate meeting of the holders of the ordinary shares of the company consenting to the modification of the rights and privileges attached to the existing ordinary shares by the conversion of such shares into preference shares ranking *pari passu* with the existing preference shares, the rights and privileges attached to the preference shares of the company shall be modified so that the preference shares of the company shall as from December 31st, 1917, be entitled *pari passu* with the existing ordinary shares to a cumulative preferential dividend, at the rate of 8 per cent. per annum on the amounts paid thereon before any dividend is paid on any new ordinary shares or on the deferred shares of the company and to the repayment out of the assets distributable amongst the members in a winding up *pari passu* with the holders of the existing ordinary shares of the company of £2 a share before any sum is paid in respect of any new ordinary shares or of the deferred shares of the company, but to no further participation in the profits or assets of the company, and hereby consents to the cancellation of any further rights now attached to the preference shares.

Mr. Robert Benson, chairman of the Merchants' Trust, in seconding the resolution, remarked that his company was the largest holders of preference shares, apart from Mr. Dudley Docker's financial group. Proceeding to refer to the conference at which he was present, Mr. Benson said that the scheme as now agreed upon was, in his opinion, a fair and reasonable one all round, and he hoped it would be acceptable to all the preference shareholders. He represented 10,000 shares held by the Merchants' Trust, who were subscribers under the original prospectus, and they had never sold a single share. They had, of course, written down the value of the shares in their books, but their paramount object was to get the whole value back some time if they possibly could, and under the new scheme they would have the chance of doing so. Mr. Dudley Docker and his friends proposed to create five million new ordinary shares behind the preference, and to issue them at par as fast as the necessities of the company for new electrical plant required it. He believed that the field was open for the British Westinghouse Co. to develop as a going concern upon the foundations already laid, especially now that the great German company, with its 50 millions of capital, was not likely to be permitted any longer to undersell British work or British workmen. Reconstruction, he believed, offered the company a great opportunity. Very soon there was to be an issue of one million ordinary shares of £1 each, and the subscription was to be guaranteed at par, without underwriting, by the Metropolitan Carriage Co. That million was to be followed by other amounts as further capital was required. Each million of capital put in behind the preference shares, assuming it was worth 6 per cent. per annum, meant a margin behind them of £60,000 a year, so that when the whole contemplated five million of new ordinary share capital was issued behind them there would be a margin of £300,000 a year to guarantee the 8 per cent. upon their cumulative preference shares. With regard to the right of conversion, the main difference between the two parties at the conference was over the length of the option. He (Mr. Benson) wanted a free option unfettered by time, but they had to go away content with an option for 18 months. Later on however, on the same evening, he saw Mr. Docker again, and that gentleman voluntarily raised the length of the option to two years from the date of the first issue of new ordinary shares, and, in his opinion, it was a fair deal. Mr. Docker, in the offer he had made, showed that he recognised the value of the support even of a minority who were in his power, and he (Mr. Benson) believed that if they all pulled together as a body loyal to the directors and the management, they could contribute to, as well as share in, their success. Mr. Westinghouse was a great inventor and a great mechanic, but he was not a financier, and he lost his money. On the other hand, he was inclined to think that Mr. Dudley Docker was a money-maker.

Mr. Herbert Smith, in supporting the resolution, said that when he attended the conference he went there quite naturally with a desire to surrender as little of their rights as possible, and to get as much as they could in exchange—quite obviously the exact reverse of the attitude of those with whom they had to confer. He could only say that, in his opinion, the arrangement which had been come to was a thoroughly reasonable one, and he thought that, having regard to the fact which Mr. Benson had pointed out, that they were in a minority, they had been received very fairly by Mr. Dudley Docker's financial group, and the terms which they had made were such as they could thoroughly recommend the preference shareholders to accept.

Mr. Varley and other shareholders having spoken in support of the resolution, it was carried with two dissentients.

Subsequently the necessary resolution to carry the scheme into effect was passed at a meeting of the ordinary shareholders, and at an extraordinary general meeting of both classes of shareholders a series of resolutions were carried altering certain of the Articles of Association with the same object in view.

International Light & Power Co., Ltd.—Mr. Follett Holt, presiding at a meeting of shareholders in London, said that there had been no break in the steady growth of the business of the Caracas undertaking since it was acquired. The number of connections to the electric supply mains was in excess of 7,000, which was a high figure for a South American city of the size of Caracas, and the maximum had not been reached. A dividend on account of accrued arrears equivalent to two quarters at the rate of 6 per cent. per annum had just been paid to the preference shareholders, and the board was considering how to deal with the remaining arrears. During the war they had passed through very difficult times, and he expressed their thanks to Messrs. J. G. White & Co., Ltd., who had looked after the technical management of their subsidiaries and controlled them with care and skill, bringing them through into comparative safety. The chairman asked shareholders to sign proxies for use at the annual meeting in Toronto on December 30th.

Western Telegraph Co., Ltd.—The report to June 30th, 1918, states that the revenue was £1,465,911, and the working expenses were £528,602. After providing £32,747 for debenture stock interest and £385,521 for income-tax and excess profits duty, £519,041 remains, plus £35,433 brought forward. £250,000 has been transferred to general reserve, £30,000 to land and buildings depreciation, £50,000 to maintenance ships reserve fund, £25,000 to provision on account of investment fluctuations. The total distribution for the year (dividend and bonus) is 8 per cent., free of tax, leaving £33,130 to carry forward. Sir J. Denison Pender has been elected chairman.

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Bogota Telephone Co., Ltd.—The report to June 30th, 1918, states that the equipment at Bogota has been maintained in an efficient condition. The company has been fortunate in being able to proceed further with the installation of the additional plant, in spite of the difficulty in exportation. It is hoped that the new capital expenditure involved will enable the company to improve the system and meet the demands for service at an early date.

Monte Video Telephone Co., Ltd.—After providing for all charges, income-tax, and excess profits duty the net profit for the year ended July 31st, 1918, was £27,780, against £26,324. £6,332 was brought forward. After applying £8,000 to depreciation of property and plant, transferring £9,000 to reserve for renewals, and paying final dividends of 3 per cent. free of tax on the ordinary shares, making 6 per cent. for the year, £8,428 remains to be carried forward.

Callender's Share & Investment Trust, Ltd.—A financial paper announces a dividend of 3½ per cent. (8 2-5d. per share), less income-tax, for the half-year, making 6 per cent. for the year; £500 to reserve; £741 written off preliminary expenses and cost of debenture stock issue; £5,305 forward.

Siemens Bros. & Co., Ltd.—According to statements appearing in several London evening papers this company is about to make a public issue of capital consisting of 80,000 shares of £5 each, offered at par, and £500,000 debenture stock (4½ per cent.), at £87 10s.

British Electric Traction Co., Ltd.—Dividend on the 6 per cent. cumulative preference stock for the half-year ended September 30th.

Ruston & Hornsby, Ltd.—Interim dividend on the ordinary shares at the rate of 5 per cent. per annum for the half-year ended September 30th.

J. F. & G. Harris, Ltd.—Net profit for year ended June, 1918, £655, plus £124 brought forward. Income-tax and preference dividends £379; directors' fees £75; £325 carried forward.

Chloride Electrical Storage Co., Ltd.—Interim dividend of 5 per cent., free of tax, on the ordinary shares.

Power Gas Corporation, Ltd.—Dividend, 6 per cent., less income-tax.

Canadian Western Natural Gas, Light, Heat & Power Co.—Dividend 2 per cent. for the year ended September 30th.

STOCKS AND SHARES.

TUESDAY EVENING.

VARYING degrees of normality are noticeable in the Stock Exchange markets. The depression in prices that succeeded the first burst of enthusiasm on the armistice news has been followed in its turn by another upward movement, and by a return of better business. Profit-snatchers were soon cleared out of the way. Steady investment buyers have taken their place. Plenty of money is available for tempting securities, and knowledge of this is no doubt responsible for the rumours as to large numbers of new issues being ready for subcription as soon as the Treasury relaxes its regulations in regard to offers of shares.

The appeal by Sir Rider Haggard for some scheme whereby electricity could be brought to the door of every cottage in the Kingdom has left the Stock Exchange rather cold, for the reason that most of the many efforts made in this direction during the past five-and-twenty years have met with failure. The idea is no new one. Big financial interests have bent their energies and spent their money in trying to induce this same result. Every effort has been made to get large employers to take current, to persuade the cottager to use electricity. With slender avail, however. A few successes made the failures more emphatic. Maybe the war, jostling old ideas into limbo, will work the change which peace-time merely toyed with. Given a readiness to grasp at improvement, there will be an equal readiness—despite past disappointment—to provide the power. Apparently the Government is alive to the modern need, and when the immediate post-war problems are dealt with, a comprehensive national scheme may be introduced on lines already roughed out by the Parliamentary Commission.

Meanwhile, the share market continues quiet and firm. Bromptons continue to advance, and Chelseas have gained a further 5s. Edmundson's are good, with rises in the ordinary to 12s., preference to 3¼, and non-cumulative preference to 1¼. British Westinghouse preference have rallied to 2¾. General Electric ordinary shed 5s., but Fraser & Chalmers spurted to 32s.

Home Railway stocks have shaken off their recent heaviness, and a feature is the sharp recovery in Metropolitans and Districts. The Underground Railways group is steady. A second report is published by the Select Committee on Transport, advocating, amongst other things, a unification of the railway industry under public or private control. As, is well known, the Government have the power, through an ancient Act of Parliament, to take over the railways on the basis of 25 years' purchase calculated on the average dividend of the past three years. Nationalisation would probably vary such terms now. The Stock Exchange view is that nothing is likely to be done yet awhile, although it is recognised that the handing back of the railways to their proprietors is not the easy matter that may be assumed on the face of it.

The flourishing Adelaide Electric Supply has declared a final dividend of 7 per cent., free of tax, making 12 per cent. for the year, and the Melbourne Electric Supply, little less prosperous, announces a 6 per cent. tax-free final dividend, making 10 per cent. for the year. Canadian Electrical bonds are better, Kaministiqua fives at 87 and Electrical Development of Ontario fives at a point less. British Columbia issues show big rises. Brazilians are also good, Tractions recovering 1 and Rio Tramway Firsts hardening to 92, Sao Paulo Consolidated stock to 81.

Marconis have thrown off their recent depression, and the price of the parent shares recovered to 4⅛ before a slight reaction occurred. Americans picked up to 32s. 3d., and Marconi Marines to 3 11/16. Canadians continue quiescent about 14s. 3d. The cable list is uninteresting. The Oriental Telephone and Electric Co. has decided to return the useful sum of 26s. per share to its proprietors, "being part of the moneys resulting from the conversion into money and collection of certain capital assets." This is just about what the market anticipated that the bonus would be likely to come to. Great Northerns are £1 lower, and Eastern ordinary fell a point. Telegraph Constructions continue their rise, hardening to 48½.

Foreign descriptions are still popular. The strength of Brazilians has already been noticed. Mexico Tramways Common are up to 41; the bonds are also better. Telephone of Egypt 4½ per cent. debenture has gained 2 points at 72. Anglo-Argentine Tramways preference shares are both 1/16 harder. Other industrials keep firm. Rubber shares are gaining more support again. Armament and explosive issues, despite the armistice, are steadily mounting. But copper and other base-metal shares are dull throughout.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Nov. 26, 1918.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	9	10	7⅛	+ ¼	£7 0 6
Charing Cross Ordinary	5	4	3½	—	5 14 4
do. do. do. 4½ Pref.	4½	4½	8½	—	6 18 4
Chelsea	8	5	8¼	+ ½	6 9 0
City of London	8	8	13½	—	5 18 6
do. do. 6 per cent. Pref.	6	6	10⅜	—	5 18 5
County of London	7	7	11¼	—	6 5 7
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	6	7	5½	—	6 7 8
London Electric	Nil	Nil	1⅜	—	Nil
do. do. 6 per cent. Pref.	4	5	4	—	6 5 0
Metropolitan	3	4	8½	—	6 3 1
do. 4½ per cent. Pref.	4½	4½	3½	—	6 18 6
St. James' and Pall Mall	8	9	7⅛	—	6 6 4
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	7⅛	—	6 6 4
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	99	—	6 1 0
do. Def.	1½	1½	23⅜	—	6 8 6
Chile Telephone	8	8	7⅜	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	15¾	—	*5 1 7
Eastern Tel. Ord.	8	8	160½	—1	*4 19 7
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 5
do. do. Pref.	6	6	10½	—	5 14 3
Great Northern Tel.	24	22	83	—1	6 13 5
Indo-European	13	13	58½	—	5 11 0
Marconi	15	20	4⅛	+ ½	4 4 0
Oriental Telephone Ord.	10	10	3⅛	—	2 17 2
United R. Plate Tel.	8	8	7⅛	+ 1/16	*5 4 0
West India and Panama	6d.	1/3	1 11/16xd	—	*8 12 6
Western Telegraph	8	8	16½	—	*4 15 7
HOME RAILS.					
Central London Ord. Assented	4	4	65½	—	6 2 3
Metropolitan	Nil	1	39½	+3	8 7 10
do. District	Nil	Nil	26	+1½	Nil
Underground Electric Ordinary	Nil	Nil	8½	+ ⅛	Nil
do. do. "A"	Nil	Nil	9/	—	Nil
do. do. Income	6	4	88½	—	*4 10 5
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	4 15/16	+ 1/16	—
do. do. 2nd Pref.	5½	—	3 15/16	+ 1/16	—
do. do. 5 Deb.	5	5	77½	—	6 9 0
Brazil Tractions	—	—	58	+1	—
Bombay Electric Pref.	6	6	10⅜	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	66xd	+2½	7 11 5
do. do. Preferred	Nil	Nil	52½	+4	Nil
do. do. Deferred	Nil	Nil	48½	+2	Nil
do. do. Deb.	4½	4½	63	+1	6 17 3
Mexico Trams 5 per cent. Bonds	Nil	Nil	67	—	Nil
do. 6 per cent. Bonds	Nil	Nil	55	+2	Nil
Mexican Light Common	Nil	Nil	40	—	Nil
do. Pref.	Nil	Nil	50	—	Nil
do. 1st Bonds	Nil	Nil	73	+1	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	8⅜	—	4 2 4
British Aluminium Ord.	10	10	1⅞	— 3/16	5 14 4
British Insulated Ord.	20	20	3½	—	4 9 0
British Westinghouse Pref.	7½	7½	2⅜	+ 1/16	5 9 1
Callenders	20	35	9⅜	— ⅛	6 9 10
do. 5 Pref.	5	5	5⅛	—	—
Castner-Kellner	22	20	3⅝	—	5 10 4
Edison-Swan, "A"	—	—	⅛	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	10	1⅛	—	7 12 6
Gen. Elec. Pref.	6	6	10⅝	—	6 2 4
do. Ord.	10	10	17⅜	— ½	*5 12 8
Henley	25	25	2½	—	5 11 4
do. 4½ Pref.	4½	4½	4	—	5 13 6
India-Rubber	10	10	17½	—	*5 14 8
Telegraph Con.	20	20	48½	+ ½	*4 19 0

*Dividends paid free of Income Tax.

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AMERICAN EXPORTS OF ELECTRICAL GOODS.

The following figures, showing the exports of electrical goods from the United States during the year ended June, 1917, are taken from the recently-issued trade statistics; figures for 1915-16 have been added for purposes of comparison, and notes of any increases or decreases given :—

	Dollars. 1915-16.	Dollars. 1916-17.		Dollars. Inc. or dec.
Telegraph instruments.—				
To Denmark	17,000	17,000		—
,, Canada	26,000	50,000	+	24,000
,, Central America	8,000	11,000	+	3,000
,, Mexico	41,000	14,000	−	27,000
,, Colombia	1,000	12,000	+	11,000
,, Argentina	2,000	5,000	+	3,000
,, Cuba	2,000	15,000	+	13,000
,, Brazil	1,000	9,000	+	8,000
,, Great Britain	23,000	94,000	+	71,000
,, Other countries	28,000	312,000*	+	284,000
Total	149,000	539,000	+	390,000

* Italy $141,000, China $15,000, Japan $26,000.

Telephone instruments.—				
To United Kingdom	582,000	51,000	−	531,000
,, Canada	161,000	213,000	+	52,000
,, Central America	20,000	13,000	−	7,000
,, Mexico	20,000	19,000	−	1,000
,, Cuba	80,000	190,000	+	110,000
,, Brazil	48,000	232,000	+	184,000
,, Colombia	11,000	20,000	+	9,000
,, Ecuador	11,000	21,000	+	10,000
,, Japan	74,000	148,000	+	74,000
,, Australia	62,000	56,000	−	6,000
,, Italy	137,000	230,000	+	93,000
,, Other countries	123,000	761,000*	+	638,000
Total	1,329,000	1,954,000	+	625,000

* Russia $246,000, China $117,000.

Other electrical instruments and appliances.—				
To Canada	2,693,000	5,298,000	+	2,605,000
,, Mexico	314,000	400,000	+	86,000
,, Panama	212,000	299,000	+	87,000
,, Cuba	558,000	981,000	+	423,000
,, Argentina	412,000	760,000	+	348,000
,, Brazil	497,000	715,000	+	218,000
,, Japan	411,000	1,019,000	+	608,000
,, Philippine Islands	177,000	146,000	−	31,000
,, Australia	520,000	821,000	+	301,000
,, United Kingdom	3,490,000	4,620,000	+	1,130,000
,, France	592,000	1,583,000	+	991,000
,, Italy	910,000	2,186,000	+	1,276,000
,, Norway	678,000	824,000	+	146,000
,, Russia	452,000	1,210,000	+	758,000
,, Other countries	2,057,000	3,675,000*	+	1,618,000
Total	13,973,000	24,537,000	+	10,564,000

* Chile $625,000, China $281,000.

Gas engines, stationary.—				
To Canada	58,000	63,000	+	5,000
,, Argentina	4,000	5,000	+	1,000
,, Australia	32,000	66,000	+	34,000
,, Europe	146,000	335,000	+	189,000
,, Other countries	112,000	249,000*	+	137,000
Total	352,000	718,000	+	366,000

* Japan $23,000.

Electric motors.—				
To France	334,000	387,000	+	53,000
,, United Kingdom	380,000	555,000	+	175,000
,, Canada	638,000	1,286,000	+	648,000
,, Panama	102,000	33,000	−	69,000
,, Mexico	49,000	107,000	+	58,000
,, Cuba	140,000	289,000	+	149,000
,, Argentina	54,000	104,000	+	50,000
,, Brazil	52,000	126,000	+	74,000
,, Chile	91,000	310,000	+	219,000
,, British India	69,000	114,000	+	45,000
,, Japan	139,000	195,000	+	56,000
,, Australia	686,000	720,000	+	34,000
,, South Africa	154,000	204,000	+	50,000
,, Russia-in-Europe	614,000	261,000	−	353,000
,, Italy	147,000	216,000	+	69,000
,, Spain	90,000	205,000	+	115,000
,, Other countries	480,000	778,000*	+	298,000
Total	4,219,000	5,890,000	+	1,671,000

* China $126,000.

Steam engines, stationary.—				
,, Canada	142,000	195,000	+	53,000
,, Cuba	133,000	195,000	+	62,000
,, Mexico	17,000	23,000	+	6,000
,, Brazil	2,000	21,000	+	19,000
,, Philippine Islands	12,000	6,000	−	6,000
,, Other countries	106,000*	485,000†	+	379,000
Total	412,000	925,000	+	513,000

* Venezuela $18,000.
† Russia $310,000, Chile $13,000, Australia $11,000.

	Dollars. 1915-16.	Dollars. 1916-17.		Dollars. Inc. or dec.
Electric locomotives.—				
To United Kingdom	—	15,000	+	15,000
,, Canada	72,000	208,000	+	136,000
,, Argentina	—	61,000	+	61,000
,, Mexico	3,000	11,000	+	8,000
,, Bolivia	—	2,000	+	2,000
,, Chile	19,000	182,000	+	163,000
,, China	33,000	—	−	33,000
,, Brazil	12,000	—	−	12,000
,, Russia-in-Europe	146,000	—	−	146,000
,, Bermuda	96,000	—	−	96,000
,, Other countries	71,000	84,000*	+	13,000
Total	452,000	563,000	+	111,000

* France $19,000.

Dynamos and generators.—				
To Canada	330,000	426,000	+	96,000
,, United Kingdom	204,000	63,000	−	141,000
,, Panama	17,000	5,000	−	12,000
,, Mexico	9,000	51,000	+	42,000
,, Cuba	141,000	229,000	+	88,000
,, Brazil	4,000	29,000	+	25,000
,, Peru	8,000	53,000	+	45,000
,, Japan	88,000	245,000	+	157,000
,, Australia	24,000	88,000	+	64,000
,, Spain	34,000	107,000	+	73,000
,, France	142,000	160,000	+	18,000
,, Italy	67,000	291,000	+	224,000
,, Other countries	401,000	808,000*	+	407,000
Total	1,469,000	2,555,000	+	1,086,000

* China $222,000.

Fans.—				
To Canada	23,000	97,000	+	74,000
,, Argentina	63,000	30,000	−	33,000
,, Brazil	7,000	6,000	−	1,000
,, China	18,000	33,000	+	15,000
,, British India	92,000	164,000	+	72,000
,, Japan	11,000	8,000	−	3,000
,, Australia	21,000	16,000	−	5,000
,, United Kingdom	20,000	21,000	+	1,000
,, Other countries	102,000	108,000*	+	6,000
Total	357,000	483,000	+	126,000

* Mexico $17,000.

Arc lamps.—				
To Canada	8,000	4,000	−	4,000
,, Brazil	2,000	1,000	−	1,000
,, Other countries	9,000	11,000	+	2,000
Total	19,000	16,000	−	3,000

Metal-filament lamps.—				
To Russia-in-Europe	115,000	6,000	−	109,000
,, Russia-in-Asia	9,000	3,000	−	6,000
,, United Kingdom	87,000	15,000	−	72,000
,, Canada	135,000	461,000	+	326,000
,, Mexico	86,000	168,000	+	82,000
,, Cuba	172,000	273,000	+	101,000
,, Argentina	82,000	216,000	+	134,000
,, Brazil	101,000	265,000	+	164,000
,, Australia	92,000	83,000	−	9,000
,, China	67,000	90,000	+	23,000
,, Other countries	336,000†	564,000*	+	228,000
Total	1,282,000	2,144,000	+	962,000

* Italy $31,000, Chile $93,000, Uruguay $54,000.
† South Africa $57,000, India $21,000.

Carbon-filament lamps.—				
To Argentina	11,000	7,000	−	4,000
,, Canada	18,000	87,000	+	69,000
,, Mexico	14,000	17,000	+	3,000
,, Brazil	7,000	5,000	−	2,000
,, Peru	7,000	8,000	+	1,000
,, Other countries	88,000*	33,000	−	55,000
Total	145,000	157,000	+	12,000

* Russia-in-Europe $18,000, Australia $6,000.

Static transformers.—				
To United Kingdom	44,000	13,000	−	31,000
,, Spain	133,000	39,000	−	94,000
,, Canada	132,000	220,000	+	88,000
,, Panama	50,000	15,000	−	35,000
,, Mexico	17,000	51,000	+	34,000
,, Cuba	32,000	103,000	+	71,000
,, Brazil	94,000	132,000	+	38,000
,, Chile	17,000	119,000	+	102,000
,, Japan	4,000	11,000	+	7,000
,, Australia	70,000	44,000	−	26,000
,, Italy	84,000	46,000	−	38,000
,, South Africa	60,000	41,000	−	19,000
,, Other countries	256,000	431,000*	+	175,000
Total	993,000	1,265,000	+	272,000

* Russia $136,000, China $57,000.

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Insulated wire and cables.—	Dollars. 1915-16.	Dollars. 1916-17.	Dollars. Inc. or dec.
To France	150,000	1,965,000	+ 1,815,000
,, Norway	318,000	463,000	+ 145,000
,, United Kingdom ...	663,000	759,000	+ 96,000
,, Spain	87,000	234,000	+ 147,000
,, Canada	148,000	180,000	+ 32,000
,, Panama	236,000	225,000	- 11,000
,, Mexico	58,000	189,000	+ 131,000
,, Cuba	281,000	495,000	+ 214,000
,, Brazil	286,000	571,000	+ 285,000
,, Australia	66,000	73,000	+ 7,000
,, Other countries ...	864,000	2,038,000	+ 1,174,000
Total	3,157,000	7,192,000	+ 4,035,000

PATENT LAW AMENDMENT.

(*Concluded from page* 487.)

Articles for Food or Medical Purposes.—Clause 11 (section 38a). This clause makes it impossible to patent articles intended for food or medicinal or surgical purposes or capable of being used for the production of food or medicine or surgical appliances.

The processes of making foods, drugs, and medicines can, however, be patented. To illustrate the drastic effect of such provisions it is only necessary to mention the following examples of a few of the articles which would be unpatentable under the section:—

1. All new machinery capable of being used in bakeries or for food production.
2. Surgical instruments and appliances of all kinds.
3. Electric motors capable of being used for driving dentists' drills, &c.
4. X-ray tubes and other X-ray apparatus.
5. Machines and apparatus useful in the manufacture of drugs and medicines.

The provisions of the section will prevent inventors and capitalists from developing industries which are admittedly in great need of stimulation and encouragement. It will tend to prevent many new developments which otherwise would surely take place after the war. It must not be forgotten that it is very difficult to induce manufacturers to take up unpatented inventions. This country is notoriously behindhand not only with inventions relating to drugs and the like, and surgical and therapeutic appliances, but also in their development and manufacture. Practically all the supplies of modern articles used in surgery and other curative treatment, for example, electrotherapeutic apparatus, dental material, and surgical appliances of all kinds, have been imported from America and Germany, where considerable industries exist in this class of apparatus.

There is no reason why this industrial development and manufacture should not be carried on in this country. Our position in medical and surgical science justifies all the industrial support that can be given to it.

The framers of the section in considering its effect from a humanitarian point of view appear to have overlooked the fact that the encouragement of invention greatly helps progress.

The committee considers that the section should be eliminated from the Bill, and suggests that the real objects of the section so far as it relates to drugs and medicines will be more readily accomplished by altering the present Acts relating to foods and drugs.

Approval of Clauses 5, 8, 9, *and* 15.—The committee considers that these clauses of the Bill embody improvements—clause 8 being the most important.

Clause 5 provides that when: (*a*) an applicant has agreed in writing to assign a patent when granted to another party or joint applicant and refuses to proceed with the application; or (*b*) disputes arise between joint applicants as to proceeding with an application, the Comptroller under certain conditions may grant a patent to the other party or to one of the joint applicants.

Clause 8 provides that in any action for infringement, a patent, otherwise bad, shall not be invalidated if it contains one good claim. At present a patent otherwise good is invalidated if it contains one bad claim.

Clause 9. "In an action for infringement, the plaintiff shall be entitled to relief by way of injunction and damages, but not to an account of profits."

Clause 15. An assignment of or a licence to use a patent shall not be admitted in evidence in any Court unless it has been recorded on the Patent Office Register.

Term of Patents.—Clause 6 increases the term, which is now 14 years, to 15 years, with a proviso that it may be extended to 16 years if it is found expedient to secure greater uniformity with countries which may be parties to any international convention.

While the committee would prefer that the term be 17 years, as in the U.S.A., it recommends that at least the term should definitely be made 16 years, as there would clearly be no objection in principle to that.

Suggested Extension of Provisional Term.—The committee regrets that the period within which a complete specification may be left, after an application accompanied by a provisional specification has been filed, has not been extended. Section 5 of the Act of 1907 reduced this period from nine months to six months, it is understood because the period of three months then remaining before the acceptance of the complete specification must take place was too short to enable the Patent Office to make its search as to the novelty of the invention and for the specification and claims, if necessary, to be amended.

With many inventions, especially those relating to complicated machines and apparatus, the present period of six months' provisional protection is entirely inadequate to allow of an experimental machine or apparatus being made or tested. This is not to the benefit of the patentee, who should have sufficient time to test his invention and to prepare a complete specification and claims which will adequately protect that invention. And it is not to the benefit of the public, because they are thereby debarred from obtaining from the inventor such a full disclosure of the invention as will enable them to work it after the expiry of the patent to the best advantage. The committee strongly urges that there should be a reversion to the old period of nine months, with the possibility of obtaining at least three months' extension of this term on payment of a nominal fee, instead of one month only as at present. Thus the maximum period would be twelve months instead of seven months from the filing of the provisional to the filing of the complete specification.

In the United States the law gives the inventor what amounts to provisional protection for two years. This arises from the fact that the invention may have been in public use, or on sale, in the United States for two years prior to the date of application for the patent without in any way affecting its validity.

Extension of Term for Acceptance.—The committee also strongly urges that the time within which, after filing the complete specification, the same may be accepted, should be extended. Such an extension will be necessary if the provisional term is extended to nine months as suggested above. Under the present Act (section 6) (5) the complete specification must be accepted within twelve months of the date of application, with a possible extension of not more than three months on payment of fees amounting in all to £6, or actually more than the fees payable on application for and sealing of the patent.

One reason for closely limiting the time within which complete specifications must be accepted has now disappeared. Previously, delay in the acceptance of a complete specification delayed the appearance of the illustrated abridgments of specifications, but this is no longer the case, as under the new system now in force each specification is given a fresh consecutive number on acceptance, which ultimately becomes the patent number.

At present it sometimes happens that the examiner's search for novelty is not communicated to the applicant until three or possibly four months after the date of filing the complete specification.

If the complete specification is filed six months after filing the provisional specification, this leaves only two months within which the result of the search can be communicated to the applicant. If he resides abroad, or is temporarily absent from this country, this period of two months is usually insufficient—and for the more distant colonies quite insufficient for him to study the whole matter and consider what amendment of his specification or claims may be necessary, and generally complete the prosecution of his application.

The committee strongly recommends that the time within which the complete specification must be accepted should be extended as a minimum to eighteen months after the date of application, with the possibility of extending this term as at present by three months on payment of a fee which the committee thinks should be much less than at present.

The restrictive procedure here as regards extensions compares very unfavourably with that in other industrial countries. Thus the period allowed in the United States is one year for filing an amendment to each official action of the Patent Office examiner. On allowance of an application, even though it has taken several years to go through the Patent Office, there is a further period of six months within which to pay the final fee (corresponding to the sealing fee here) and secure the issue of the patent.

In Germany, on allowance of an application, even though it has taken two or three years to go through the office, the applicant may demand three months' delay of publication, and this cannot be refused, and he may obtain a further three months' delay, all without payment.

These periods are very valuable because, having secured allowance of his application either in Germany or the United States, an inventor then has time to file applications for patents in such other countries as he desires without having such patents invalidated by the publication of the German or United States specification. In this country, contrary to what is the case in the United States and Germany, the applicant has only a partial search to guide him as to the novelty of his invention, and after securing the acceptance of his application at high pressure, the utmost delay he can

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obtain within which to make a decision and file foreign patents before the British specification is published is three months, for which he must pay £6, assuming, of course, that it has not been necessary for him already to secure this extension of three months within which to meet the examiner's objections and secure the acceptance of his specification.

The view is held in some quarters that acceptance of a complete specification should take place at an early date in order that manufacturers here should be in a position to ascertain without undue delay what patents have been applied for so that they may not suddenly find themselves confronted with a patent covering a process which they have adopted, or an article upon the manufacture of which they have embarked. The committee does not believe that the danger in question exists to any extent, but it could be guarded against by arranging that if not accepted after the expiration of twelve months—or 15 months if the provisional term be restored to nine months as suggested—the complete specification should be open to public inspection *in the condition in which it was originally filed*. This procedure is already adopted in connection with applications for patents filed under the International Patents Convention. (See section 91 (3) (*a*) of the Act.)

The applicant is not likely to cause unnecessary delay, since under section 10 of the Act he does not enjoy the rights of a patentee until his complete specification is accepted.

Patent to Bind the Crown (section 29 of the Act).—The committee regrets that no substantial alteration is made in this section by the proposed Bill.

Notwithstanding the provision of the section that a patent shall have the like effect against His Majesty the King as it has against a subject, experience has shown that the administration of the proviso of the section has in effect practically nullified the operation of a patent against Government departments.

Great dissatisfaction has for many years been expressed in connection with the operation of the section, and the committee feels that inventors have been greatly discouraged in their endeavours to produce inventions of national importance.

It has been found practically impossible for patentees to obtain compensation for the use by or on behalf of Government departments of their patented inventions. In many cases patentees have been asked to supply and have supplied working drawings, only to find that the latter have been distributed freely to their competitors, who have obtained most, if not all, of the Government orders for the patented article. The patentee has had no effective remedy, and frequently, after voluminous and prolonged correspondence with the department in question, has had to abandon all hope of obtaining any compensation.

There is no method under the present legislation whereby the patentee can compel the determination of the matters in dispute between himself and a Government department with regard to his patent. Inventors and patentees object to the Treasury being practically in the position of purchaser, having the right to dictate the amount which shall be paid for the use of inventions. The committee strongly recommends that the terms upon which an invention may be used by the Crown shall in default of agreement be decided by the High Court, and that the patentees should be entitled to apply to the Court for this purpose. On the hearing of such applications the Crown and the Treasury can be represented, and the interests of all parties would be properly safeguarded—with due regard to national requirements, for example, as regards secrecy and otherwise.

The committee believes that the adoption of the above procedure would greatly stimulate the development of inventions of national importance.

Cancellation of Registration of Designs.—The committee points out that the amendment proposed in clause 14 of the Bill will necessitate section 56 of the Act itself being amended. Clause 14 proposes that *at any time* after the registration of a design a petition may be presented to the Comptroller for cancellation of the registration. Section 56 of the Act, however, provides that registered designs shall not be open to inspection for a period of at least two years after the date of registration except by certain privileged persons, and then only in the presence of an officer and on payment of a fee, and no copy of the design may be taken by the person making the inspection. These restrictions would very largely nullify the usefulness of the amendment proposed in section 14.

Patents of Addition.—The committee is of opinion that the proviso proposed to be added to section 19 (3) of the Act should be as follows:—"Provided that if the patent for the original invention is revoked or lepses for any reason, then the patent of addition shall, if the patentee so applies in writing to the Comptroller, become an independent patent, &c." (to end of proviso).

The committee feels that this alteration is more fair to patentees than that the matter should be in the discretion of the Comptroller or the Court as proposed in the Bill.

Patents Fees and Profits of Patent Office.—The Bill makes no change in the present official fees. The 1907 Act, by section 65 and schedule 1, allows maximum official fees of £155 on a full-term patent, but provides that lower fees may be prescribed by the Board of Trade with the approval of the Treasury.

At present the prescribed fees on a full-term patent are:—

	£	£
On filing provisional specification	1	
On filing complete specification	3—	4
Or, on filing a complete specification		4
On sealing of patent		1
Total (four years' life)		5
Annual Renewal Fees begin with £5 at the end of the fourth year, and rise £1 a year to £14 at the end of the fourteenth year. Total renewal fees		95
Total fees for full-term patent		100

In the opinion of the committee these fees are much too high, and compare unfavourably with those in many other industrial countries. Low patent fees would lead to a great development in invention, and the country would benefit thereby.

It is probable that the favourable position occupied by the United States as regards inventions is largely due to the fact that patenting is cheap in that country—where patents are granted for their full term of 17 years at a cost in official fees of only £7 ($35). There are about 70,000 patent application per annum in the United States, as compared with about 27,000 here. And it is to be noted that in spite of the smallness of the fees the U.S. Patent Office is not only self-supporting, but yields an average surplus of more than £40,000 per annum. Although the committee prefers the British system of a short-term patent renewable after four years by the payment of annual fees, and considers the present fees of £5 to cover the first four years of the life of a patent reasonable, it feels very strongly that the renewal fees are much too high.

It is submitted that the present system by which large profits are made out of patent fees is wrong—that patents should be granted at the lowest possible cost consistent with the Patent Office being self-supporting—that the State should tax patents only through the income tax of patentees, thus taxing only successful inventors, and that the encouragement of invention by lowering the cost of patents would almost certainly lead to a far greater return in income tax than the loss of revenue consequent on lower official fees.

It is thought probable that even in the very unlikely event of the number of patents not being increased, the reduction of renewal fees would very soon produce as much as at present, by reason of the increase in the number of patents that would be kept up.

At present the mortality of patents is very great. Less than 40 per cent. survive the fifth year, and less than 20 per cent. the seventh.

Patent Office Finances.—The average results of working the Patent Office for the ten years 1907-16 may be summarised as follows:—

	£
Receipts.—Patent fees on application, including sealing	92,574
Patent fees, renewal fees	172,896
Total ...	265,470
Receipts from all other sources	45,741
Total ...	311,211
Expenditure	194,867
Annual Surplus	116,344

Attention is drawn to the very large proportion of the total receipts represented by patent fees, and to the very large proportion of the latter that is made up of renewal fees. It will be understood that almost all the expenditure of the Patent Office on patents is incurred at the early stages of a patent, and practically none on the granting of renewals.

Suggested Reduction of Renewal Fees.—The committee recommends that in view of the large average surplus of £116,344, the cost of patents should be very substantially reduced. This recommendation is in accord with the principle set forth in Parliament by the Chancellor of the Exchequer, Sir Michael Hicks Beach, in 1890—that while patentees should bear the cost of the Patent Office, he did not think the country ought to look to the Patent system as a permanent source of income.

A reduction of the renewal fees by one-half is strongly recommended. This would make the cost of a full-term patent:—

	£	s.	d.
To grant and sealing (as at present)	5	0	0
Renewal fees	47	10	0
	52	10	0

Even in the very improbable event of no increase taking place in the number of patents applied for, completed, and kept up, such a reduction—on the basis of the average of the ten years 1907-16—would still leave a surplus of £29,896.

Should the effect of the reduction now recommended be to produce a considerable surplus, it is suggested that such surplus should be used for a further reduction of the renewal fees.

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In support of this recommendation by the committee of a reduction of renewal fees by one-half, attention is drawn to the fact that clause 2 of the Bill provides that patents endorsed "licences of right" shall be subject to such a reduction.

Proposed New Tribunal.—The committee states its views upon a matter which, although it does not relate directly to the proposed Patent Bill, has a very important bearing upon it, namely, the legal procedure by which all disputes involving scientific questions are determined. Recommendations on this matter have already been made by the Federation of British Industries, an association which, it is understood, represents capital of some £2,500,000,000 sterling.

The committee feels that it is due to the industries of the country that there should exist in the High Court of Justice a division specially constituted to deal with litigation involving scientific and technical questions. During recent years the application of science to industry has become so increasingly complex that such a division is more than ever essential.

Although the great ability of the judges of the Chancery Division, and their willingness to try scientific cases are admitted, yet the views of the judges as to what is invention have varied to a degree which has made it nearly, if not quite, impossible for manufacturers to obtain definite opinions as to the chances of success in patent disputes. The much larger field which embraces questions of industrial contracts is also in a very unsatisfactory state. There is, in the opinion of both parties to such contracts, no satisfactory tribunal to decide such matters.

If industry is to flourish to the fullest extent there must exist machinery for adjudicating effectively upon actions involving technical matters, and the Committee urges in the strongest manner possible that such machinery should be provided. It is probable that more money and more serious issues are involved in patent and other technical questions than in all other actions put together.

It is in the opinion of the committee obvious that no adequate experience can be gained or proper consideration given by a tribunal which does not give its whole attention to technical disputes.

Any alterations in the law relating to patents, trade marks, or designs should be made coincidentally with the constitution of such a division.

NOTES FROM CANADA.

(From our Special Correspondent.)

Several times, before war broke out, the question of the Hydroelectric Power Commission of Ontario building and operating a system of municipally-owned telephones was mentioned; according to the daily Press, the matter is to come up again, as it is announced that there will be called soon a meeting of the executive of the Ontario Municipal Electrical Association, which represents 190 municipalities, to discuss the proposal. The Mayor of Toronto is quoted as saying that it would put a telephone in every working man's house in the city at half the present cost.

There is no doubt that if the cost is reduced to half of what it is at the present there would not be many houses in the province without the convenience of a telephone, as they are very much more common here, even under present conditions, than they are in England.

It is curious, however, to note that, since the Mayor referred to made his statement about halving the present cost of telephones, the Bell Telephone Co., of Canada, has announced its intention of increasing the rate charged for telephones by 20 per cent. on the plea that increased costs justify it—this is being rigorously opposed in some parts of Canada.

The power shortage in Ontario is so serious owing to munitions works requirements that there is talk of the necessity of rationing power—this is in spite of the fact that of more than 200,000 h.p. being furnished by the Hydroelectric Power Commission of Ontario fully 75 per cent. is being used for the manufacture of munitions. This same Commission recently notified the city of Campbellford that it intended to develop power at Ranney's Falls, close to that place, to produce 8,000 to 10,000 h.p., and to cost $1,250,000.

The Provincial Government of Quebec is carrying out a great water-power development on the St. Maurice River in the building of the so-called "La Loutre" dam; by means of this dam the waters of the St. Maurice will be stored up, and the low-water flow will be doubled. The dam is now nearing completion, the cost is about $1,500,000.

Upon its completion, a reservoir of 160,000 million cu. ft. will be created. From some 17 existing water-power sites about 350,000 h.p. can be obtained, but the dam will enable about 900,000 h.p. to be obtained, and from three existing power sites on the St. Maurice River yielding 190,000 theoretical h.p., it is expected that over 400,000 h.p. can be obtained.

Reference was made in these notes recently to the application of the St. Lawrence River Power Co. to the International Joint Waterways Commission for permission to build a submerged weir in the south channel of the St. Lawrence River near Long Sault Island, to enable it to get rid of ice troubles in the winter. Although the Canadian Government officially objected to the granting of the application, yet the permission was accorded, chiefly because in Washington the weir was considered to be an urgent war requirement. It is believed, however, that the matter is to come before the Commission again in five years' time.

The decision made in the above case seems to have emboldened another company—the New York & Ontario Power Co.—to ask of the same Commission approval of plans to construct a dam across the Little River on the south branch of the St. Lawrence at Ogden Island; the Dominion Government is opposing this application also.

The Board of Trade of the town of Estevan, Saskatchewan, is trying to secure co-operation amongst several towns to further a scheme for a municipal power scheme, the intention being to generate either electricity or gas from the great deposits of lignite near Estevan to supply Moose Jaw, Regina, and other places.

The development of 40,000 h.p. on the Rivière des Prairies, Island of Montreal, P.Q., is contemplated, as a company is seeking permission from the Quebec Government to go ahead with the scheme, $12,000,000 is named as the estimated cost.

Electricians in Toronto, in order that a high standard of proficiency may be maintained, are said to favour the appointment, by the Government, of a special licensing board to consist of five members, two from the Electrical Workers' Union, two from the Electrical Contractors' Association, and one from the Hydroelectric Power Commission.

NATIONAL ELECTRIC POWER SUPPLY.

A statement drawn up on behalf of local authorities in the North-East Coast area who are electricity undertakers has been presented to the Government departments concerned, with regard to the interim report made to the Reconstruction Committee by the Coal Conservation Sub-committee on Electric Power Supply in Great Britain, and the report made by the Electric Power Supply Committee appointed by the Board of Trade. The municipalities which have adopted the statement are those of Berwick-upon-Tweed, Middlesbrough, Newcastle-upon-Tyne, South Shields, Stockton-on-Tees, Tynemouth, and West Hartlepool. The following is an abstract of the document.

The municipalities concede that the unification of the production and distribution of electrical energy is desirable, provided that the best use is made of existing systems, that the generation and distribution of electrical energy is under local public control, and that proper safeguards are adopted in the interests of existing undertakers and consumers, and in particular that those municipal undertakings which can, in the opinion of the Electricity Commissioners, be economically worked without interfering with the efficiency of any general scheme, should continue to be owned and operated by their present owners. Limitations of areas of supply have in the N.E. Coast area operated to restrict expansion and to limit economy of production in regard to municipal electrical undertakings, to an extent markedly greater than has been the case with respect to private supply companies, and in so far as the reports affirm the desirability of widely extended areas of supply, the municipalities are in agreement with the recommendations.

With respect, however, to the Coal Conservation Sub-committee's report, the municipalities cannot ignore the fact that a report purporting to deal with problems of national economy in coal consumption has been utilised as a vehicle of attack upon the policy of municipal control of electricity undertakings, and of promulgating proposals which, if carried into effect, may be expected to consolidate the position of the Newcastle-upon-Tyne Electric Supply Co. and its allied and subsidiary companies, and to involve the subordination of municipal electrical undertakings to the dominance and control of the North-East Coast group of power companies.

The report of the Coal Conservation Sub-Committee is accepted by, and has clearly influenced, the Electric Power Supply Committee in arriving at its conclusions. The report cannot, however, be regarded as presenting any elements of finality, nor as offering other than the expression of the individual opinions of its framers. Its conclusions are supported mainly (*i*) by an estimated coal saving of 55 million tons per annum, and (*ii*) by a comparison between the average charge for electricity in the North-East Coast area and the charges of a number of municipalities in the southern parts of Lancashire.

The municipalities challenge the statement that a coal saving such as is estimated will be effected, even supposing the proposals of the reports be put into operation forthwith.

The adverse comparison between the alleged "average charge of less than ½d. per unit" of the North-East Coast supply companies and the charges of the Lancashire municipalities, is misleading and mischievous. No details are given

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showing how this charge is arrived at, and the municipalities deny that it is a true representation of the facts, asserting that where all material factors are taken into consideration, the charges of the North-East Coast supply companies will be found to approximate very closely to those of comparable municipal undertakings.

Even should the allegation of an *average* charge of less than ½d. per unit be justified, the comparison is none the less misleading and fallacious, because the statement in table V. of the report, purporting to give the average prices charged for power by the Lancashire municipalities, gives prices which include the cost of distribution and other incidental expenses, and relate very largely to low-tension units supplied to consumers on their own premises, whereas a large proportion of the units supplied by the North-East Coast supply companies, the prices charged for which are apparently taken into account in arriving at the average charge of less than ½d. per unit, are high-tension units supplied in bulk to the distributors and users of electrical energy who, generally speaking, have to add the cost of transformation, and in some cases that of distribution, together with their profit, in the price actually charged to the ultimate consumer.

As regards the proposals of the reports respecting the constitution and powers of the proposed Board of Electricity Commissioners, the municipalities recognise the desirability of the establishment of some central and impartial authority charged with the duty of fostering electrical enterprise and encouraging the use of electricity as a source of motive power in industrial concerns. The municipalities, however, view with grave concern as a dangerous extension of the policy of bureaucratic control which has been increasingly prevalent during the war, the proposal to confer powers which for all practical purposes will determine the development of electrical enterprise throughout the country upon a small body of permanent officials, who will be supreme over all existing and future electricity undertakings, appointed by the President of the Board of Trade without reference to any superior authority, three of whom will hold office subject only to an age limit, and two of whom will be appointed for a short term of years. A small body of technical experts, however eminent individually, is in the view of the municipalities unfitted to be entrusted with autocratic powers of the character proposed; the central electrical authority should be so constituted as to be directly susceptible to the influence of public opinion and should comprise a sufficiency of members of independent judgment and general experience. It is essential that any such central electrical authority should be free from partisan bias.

The first Board of Electricity Commissioners should either be appointed directly by Parliament, or be constituted in accordance with directions given by Parliament so as to secure an impartial and judicial body, and the appointment of its constituent members should not be left to the absolute discretion of the President of the Board of Trade.

With respect to the delimitation of electrical districts and the constitution of District Boards, these questions should be disposed of by direct Parliamentary action after preliminary local inquiries. In no case should the decision on matters of this character be left in the disposition of a small body of experts.

It is unreasonable that any embargo should be placed upon extensions of existing electrical undertakings during any interval which may occur before the suggested super-power stations are in a position to supply power, especially as, instead of the "temporary lull in manufacturing output immediately after the war" contemplated by the Coal Conservation Sub-committee's report, the commercial necessities of the situation may then, on the contrary, as is apparently recognised by the Electric Power Supply Committee, more probably demand an immediate increase in the supply of electric power, which, the municipalities submit, can be effected quickly and economically by enlargements and extensions of the plant of existing undertakings.

The municipalities have already commented upon the pronounced anti-municipal bias of the Coal Conservation Sub-committee's report. This bias, while not so directly expressed in the report of the Electric Power Supply Committee, is none the less present therein, and the municipalities fear that if its proposals are put into effect the result in the North-East Coast area will be that the generation and supply in bulk of electricity may well pass from the municipalities, and that the North-East Coast group of companies will be left to continue their operations either on their own account or as lessees from the District Board.

The municipalities further direct attention to the inequitable character, so far as regards municipal electrical enterprises, of the financial proposals of the report. The basis of compensation proposed by the report will act unfairly as between municipalities and companies, and will have the effect of penalising those undertakers who have set up adequate reserve funds and maintained their undertakings in an efficient manner, and of favouring those undertakings which have distributed an undue proportion of their surplus revenues amongst shareholders, or in reduction of rates. If Electricity Boards are to be constituted to take over existing electrical undertakings the terms of transfer of municipally and commercially-owned generating stations and distributing systems should proceed upon the same basis, so that in the case of the former the capital of the undertaking should accrue to the municipality which has borne the risk and responsibility of the undertaking in the past.

Again, the municipalities object to the recommendation of the Electric Power Supply Committee's report that whereas commercial distributors of electricity are to continue to exercise the right of paying dividends to their shareholders, subject only to the limitations of a sliding scale of charges to consumers, municipalities which continue to distribute electricity are to be permitted either to make no profit at all or only a nominal profit.

Furthermore, the municipalities take strong exception to the proposal that District Electricity Boards or their lessees should be empowered to supply high-tension electricity in the areas of municipal distributors of electricity, and it is contended that, with the possible exception of electricity used by railway companies for traction purposes, there should be for each local area of supply a single distributor of electricity regardless of the question whether the energy supplied is low-tension or high-tension electricity.

Finally, it is manifestly inequitable that power supply companies (whose areas of supply for power happen to be reduced by the District Electricity Board, to cut out districts which can be better served from other districts) should, to the exclusion of municipalities (which may apparently be subjected to similar reduction of their areas of supply), have conferred upon them, as is proposed by the Electric Power Supply Committee's report, the right of supplying electricity for lighting purposes in places where there is at the time no lighting supply.

The municipalities do not concur in the proposals of the Electric Power Supply Committee's report that a preferential basis of rating should be accorded to electricity transmission mains, and that the existing restrictions as to the use of overhead lines should be removed.

The municipalities observe with satisfaction that the Electric Power Supply Committee's report recommends that in the national interest generating stations and main transmission lines ought, as a general rule, to be publicly owned, and they submit that the District Electricity Boards should, in all cases, be so constituted as to be wholly independent of the influence or control of commercially-owned electrical enterprises. To secure this object, it is strongly urged that the District Electricity Boards should consist of representatives of local authorities and large consumers to the exclusion of companies generating electricity.

In conclusion, the municipalities view with the gravest misgivings the manifest dangers presented by the recommendations of the reports of the establishment in the North-East Coast area of an electrical "trust" exercising with Parliamentary sanction paramount powers in that area with respect to the production and supply in bulk of electricity. They therefore most earnestly request that before any proposals are submitted to Parliament, based upon the reports, His Majesty's Government will institute a complete and exhaustive inquiry, and that no affirmative action be taken until an adequate opportunity has been afforded to the municipalities of presenting their views before an unbiased and impartial Committee of Parliament.

The statement was accompanied by three appendices, giving summaries of the two reports, and a list of the allied and subsidiary companies associated with the Newcastle-upon-Tyne Electric Supply Co., Ltd.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

SOUTH AFRICA.—A decision has recently been given by the Commissioner of Customs as to the rate of import duty on voltoids for charging batteries. When imported in bulk the duty is 3 per cent. *ad val.*, a rebate of the whole duty being allowed on goods manufactured in the U.K. or reciprocating British Colonies. When imported not in bulk the duty is 20 per cent. *ad val.*, the rebate being 3 per cent.

The increases of Customs duties imposed in 1915 and re-imposed in 1916 and 1917—see ELECTRICAL REVIEW of December 21st last—have, with certain alterations, again been re-imposed, and will continue in force until June 30th, 1919.

SOUTH-WEST AFRICA PROTECTORATE. — The Customs duties for S. Africa referred to above, have, by Proclamation, been applied to, and are now operative in, the Protectorate of S.W. Africa.

SOUTHERN RHODESIA.—The following appear among recent decisions issued by the Customs authorities :—

	Duty under general tariff.	On goods the produce or manuf. of the U.K. and British Possessions
Bronze foil	3 % *ad val.*	Free.
Granulated lead ...	20 % "	9 % *ad val.*
Merrilite (zinc dust)	3 % "	Free.

TRINIDAD AND TOBAGO.—The revised Customs tariff of Trinidad and Tobago provides for the extension of the preferential rates of duty, which previously were restricted to goods originating in the U.K., Canada, or Newfoundland, so as to apply to goods

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produced in any part of the Empire. Among the changes made in the new tariff may be noted the duty on machines and parts for electric lighting and power plant, which is now at the rate of 2 per cent. *ad val.* under the British preferential tariff and 2½ per cent. under the general tariff.

MALTA.—Increased import duties have been imposed by this year's revised tariff. Electrical goods now pay duty at the rate of 10 per cent. *ad val.*, while india-rubber and manufactures thereof pay 5 per cent. *ad val.* The new free list includes machinery for industrial purposes and parts thereof; also tin, copper, zinc, and lead in block and sheets.

BRITISH INDIA.—The revised import tariff valuations for 1918, upon which the duties leviable are based, include the following items of interest to the electrical industry :—

	Tariff valuation. Rs. A.	Duty.
Metallic ores, all sorts	*ad val.*	7½ %
Salammoniac	„	„
Telegraphic instruments and apparatus, and parts, imported by, or for, a railway company ...	„	2½ %
Electrical machinery, and component parts ...	„	„
Brass sheets, flat or in rolls, and sheathing weighing less than 1 lb. per sq. ft.; brass wire	„	7½ %
Copper, bolt and bar, rolled	„	„
„ braziers, sheets, plates and sheathing (cwt.)	110 0	„
„ nails and composition nails	*ad val.*	„
„ old ... ... (cwt.)	65 0	„
„ pigs, tiles, ingots, cakes, bricks, and slabs (cwt.)	95 0	„
„ china, white, copperware ... ... (lb.)	2 4	„
„ wire, including phosphor bronze and all other sorts of copper	*ad val.*	„
Lead, all sorts (except sheets for tea chests) ...	„	„
Quicksilver ... ... (lb.)	4 8	„
Tin (block) ... ... (cwt.)	155 0	„
„ foil and other sorts	*ad val.*	„
Zinc or spelter, nails	„	„
„ „ „ tiles or slabs, soft ... (cwt.)	50 0	„
„ „ „ all other sorts	*ad val.*	„
Trade catalogues and advertising circulars ...	—	Free

CANADA.—An Order in Council provides for the payment of a drawback of 99 per cent. of the duties paid on imported materials used in the manufacture of wireless telegraph apparatus supplied to vessels in Canada subsequent to January 1st, 1918.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

18,400. "Contact devices for ceiling roses, cut-outs, connectors, rosettes, and electrical fittings." H. B. PRENTICE. November 11th.

18,425. "Spring contact clips for replacement electric fuses." J. H. COLLIE. November 11th.

18,431. "Electric driving." S. G. JONES. November 11th.

18,433. "Electric arc lamps." H. B. GRYLLS & W. HEAPE. November 11th.

18,435. "Means for supporting electric cables, &c." J. R. HEWITSON, A. SIEMENS AND SIEMENS BROS. & CO. November 11th.

18,454. "Controllers for electric motors." H. C. WALKER. November 11th.

18,464. "Regulating devices for electrical machinery." SOC. ANON. DES ETABLISSEMENTS L. BLERIOT. November 11th. (France, July 31st.)

18,467. "Processes of electro-depositing magnesium." G. O. SEWARD. November 11th. (U.S.A., November 19th, 1917.)

18,468. "Circuits instantaneously sensitive to photo-electron action." F. TAVANI. November 11th.

18,500. "Electric heaters." A. H. GREEN. November 12th.

18,502. "Adapter or connector for electric wires." V. E. JOYCE & PARK ROYAL ENGINEERING WORKS. November 12th.

18,507. "Galvanic cells." G. W. PERRY AND SIEMENS BROS. & CO. November 12th.

18,511. "Telephone transmitter." J. SKINDERVIKEN. November 12th. (U.S.A., November 7th, 1917.)

18,517. "Sparking plugs for internal-combustion engines." L. HENRY AND R. MONNIER. November 12th.

18,534. "Alternating-current welding transformers." C. J. HOLSGAG. November 12th.

18,539. "Means for mounting electrodes in steam boilers, condensers, &c." A. S. GUSH. November 12th.

18,543. "Contact shoes for train-controlling systems." W. J. MELLERSH-JACKSON (E. P. Waterhouse). November 12th.

18,559. "Electric motor-control systems." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO., W. BROOKE & L. MILLER. November 13th.

18,576 "Electric transformers." R. CROSBIE-HILL. November 13th.

18,585. "Dynamo-electric machines." BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO. November 13th. (U.S.A., November 23rd, 1917.)

18,590. "Attaching means for electric fixtures." F. D. PARMENTER. November 13th.

18,594. "Registration of telephone calls." W. H. GRINSTED, T. PETTIGREW AND SIEMENS BROS. & CO. November 13th.

19,601. "Electrical switches." H. J. DEAN-OSGOOD. November 13th.

18,614. "Inductance coils." H. A. EWEN. November 13th.

18,622. "Electric heating elements for radiator ovens." J. H. COUPE AND E. J. DOYLE. November 13th.

18,625. "Control and firing of mines, &c., by electricity." W. H. BRAGG, C. V. DRYSDALE & P. V. HUNTER. November 13th.

18,650. "Holders for incandescent electric lamps." F. QUARMBY. November 14th.

18,659. "Telephone transmitters." G. H. NASH & WESTERN ELECTRIC CO. November 14th.

18,660. "Instantaneous connector of electrical, &c., wire or wires." E. R. HEAFFORD & E. J. TILLEY. November 14th.

18,661. "Electric heating devices." H. H. BERRY & J. W. REID. November 14th.

18,669. "Chairs for electro-magnetic treatment of the human body." J. KRAUER. November 14th.

18,683. "Arrangement of electric generating groups for supplying equal number of electric motor groups." H. CROCHAT. November 14th. (France, November 14th, 1917.)

18,689. "Method of electric arc welding, cutting, and repairing." C. J. HOLSGAG. November 14th. (U.S.A., April 30th.)

18,700. "Electric switch box." G. H. SCHOLES. November 14th.

18,702. "Apparatus with horizontal diaphragm for electrolysis of alkaline chlorides." NORSK ALKALI AKTIESELSKABET. November 14th. (Norway, April 4th.)

18,703. "Electric magnetic lock-out switches." IGRANIC ELECTRIC CO. (Cutler-Hammer Manufacturing Co., U.S.A.) November 14th.

18,714. "Means for securing pole shoes of magneto machines." A. E. BENNETT AND BRITISH LIGHTING & IGNITION CO. November 14th.

18,715. "Armature windings of electric alternating-current machines." BRITISH LIGHTING & IGNITION CO. AND E. O. TURNER. November 14th.

18,716. "Winding armatures of magneto machines." BRITISH LIGHTING AND IGNITION CO. & E. O. TURNER. November 14th.

18,722. "Electrical sound-detecting devices." AUTOMATIC TELEPHONE MANUFACTURING CO. & J. B. REDFERN. November 15th.

18,740. "Electric switches or circuit interrupters." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. AND W. B. DALE. November 15th.

18,745. "Electrically-operated signalling devices." C. B. HARLOW. November 15th. (U.S.A., November 21st, 1917.)

18,746. "Moulds and method of casting grids for accumulator electrodes." H. F. JOEL. November 15th.

18,754. "Dynamo-electric machines." BRITISH THOMSON-HOUSTON CO. AND F. P. WHITTAKER. November 15th.

18,759. "Electrical heaters." C. R. ALLENSBY AND BENHAM & SONS. November 15th.

18,760. "Rotary electrical switches." E. L. RANKIN. November 15th.

18,764. "Electrical signalling apparatus for ships, &c." W. BURWELL, R. P. MYERS & E. ITTERSON-PRONKS. November 15th.

18,780. "Electromagnetic lock-out switch." IGRANIC ELECTRIC CO. (Cutler-Hammer Manufacturing Co., U.S.A.) November 15th.

18,792. "Cooling electrical machines." A. ROLFE. November 15th.

18,802. "Electric switches." R. W. BELL. November 16th.

18,819. "Electrical heating elements." N. C. BARRETT & G. PATE. November 16th.

18,827. "Multi-speed alternating-current motors applicable to electric propulsion of ships, &c." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) November 16th.

18,836. "Audion or lamp relay or amplifying apparatus." M. LATOUR. November 16th. (France, November 17th, 1917.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

9,543. APPARATUS FOR SIGNALLING BY MEANS OF LIGHT. Brodsky. June 30th, 1915. (Cognate application 11,423/15.)

10,187. REGULATION OF DYNAMO-ELECTRIC MACHINES. Remy Electric Co. December 19th, 1916. (112,415.)

1917.

13,527. DIRECT-CURRENT MACHINES AND SINGLE-PHASE MOTORS WITHOUT COMMUTATORS. O. Ligotti. September 20th, 1917. (120,062.)

13,692. ELECTRIC LAMPHOLDERS OR ATTACHMENTS. L. Bagguley & C. W. Lacey. September 24th, 1917. (120,064.)

14,412. APPARATUS AND METHOD FOR THE LOCALISATION OF FAULTS IN ELECTRICAL CONDUCTORS. J. E. Taylor. October 5th, 1917. (120,066.)

14,918. ELECTRIC LAMP FITTINGS. A. J. Bonnella. October 15th, 1917. (120,070.)

15,062. GAS, ELECTRIC, AND LIKE FIRES. W. B. MacLusky. October 17th, 1917. (120,073.)

15,111. BOXES AND SWITCHES OF ELECTRICAL FUSES. W. Donovan & G. O. Donovan. October 18th, 1917. (120,074.)

15,219. MEANS FOR SECURING ELECTRICAL FITTINGS TO CONDUIT OUTLET BOXES, PATRASSES AND THE LIKE. L. Milne. October 19th, 1917. (120,075.)

15,431. MEANS OR APPARATUS FOR COOLING AND VENTILATING ELECTRIC MOTORS AND DYNAMOS. E. Harris. October 24th, 1917. (Cognate application 2,120/18.) (120,083.)

15,635. ELECTRIC LIGHT APPARATUS. N. Papa. October 26th, 1917. (120,092.)

16,224. ELECTRIC HEATING AND COOKING APPARATUS. W. H. Bennett. November 7th, 1917. (120,108.)

16,398. SPARK PLUGS. F. Gerken. November 8th, 1917. (120,113.)

16,746. ELECTRICAL RELAYS FOR USE IN CANCELLING ARRANGEMENTS FOR ELECTRICAL SIGNALLING SYSTEMS AND OTHER PURPOSES. Sterling Telephone & Electric Co., F. G. Bell and W. C. Davey. November 14th, 1917. (120,119.)

18,115. TELEGRAPHY. E. S. Heurtley. December 6th, 1917. (120,135.)

18,494. ENGINE STARTERS. V. Bendix. December 13th, 1917. (120,138.)

1918.

2,561. INSULATORS FOR TELEGRAPH, TELEPHONE AND OTHER WIRES. Taylor, Tunnicliff & Co. and E. D. M. Scrivener. February 13th, 1918. (119,795.)

2,674. BUZZER SETS FOR LEARNING TELEGRAPHY. A. C. Brown. February 14th, 1918. (119,797.)

3,718. COUPLINGS OR CONNECTING DEVICES FOR ELECTRIC CIRCUITS. V. H. Broc. March 14th, 1917. (114,828.)

3,623. JOINTING OF ELECTRIC CABLES. W. J. Howard. March 1st, 1918. (119,984.)

4,125. CANCELLING MECHANISM FOR MINE-SIGNALLING SYSTEMS. Sterling Telephone & Electric Co., Ltd., F. G. Bell & W. C. Davey. March 8th, 1918. (Addition to 6,542/17.) (119,808.)

4,189. ELECTRIC PLUG CONNECTORS. H. Fairbrother (W. Ile). March 9th, 1918. (119,988.)

4,553. CONTROLLERS FOR ALTERNATING-CURRENT MOTORS. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) March 14th, 1918. (119,615.)

5,329 ELECTRICAL HEATING APPARATUS. C. Sorensen. March 26th, 1918. (119,822.)

5,420. AUTOGENERATING PORTABLE ELECTRIC LAMPS. V. Filippone. March 27th, 1918. (119,619.)

5,866. ELECTRODE HOLDERS FOR ELECTRIC FURNACES. Aktieselskab Arendal Smelteverk. April 13th, 1917. (114,841.)

6,110. MAGNETO-ELECTRIC MACHINES. G. Smith. April 10th, 1918. (120,167.)

6,641. ELECTRIC SWITCHES. W. Donovan & G. O. Donovan. October 18th, 1917. (Divided application on 15,111/17.) (119,627.)

6,642. ELECTRIC SWITCHES. W. Donovan & G. O. Donovan. October 18th, 1917. (Divided application on 15,111/17.) (119,628.)

6,896. FERRARIS RELAY FOR THE PROTECTION OF MULTI-PHASE MOTORS AND THE LIKE. R. J. Jensen. April 24th, 1917. (115,238.)

7,445. PILLAR INSULATORS. G. V. Twiss & Bullers, Ltd. May 3rd, 1918. (119,829.)

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ELECTRICAL REVIEW.

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TO "ELECTRICAL REVIEW" READERS.

Owing to the continued increase in the circulation of the ELECTRICAL REVIEW in recent months, an increase which has become accelerated since the signing of the Armistice, we cannot guarantee that casual copies will be available. The only way to make sure of securing a copy regularly as issued, is to place a definite order with a newsagent, or else to subscribe direct to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

NATIONAL FACTORIES: THEIR UTILISATION FOR ELECTRICAL INDUSTRIES.

Now that a halt has been called in the march of munition production, the nation will be left with a number of large factories for which it has no further need. In a few cases it is possible that the Government may decide to retain these for their original purpose, as sections of that national arsenal with which even a successful League of Nations cannot entirely dispense.

The majority of the national factories, however, must be converted to industrial uses, whether under national or private control; and it has already been announced that the Ministry of Munitions is open to receive, from commercial and manufacturing concerns, offers for such factories, or parts thereof.

What is the general position as regards their suitability for electrical trades (which must develop rapidly in the next few months if we are to obtain the power to supply our share of the world's output of such goods)? The factories themselves vary much, as is inevitable when it is remembered that some dealt with the manufacture of one type of explosive and some with that of another, that some dealt with the filling of large shells and some with the filling of small fuses, or of detonators, and others dealt with matters even more diverse. Further, they were designed in some cases by H.M. Office of Works, in others by a firm acting as agent, in others by local committees, and, in one case, at any rate, by an individual.

Amongst the diversity of types there are several which may be regarded as useless for our purpose, consisting, as they do, merely of a number of small buildings separated from each other by considerable distances, the buildings themselves being often of the flimsiest construction, and communicating with each other by nothing more substantial than wooden footways. Such factories can only be handed over to the salvage men for dismantling and for the recovery of the valuable materials of which they are constructed and the plant with which they are equipped.

There are, nevertheless, many points which will strongly recommend many of the factories to prospective purchasers. In all cases first-class internal railroads of standard gauge have been laid down; internal water supplies, sewage arrangements, fire-hydrant services, &c., are complete; the buildings are ready for use, are well lighted and heated, frequently provided with hydraulic power, electric power, and sometimes gas; housing and canteen accommodation are usually connected with the factories; and there is always room to expand. All these are good points when one is factory-hunting.

To pass from the general to the particular, a Western factory comes to mind—in itself not the most suitable for many purposes, but still not such a one as was referred to

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as being doomed to demolition—where there is one group of four buildings, each about 120 ft. by 110 ft., and an adjacent group of eight buildings, each of which is some 180 ft. by 120 ft., separated from each other by less than 100 yards. The arrangement may not be ideal, but it is by no means impossible.

There is a case at a Midland engineering town where one section of the factory comprises four groups of eight communicating shops, each of them 100 ft. long by 50 ft. wide, standing in one cluster of 32 shops, separated by less than 10-yard spaces. These surely constitute a fine factory for electrical manufactures, having good north lights by day and brilliant electric ones by night, being fitted with racks and centre tables in most cases, with motors and shafting in many, and with hydraulic power in a few. Surrounding buildings provide storage or supplementary workshops; there are steam boilers and hot-water boilers, with a 120-ft. brick shaft and the usual good railway provision—within sight of a colliery, moreover.

Turn to another—this time in the North-West of England. Here we have two substantial buildings adjoining one another; the one of 68,000 sq. ft., the other of 42,000—a total floor area under continuous roofing of approximately 110,000 sq. ft., and equipped with 10 or 12 electric overhead travelling cranes for loads of 2 tons. Nor is this all: for within a few hundred yards are further buildings, fitted with similar cranes—two of 6,000, four of 12,000, and two of 17,000 sq. ft. floor space—truly, a property of very valuable possibilities. The engineering industry must be very fast asleep if such a factory remain for long unused.

These examples represent three distinct types of factory, each deserving the attention of our leaders of constructional industry. There are many other types from which to choose, varying in locality, design, conveniences, and, presumably, cost. Inquiry should produce something to suit most cases.

Instances might be multiplied. Possibly in the course of time the Ministry of Munitions may advertise their properties and schedule their proportions; but live firms will speak now and act to-day. Electrical engineering is not the only industry which is seeking premises for extending existing activities and inaugurating new ones. Some of the national factories may hang fire for a long time (for they are not counted merely by dozens), but the *best* will soon be spoken for, and it behoves us to get in first.

British Manufacturing in Peace and War.

Mr. Kellaway, Parliamentary Secretary to the Ministry of Munitions, delivered two speeches in London, last week. In one he referred to some of the benefits that accrued to British industry from the demands arising out of the war. The terrible tests of the emergencies to which we were exposed, especially in the earlier stages of the conflict, revealed weaknesses in regard to organisation, works' equipment, material, and so forth, which it was necessary to remove in order to arrive at a certain efficiency in production unrealisable under normal conditions. What the speaker had to say concerning mica was one of the strongest arguments that could be used for the proper utilisation of British Empire resources. The Empire is very strong as regards natural *possession* of mica as a raw material, for 50 per cent. of the world's supply is produced in India and 15 per cent. comes from Canada. But the mere existence of the material in British territory is of little avail to us industrially if we permit German interests to secure such a measure of control as to take the material to Germany to be worked up, instead of coming here to provide work for the British electrical industry. We trust that our legislators, as well as industrial and financial authorities, will profit by this experience in shaping their future course of action. But mica is only one of many lines in which the nation has been advantaged by its war-industrial necessities and efforts. The tungsten industry, the manufacture of ferro-chrome for steel production, spelter, potash, magnetos and other ignition devices, optical and scientific instruments—all of these came in for mention. The improvement of works' methods, the advantages of repetition work, the use of electric trucks in factories—indeed, the more reasonable use of the most suitable equipment and the full utilisation of scientific knowledge—have brought us through our period of stress and strain in such a way that to-day we stand, in the opinion of Mr. Kellaway, "first in the world in almost every sphere of industrial effort." It is surely up to all of us to see that there is no falling from this pinnacle of grace in the days when the menace of war does not confront us and when the tendency to become preoccupied with internal political problems may put us in danger of forgetting the lessons that have been learned at so great a cost.

The other speech delivered by Mr. Kellaway was concerned with what our works are doing to change over from munitions and war productions to commercial manufacturing. While it is true that the vastness of our war effort has been responsible for the greatness of the difficulty that now confronts us as we are proceeding with the transformation from war to peace operations, it is also true that the advances made under war conditions will, in many respects, materially help us in that transformation process. The account that the speaker gave of some of the peace-time articles that are to be turned out by works lately making war productions was entertaining. We have already mentioned a number of such changes arranged for in well-known works. Mr. Kellaway, with the information officially at his disposal, was able to go much further. He instanced aeroplane factories which were turning over to toy and furniture production; gun factories changing over to the building of locomotives—a line in which we had abundant scope, and might have done better had less of our railway building been done by the railway companies themselves; fuse factories turning over to the making of electric fittings. Others are to produce files and springs in place of shells; dairy utensils instead of steel pressing for mines and copper bands for shells; valves instead of aeroplane assembling; motor accessories and capstan lathes in place of fuse and aeroplane parts. These are only a few of the articles he mentioned, and those he mentioned were but a small portion of the whole of the changes which are being proceeded with in the hope of giving employment to hundreds of thousands of British workpeople, the utilisation of British-Empire material, and the stoppage of importation of German manufactures, which, under the altered conditions resulting from the war, we may find ourselves well able to dispense with. Of course, nobody expects all these factories to settle down to their new operations at once. In many cases arrangements have been made for the installation of special equipment, and if the needed "pivotal" men are expeditiously released from the Forces, and materials are available, there should be good progress made in the course of a few months. For a time the demand for most lines of manufacture will be very heavy, but increased production, which is to earn high wages, will call for an extended market for years to come. We are aware that the world is hungering for manufactured products, notwithstanding war-time efforts of some nations which have not been so deeply involved in the war as we have. We require to lay ourselves out enterprisingly to satisfy that hunger, and one way of doing so is to adopt an intensive export policy, and carry it out through subsidiary companies, branches, and agents, and through the medium of the regular and many-channelled weekly service of trade journals. These last have proved their utility for maintaining export trade reputations and connections in many parts of the world under the restrictions imposed upon them and their foreign circulations by the authorities during the war, and now that a period of greater freedom is at hand, they will play a more responsible part than they have ever done before in bringing orders to the books of British manufacturers and traders.

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BALANCING AND SUSPENDING THE MOVABLE COIL OF A MARINE DEAD-BEAT GALVANOMETER.*

By J. RYMER JONES.

THE improvements here described consist in the means provided for balancing the coil; in the method of attaching the suspending wires; in substituting rubbing and self-cleaning, instead of vertically *pressing* contacts, as usually employed; and also in the manner of safeguarding the coil by keeping it in a practically central position between the magnet-poles while the suspension slide is being put into, or removed from, the instrument.

In the first and most successful of the methods hitherto employed for balancing a marine galvanometer coil (suspended by means of a taut-wire attached to fixed central pins provided, one at the top and another at the bottom end of the coil frame), equilibrium between the *back* and *front*, and also between the two *sides* of the coil, is effected by slightly bending pieces of lead wire, soldered to the back and front of the coil frame, in the direction necessary to make the axis on which the coil turns pass exactly through the coil's centre of gravity.

In a later device the upper suspending strip is attached to a small nut which is engaged by the threaded shank of a screw, turnable in fixed bearings on the coil, and serving as an adjustment to make the nut traverse a small platform on the top end of the coil frame, thereby virtually altering the point of the wire's attachment to the coil. At the lower end of the coil frame the other suspending wire is attached to another nut, which can also be made to traverse a similar platform, at right angles to the upper one already referred to. This latter adjustment is intended to balance the coil for *rolling* and the top adjustment for *pitching* movements of the ship.

It is found that, with the means afforded by either of the above well-known alternative methods, patience, practice, and repeated trials are necessary to effect a perfect balance, more especially at sea and in the unfavourable conditions and often dim light of the ship's testing room.

The chief difficulty arises from the fact that the adjustment for equilibrating, say, the back and front of the coil affects in some degree also the equipoise of the two sides, and *vice versâ*; and this is found to be especially so in the second of the balancing methods above referred to. Moreover, in the latter method the extra weight of the balancing attachments adds considerably to the weight of the suspended coil, increasing the sag and therefore necessitating either stronger suspending wire, and consequently a smaller galvanometer constant; or else tighter straining, which involves greater risk of breaking.

In the writer's improved method, readjusting the balance between the back and front of the coil is effected by the simple device (fig. 1) of providing a piece of wire (b^1) about $\frac{3}{4}$ in. long, with a screw thread throughout its length, which can pass through a hole drilled in the exact central axis of the upper pin (p^1) of the coil frame. If, then, this adjustable piece of wire passes through the exact central line of suspension, it is evident that altering the length protruding on either side of the pin, in order to effect a perfect balance between (say) the *back* and *front*, will not in any material degree affect the balance between the two *sides* of the coil; and, on the other hand, altering the length of a second similar piece of wire (b^1) intended to supply an equipoise between the two *sides* of the coil, but at right angles to the first wire, will not upset the degree of balance already effected between the *back* and *front* of the coil, *provided that this adjustable wire also passes exactly through the central line of the coil's suspension.*

The important fact that the balancing adjustment for the two *sides* does not affect the degree of equipoise already existing between the *back* and *front* (or *vice versâ*) very greatly facilitates the perfecting of the coil's balance.

When first balancing, the wires may be easily and quickly screwed in or out, as required, by hand for a coarse adjustment; and, holding the extreme *flattened* end of the wire with a pair of tweezers, will enable the operator to appreciate what small fraction of a turn he is giving to the wire for the final perfecting of the balance by that particular adjustment.

This method of balancing is applicable to the coils of other marine galvanometers.

Another improvement consists in the method of attaching the suspending wires (w^1 and w^2) to the pins (p^1 and p^2) fixed at the top and bottom of the coil without any solder. This is done by drilling three small holes (d), about $\frac{1}{8}$ in. apart, in the central line of the pin's length; then reeving the end of the suspending wire through all the holes, in the manner indicated on the left of fig. 1; and finally securing the free end with a suitable lapping of very fine wire or silk thread. The edges of the holes (d) are rounded off to prevent their cutting the suspending wires at sharp angles when subjected to tension. After securing the ends of the wires with the silk thread lapping, the slack is taken up by the tension screw (x), which also tightens up the loops between the rectangular bends, and thus prevents any risk of drawing out the ends, and perfects the contact with the coil pins. Moreover, the suspending wires may be more highly strained with considerably less risk of breaking than when using solder to attach the wires to the coil pins; for not only does the heat while soldering reduce the temper,

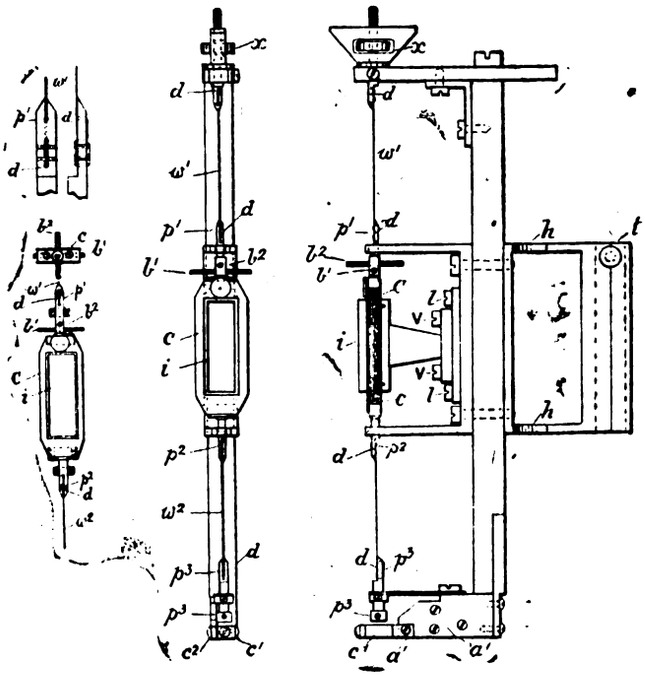

FIG. 1.—BALANCING AND SUSPENDING ARRANGEMENT.

but the softened wire is more likely to stretch under prolonged tension, and this will change the *constant* and upset the balance.

Unless, during a re-suspension, the new wire be very carefully soldered close to the *flat* surface of the pin, so as to leave the end of the pin in a perfectly straight line, not only is a previous balance quite upset, but the wire is also very liable to break, even when only reasonably strained. Moreover, if solder be used, it is very often found that the re-soldered end of the wire has been slightly displaced by the tool, so that it does not lie quite in the central line of the coil's pin. In that case, also, a former balance is wholly upset, and one side of the coil may hang too near to the soft iron core (i). If not excessive, this contingency is provided against in the form of two screw adjustments (l and v), enabling the iron core (i) to be shifted either laterally or longitudinally; but it is much safer to use no solder.

In the improved method of attaching the suspending wires to the coil by reeving the ends through the holes (d) in fig. 1, in order to dispense with soldering, the suspension,

* Patent Specification No. 108,649. Application March 19th, 1917; complete (accepted) August 16th, 1917.

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if broken, can quickly be renewed, and the line of suspension will be equally well centred every time. The method can be applied to coils of other forms of marine galvanometer.

A further improvement is the substitution of rubbing contacts (c^1 and c^2) for the usual *pressing* contacts, because the latter will hold dust and press it on to the spring contact below, whereas the rubbing contacts are self-cleaning.

With this innovation, moreover, no spring contacts are necessary on the base, so that a wooden base, with only three ebonite pillars to insulate the magnet and slide, suffices instead of the ebonite slab usually required.

Safeguarding the coil during the act of inserting it into, or removing it from, the galvanometer is effectually provided for by using *two* upright rods instead of only the usual one. One rod enters the tube (t) at the back of the slide, and keeps it in a vertical position, while a second rod placed nearer to the front, and which passes through holes (h) in the slide frame, prevents it from being deflected to the right or left sufficiently to bring the coil in contact with the magnet-poles.

An additional safeguard exists in the fact that by the time that the lower end of the coil reaches the top of the magnet-pole the contact arm (a^1) of the slide has already entered a slot cut in the brass plate and wooden block supporting the magnet; and further down it is limited in its lateral movement by the two contact springs which also serve as guides.

The galvanometer coil (c) is doubly wound, the inner end of the one half and the outer end of the other half being connected together and to one terminal, and each of the two remaining ends to other terminals on the base of the instrument, so that the two equal windings can be joined up for testing either in series in the usual way, or differentially when so required for the "Rymer-Jones High-Resistance Break Test."

The provision of a fourth terminal is necessary in order that the magnet and metal surrounding the coil may conveniently be connected to one extreme end of the coil when the two windings are joined up in series, and alternatively to the *junction* when they are connected up differentially—the object of this well-known and effective expedient being to bring the magnet poles and surrounding metal to the same potential as that of one of the *ends* of the coil in the *series* case; or as that of the *junction* between the windings when they are differentially joined up, and thus prevent any displacement of the spot from its instrument zero, which would otherwise arise from static attraction.

To convert the instrument into a highly sensitive galvanometer for use on shore, the tension of the lower taut wire is either relaxed by raising the bottom pin (p^2) or, preferably, this wire is removed, and a piece of very slack wire connected between the small screws provided for this purpose is substituted in its stead. Not only will the instrument then be ten or even twenty times more sensitive than with the bottom wire (w^2) taut, as used on board ship, but discharge throws from a cable or condenser will be much more easily observed, because the swing will be slower and dead-beat. For use on shore three screws are provided in the base for levelling.

As the base boards are fitted with trunnions, the front of the instrument can be tilted up or down, by means of back and front adjusting screws, in order to raise or lower the spot of light as required to bring it on to the scale when the galvanometer is set up.

As a good spot depends on the lamp and its lens being so adjusted as to direct the best beam obtainable on to the galvanometer mirror, it conduces greatly to this end, and is found very convenient that, by means of this galvanometer tilting adjustment, the height of the lamp and its lens need not be regulated to suit the height of the galvanometer scale.

During very heavy weather at sea, and when not in use at night, the galvanometer can be secured, so that it does not shift its position on the anti-vibration pad—in case the rubber guys provided are insufficient—by means of special insulating clamps, which can be quickly raised to remove the pressure while tests are being made.

ELECTROCULTURE EXPERIMENTS AT LLANTWIT VADRE.

An interesting series of experiments on the stimulation of plant growth has been carried on, near Pontypridd, during the last two years on the field of the Star-Delta Potato Club, which is connected with the South Wales Electrical Power Distribution Co., of which Mr. W. A. Chamen is the engineer and general manager. By the courtesy of the assistant manager, Mr. C. T. Allan, we have been favoured with a copy of the report on the results obtained, from which we extract the following particulars:—

The field had an area of 2·07 acres (see fig. 1), and the soil consisted of a typical heavy loam, approximately 70 per cent. clay and 30 per cent. sand. In 1916 the field had grown oats, but in 1917, when taken over about March, it had been two-thirds ploughed. This was completed, but no manure was used in 1917.

In March, 1918, 41 tons (20 tons per acre) of colliery manure was spread evenly over the field. In April the field was ploughed once lengthways, then harrowed and rolled. After this, 10 cwt. of 30 per cent. super-phosphate and 2½ cwt. of sulphate of ammonia was spread over the surface. It was proposed then to cross-plough, but owing to difficulty in obtaining a plough, and also to the planting season being due, the growers were compelled to open planting drills, and found only a fair tilth.

In 1917 potatoes were planted during the first week in May, and were lifted in the first week in October with the following results:—

	Cwt. planted.	Cwt. lifted.	Ratio.
King Edward ...	2	4·46	2·25 to 1
Irish Up-to-Date	20	81·7	4·0 „ 1
King's President	19	171·0	9·0 „ 1
Arran Chief ...	7·5	35·71	4·75 „ 1
	48·5 cwt.	292·87 cwt.	6·0 „ 1

In 1918 potatoes were planted in the first week in May, and lifted in the second and third weeks in October with the following results:—

	Cwt. planted.	Cwt. lifted.	Ratio.
Templar from Loch Leven.	48·6	370·4	7·6 to 1

For the purpose of the experiments, 400-volt, 25-cycle, single-phase current was stepped up by an oil-cooled, 10-K.V.A. transformer to 32,000 volts, and rectified with a Delon type of rectifier,* which held the voltage to 39,000 in dry weather and to 30,000 in the wettest weather. The apparatus gave no trouble at all, and held this voltage in the heaviest rain.

The area under electroculture was divided as follows:—

	1917.	1918.
Electrified area ...	1·21 acres	1·096 acres
Control area	0·86 „	0·977 „
Total	2·07 acres	2·07 acres

In 1917 the network consisted of 5,850 yards of No. 24 S.W.G. galvanised steel wire. The wires were spaced 6 ft. apart, with cross wires arranged in the same way, so as to make a mesh 6 ft. square. These wires were supported from main copper carriers of No. 6 S.W.G. The network at first was supported on E.H.T. insulators about 6 ft. 6 in. from the ground; later, on August 14th, this distance was reduced to 5 ft.

In 1918, 1,860 yards of the same size of wire was used, but the wires were spaced 9 ft. apart, with *no* cross wires. The network was movable, and was kept as nearly as possible 2 ft. above the haulms.

The 1918 arrangement was at right angles to that of 1917.

* See Electrical Review, February 18th, 1916.

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The voltage was measured in 1917 by a Kelvin and White electrostatic voltmeter, reading to a maximum of 100,000 volts. In 1918 it was measured by a sphere gap, previously calibrated. For measuring the current a Ferranti, D.C., 0-100-volt, moving-coil voltmeter (with the resistance cut out), calibrated as a milliammeter, was employed. This instrument, of course, gave the polarity as well as the value of the current. The synchronous motor being four-pole, by shifting the adjustable stationary arm of the rectifier a quarter revolution, the polarity could be reversed if necessary, but the network was kept positive. The ammeter was fixed on the negative.

In 1917, as stated already, the voltage varied from 39,000 volts in dry weather to 30,000 in wet weather. In 1918 it was 36,000 volts; and this did not vary 5 per cent. either way, the lower voltage being obtained during heavy rain and the higher during drier weather.

The current in 1917 varied from 2·5 milliamperes in dry weather to 4·0—7·0 in wet weather. In 1918 it varied from

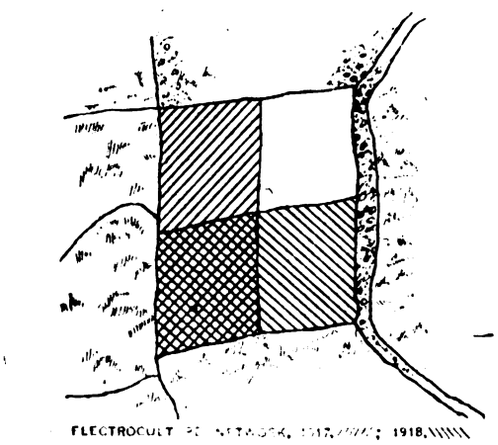

Fig. 1.—Potato Field at Llantwit Vadre.

0·35 in very dry weather to 0·8 during heavy rain, with an average of 0·5 during the normal damp weather prevalent in the district.

It was endeavoured to keep the voltage constant during the treatment, and it is interesting to note the lower readings during 1918, which may be accounted for by the smaller amount of wire used as compared with the previous season, the ratio being 3 : 1. Further, the insulators used during 1918 provided a smaller leakage path.

Treatment was usually given between the hours of 6 and 9 in the morning and 7 and 10 in the evening :—

	1917.		1918.
Commenced Aug. 10 ...	Morning, 118 hours.	June 22, 294 hours.
Finished Oct. 1 ...	Evening, 164 ,,	Sept. 27, 294 ,,
Total	282 hours.	588 hours.

The results of electroculture were as follows :—

	1917. Tons.	1917. Tons per acre.	1918. Tons.	1918. Tons per acre.
Electrified ...	9·1	7·5	10·3	9·16
Control ...	5·5	6·4	8·2	8·40
	Increase ... 17·2 %		Increase ... 12·6 %	

As previously stated, the apparatus never failed and was successful throughout, although difficulty was expected in keeping the network charged during heavy rain. On dark nights it was easy to see the glowing network wires. In the rectifier hut grass grew extremely quickly through the rough flooring of old sleepers, especially under the voltmeter, and in the dark the tips of the blades could be seen glowing, but, after some days, these went a dark brown, evidently showing that the discharge was too intense. Insects, such as butterflies, &c., on many occasions were observed, and it was noticed that when flying under the network they kept very close to the ground, or else flew back away from the wires. Insects that happened to alight on the wires in the hut could be seen glowing in the dark, and in most cases after the current was shut off they were found to be dead.

It was noticed in both seasons that the potato haulms under the network kept green much longer than those on the control portion.

Although the percentage increase in 1918 was less than in the previous year, it is to be noted that the total yield was increased from 14·6 tons to 18·5 tons, and although the treatment during 1917 only lasted seven weeks, as compared with three months during 1918, the decrease might be explained by the smaller area of network wire in 1918; but it should also be noted that, owing to the network in 1918 being arranged at right angles to that of 1917 (see sketch), about one-quarter of the 1918 control portion had been under the network the previous year.

It was unfortunate that, owing to the weather being so wet during the gathering of the 1918 crop, it was not possible to weigh separately the potatoes taken from each quarter of the field.

Cost of Equipment.

Transformer of 10 K.V.A. 400/120,000 V. ...	£204	0	0
3-H.P. synchronous motor for rectifier ...	55	0	0
	£259	0	0
Making rectifier arms, &c., approx. ...	£41	0	0
	£300	0	0

It is estimated that this equipment could easily deal with 100 to 150 acres.

Two-Acre Voltage Equipment.

Galvanised steel wire...	£2	8	0
Supporting wire, steel, say	2	0	0
Sapling poles, insulators, say eight at 10s...	4	0	0
Labour, say	4	0	0
	£12	8	0

A "Danger Notice" was kept at the gate of the field warning people of the high voltage, and this probably had a deterrent effect on prospective thieves, but did not prevent a big cart-horse breaking through the hedge during 1917, which afterwards received a shock, departing with a good portion of the network attached to it. The horse did not return, but we understand that it was undamaged. This year a sheep dog got under the network, and after receiving a shock through its tail, it departed very hurriedly, making loud noises, and also did not return. Our informants are not sure what ill-effects it received, but say they certainly knew its *voice* was in good order whilst it was within hearing!

In an adjoining field, in 1918, an experiment was made on a crop of oats, but owing to various difficulties it was not possible to carry it out thoroughly. The results seemed to point to an approximate increase of 35 per cent. in grain and an increase of 17 per cent. in straw.

Demobilising Munition Workers.—In connection with discharges of munition workers, the Minister of Munitions wishes to point out for general information that (with the exception of persons engaged in manual labour on certain building and construction work, certain classes of sea-going engineers and workmen engaged in ship repairing or whose employment is of a discontinuous or temporary nature) workpeople engaged on or in connection with the manufacture of munitions are in general entitled in accordance with the provisions of Sec. 3 of the Munitions of War Act, 1917, to a week's notice of discharge or a week's wages in lieu of notice. If, therefore, a munition worker (not falling within the above exceptions) is discharged with less than a week's notice or wages in lieu thereof, he or she can complain to a Local Munitions Tribunal and claim payment of a week's wages in lieu of notice by the employer. All necessary particulars, together with the proper form of complaint, can be obtained from any Employment Exchange. The Minister of Munitions would be glad if employers generally would give their workpeople as early an intimation as possible of any intention to discharge, and would in all cases give the Employment Exchanges at least a fortnight's notice of impending discharges.

Electric Welding in Shipbuilding.—The displacement of riveting by electric welding in ship construction is being considered in insurance circles, with regard to possible reduction in rates. It is claimed that welded plates stand the impact test as well as riveted plates, but underwriters require further information on the question of the results of stranding and collision. The costs under these heads are extremely heavy at the present time, as shown by the heavy increases in premiums on hulls. The cost of electric welding is stated to be much below that of riveting. So far, principally small boats have been tested with the new process, and a recent experiment shows that in the case of a barge which was electrically welded at a cost of about £300, the tender for riveting the vessel was £450.

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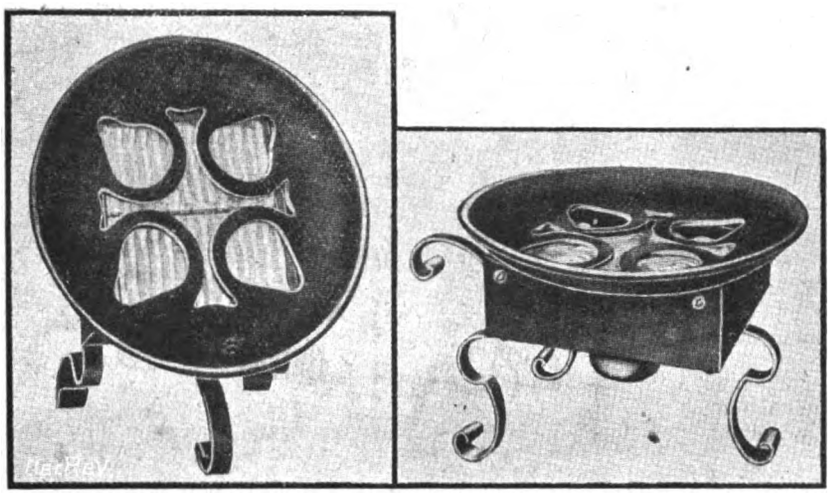
NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Combined Electric Heater and Cooker.

The "Beco" combined radiator and stove is a new device introduced by Electrical Components, Ltd., of 36, Cannon Street, Birmingham. In its upright form (fig. 1) it is used as a radiator, and in its horizontal position (fig. 2) it is adapted for cooking and domestic purposes. The apparatus is of solid construction, there being no swivel nuts, screws, or springs to get out of order, and consists of a square, cast-iron case containing the elements, mounted upon scroll legs, and having a circular, dished, ornamental front, which also serves as the top of the stove when used for cooking. Four legs are provided, so arranged that in whichever position the heater is used it stands firmly upon three of them, the fourth leg doing duty in each case as a handle. In changing over from heating to cooking, or *vice versâ*, it is only necessary to tilt the stove into the required position.

The elements consist of continuous spirals of nickel-chromium wire arranged in parallel coils on the surface of porcelain formers. Two such elements are used, the loading of the two together being either 1 or 1.5 kw., as desired.



Figs. 1 and 2.—The "Becq" Combined Radiator and Stove.

With the higher loading independent control is provided for each of the two elements. The switch or switches are mounted on the back of the element case, where also is the plug for connecting up. The front of the apparatus may be of malleable iron, either japanned black or nickel-plated, or of solid cast brass, polished. The apparatus is stocked in all the usual voltages.

"Izolex" Replacement Fuse.

A new type of replacement fuse has been placed on the market by Messrs. Ward & Goldstone, Sampson Works, Manchester, which, apart from its novelty of design, occupies no greater space than that needed for the dial-pattern cartridge fuse, while retaining the convenience of the open-type replacement fuse. At present it is made in sizes up to 15 amps., but larger patterns for currents up to 200 amps. at voltages from 250 to 500 are in preparation. From the illustrations it will

Fig. 3.—Fuse Carrier.

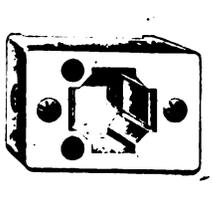


Fig. 4.—Base, with Carrier Removed.

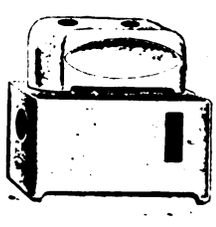


Fig. 5.—Complete Fuse Unit.

be seen that the fuse consists of two parts, the fixed base (fig. 4) and the detachable carrier (fig. 3). The tongues on the carrier are of U-shape to ensure good contact, while the contact plates in the base are flat, and arranged parallel with one another. These contacts, being solid, have no tendency to deteriorate, as is the case with spring clips. Provision has been made for ready replacement, although, owing to the substantial form of the clips in the carrier, they are unlikely to need renewal. The fuse itself is threaded through a diagonal hole formed in the porcelain body of the carrier, and when the latter is in position (fig. 5) no metal parts can be touched by the hand. When the "Izolex" fuse is required for single-way circuits only, and is not to be mounted up in fuse-boards with bus-bars, it can be fitted with in-going and out-going terminals. It is recommended that "Testotin" fuse-wire be used with these fuses. Suitable ironclad cases to accommodate single-pole or groups of fuse units are supplied, these being designed with ample space at the sides so as to facilitate wiring up. The china bases are raised to permit of the wires being passed below, the main cables being fitted in full view, while the in-coming cable holes are bushed, but can be screwed to take conduit at small additional cost.

Industrial Lighting Fittings.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham, have issued a new catalogue of industrial lighting fittings, which includes many new designs of inexpensive reflectors and lanterns, suitable for factory use. The workshop reflectors are shown in many sizes, arranged for intensive and extensive illumination. In these days, when economy and efficiency are the watchwords of factory practice, it behoves all works engineers to look well to the lighting of their works, and see that light is not wasted in glare and shadows. There are sufficient designs illustrated in the list before us to meet all the requirements of any well-lighted works, while we note, also, that the prices are low. The outside lanterns shown vary from small sizes, suitable for 100-watt, gas-filled lamps, up to the large lanterns taking

Fig. 6.—Simplex Lantern for Gas-filled Lamps.—Light Pattern.

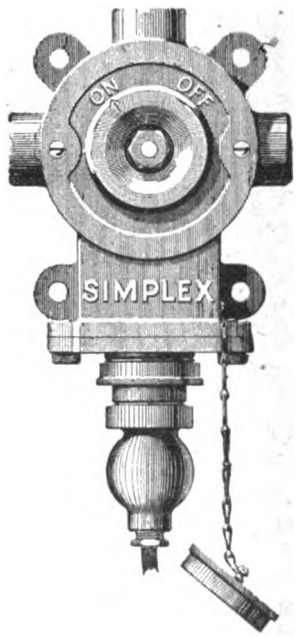


Fig. 7.—Simplex Watertight Switch and Plug.—Heavy Pattern.

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1,500 watts. There are several patterns of each size shown, some quite light and inexpensive (fig. 6), suitable for factory and subway use, and others much heavier and more expensive, suitable for railway or street lighting. They are specially designed for the economic lighting of large spaces. There are also shown indirect and semi-indirect fittings of inexpensive types, for drawing offices, booking halls, shops, &c. At the end of the catalogue are illustrated switch and plug fittings (fig. 7), designed for heavy factory use and special positions where both watertightness and gastightness are desired.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Coal Economy.

With reference to the appeal which my Committee made in the Press that electric supply stations should assist the Coal Controller in distributing circulars with a view to urging the public to economise in coal, I should like to say that the appeal met with a most gratifying response, and the following letter will be of interest to those who thus kindly assisted:—

Board of Trade,
Coal Mines Department,
Holborn Viaduct Hotel,
November 20th, 1918.

T. W. Cole, Esq.,
The Provincial Electric Supply
Committee of the United Kingdom.

Coal Economy Circulars.

Dear Sir,

With reference to the assistance which has been given by member companies of your Committee and other undertakings in distributing circulars on coal economy, would you kindly convey to these companies the thanks of the Coal Controller, and inform them that the Department very much appreciates their kind help, which we feel has been of material value.

May I point out that there is little promise of an alleviation of the serious coal shortage this winter, and that the utmost economy in the consumption of fuel and light is still necessary.

Yours faithfully,
(Signed) C. W. SANDEMAN,
Director of Publicity.
T. W. Cole,
Secretary,
Prov. Elec. Supply Committee.

London, E.C., *November 27th*, 1918.

"To Him that Hath ——."

In an article recently published in your columns,* the writer expressed the fear that the clerical worker in munition factories would not receive, at the hands of the Government, the same consideration as was extended to the manual worker when munitions of war were no longer required, and a perusal of the Government "out-of-work" donation scheme, which allows for benefits to be paid only to persons who come within the scope of the National Health Insurance Act, will prove that the fear was well founded.

Persons insurable under the Health Insurance Act are all manual workers, whatever their wages may be, and those clerical workers whose income does not exceed £160 per annum. Thus it will be seen that out-of-work benefits will be paid to those workers who, during the past four and a half years, have been in receipt of unprecedented high wages, amounting in many instances to between £500 and £600 a year, and yet denied to all clerical workers who have been fortunate enough to earn more than £160 per annum.

Many thousands of clerks, from an actual wages standpoint, are really eligible for benefits under the National Health Insurance, but as the war bonus they receive has brought their income slightly over the £160 limit, they are deemed to be ineligible, and their contributions have been dispensed with. This has come into effect quite recently, doubtless on the assumption that their income will not descend below the limit, but when the clerk is thrown out of employment, and has nothing to fall back upon, he will probably be obliged to accept a job at his pre-war rate of pay, without the war bonus he at present enjoys.

It is impossible that this miserable distinction can be tolerated. Is it logical that the comparatively low-paid clerk (for what is £3 per week worth in these days?) can save in anything like the same degree as his much better paid manual confrère? Why should this distinction be made between the manual and the clerical worker? The Government feels that the manual worker is likely to incur hardship owing to temporary unemployment, and has granted out-of-work donations in consequence; but surely the same ill-effects are likely to be felt by the clerical worker, even if his war-time income has exceeded £160 per annum. The manual worker has at least had the opportunity of putting a bit by for a rainy day, but it looks as though the Biblical quotation, "To him that hath shall be given," was in the mind of those responsible for the framing of the "out-of-work" donation scheme.

It is not suggested in this letter that the out-of-work benefits should not be paid to the manual workers who have been in receipt of high wages, for it is recognised that, high as these wages are, the terribly high cost of living has greatly reduced their value. It must, however, be remembered that the clerk, with his £165 or £170 per annum, has to pay exactly the same as the manual worker for the necessaries of life, and as the chances of temporary unemployment are at least equal, it is only fair that the same consideration shall be extended to the clerk as to the mechanic. The Government scheme should be amended forthwith, so as to embrace *all* workers (no matter what their war-time wages may have been) who during the change-over period are thrown out of employment.

M. E. Nicholls.

* ELEC. REV., November 22nd, 1918.

The Royal Albert Hall.

I notice in your issue of last week a paragraph in regard to the above, which says that certain people "removed a paving stone outside the Hall and cut off the electric supply at the main." I am sure everyone will agree that it would be very unfortunate if such an example were seized upon as a normal weapon of retaliation, and I think in this connection it might not be unwise to draw attention to a provision in the Electric Lighting Acts, a consideration of which might possibly form a deterrent to anyone who had memorised the method as one to pursue should occasion arise. Section 22 of the Electric Lighting Act, 1882, reads as follows:—

"Any person who unlawfully and maliciously cuts or injures any electric line or work with intent to cut off any supply of electricity shall be guilty of felony, and be liable to be kept in penal servitude for any term not exceeding five years, or to be imprisoned with or without hard labour for any term not exceeding two years."

Electric Supply.

London, E.C., *November 30th*, 1918.

Charges for Electricity.

The summarised list of price increases made by electrical undertakings in your issue of July 26th is an interesting and valuable one. I note that the majority of undertakings have increased their prices for lighting and power by either a fixed amount per unit or by some percentage.

In our undertakings at Ballarat and Bendigo we have made certain increases in the price of electric light and power during the war, but owing to the frequent increases in the price of coal that we have in the last few years had to face, I considered it desirable to introduce a coal clause, which would be applied automatically as soon as an increase occurred to all power consumers, both large and small, with the exception of those taking 50 and less units per month.

Commencing from the beginning of this month we have introduced a new tariff, as per the enclosed printed note.* An endeavour has been made in drawing this up to provide for all possible contingencies. It will be noted that the coal from the State coal mine, which is our main source of supply, is taken as the basis, but, owing to strikes and stoppages at this mine, we have frequently to fall back on coal from New South Wales, which has to be shipped to Melbourne, 650 miles, and then carried by rail 75 miles to Ballarat, and 100 miles to Bendigo. Our State mine coal is carried by rail 161 miles to Ballarat, and 188 miles to Bendigo.

All our coal reserves have to be Newcastle coal, and not our basis coal, owing to the latter seriously deteriorating under storage. We may, in addition, have to provide for the use of other classes of coal of inferior calorific value, and in view of the possibility of a shut-down of black coal supplies, the use of brown coal as an emergency measure. For these reasons the *average* cost of fuel is compared with the basis.

The basis is the cost delivered in bunker, which provides for extra carting and handling charges, when reserve stocks have to be drawn on during strike periods.

It will be noted also that the relative calorific values of the various fuels are provided for in the estimated price, and when the reserve stocks are consumed these will be priced not at their purchase value, but at their current, or their replacement, value. If, when these reserve stocks are consumed, the replacement value is unknown, then the price current prior to the strike is taken, and later on, when the renewal price is known, the difference between these two on the number of tons consumed from the reserve stocks will be spread over some future month or months' costs of fuel delivered in bunker.

*Power, heating, cooking, ventilating, and other purposes, at 3½d. per unit for the first 38 hours' use per month of the maximum demand, and 1½d. per unit afterwards.

The above tariff is based on coal (from the State mine) delivered in bunkers at power house at 21s. 6½d. per ton, and for every increase of 6d. per ton in the monthly average cost of fuel above the basic price a charge of .015d. per unit will be added to the tariff. In the event of reserve stocks or other fuels being used the relative calorific values and current or renewal prices will be calculated on the above basis.

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Consumers using up to 50 units monthly are increased by ½d. per unit. In previous alterations in power tariff the hours' use of the maximum demand was extended, and the majority of these small consumers, principally private houses using power, did not face an increase in price, because most of their units were consumed at the 3½d. per unit rate. As they were not affected, therefore, by the previous increases, we are combining that with the present super-charge, and putting them up a flate rate of ½d.

Consumers taking up to 50 units per month represent 77½ per cent. of all our power consumers. In bringing in the present super-charge we have to provide for a 4s. 6d. per ton increase in fuel, or nine times the basic super-charge of .015d., representing .135d. per unit. Approximately eight times this represents 1d.

For convenience in calculating the super-charge to be added to the bills, a ready-reckoner has been prepared, working out the cost in even pence for every seven and eight units alternatively. The amount of additional clerical work, therefore, in dealing with this super-charge will be of little or no importance. In the event of, say, another 1s. 6d. increase in the price of fuel the super-charge would be increased from nine times the basic price to 12, and a new ready-reckoner would be prepared to deal with the same.

Coal clauses are frequently provided for very large consumers, or for special-rate consumers, which automatically come into force when an increase in fuel takes place. It is, however, somewhat incongrous for a super-charge to be immediately made in the case of such consumers, and the smaller consumers to escape until such times as the increases in the price of fuel has necessitated a general increase in the tariff.

The price of fuel is causing many of the Australian undertakings as much concern as the home ones. For instance, slack at the pit has increased from 6s. to 16s. 6d. in six years, or an increase of 175 per cent.

P. J. Pringle.

Ballarat, Vic., *September 24th*, 1918.

"Fraternity"—or Tyranny?

With regard to the correspondence which has taken place recently in the Electrical Review on the pros and cons of the E.P.E.A. and the E.T.U., I wish to endorse "Borough Electrical Engineer's" views in relation thereto. I am writing as a member of the E.P.E.A., and I have come to feel that some means should be found of associating ourselves with the E.T.U. The E.T.U.'s methods in the past have perhaps not altogether been to our liking, but with the assistance of engineers I feel confident the tone of the union would be improved to the benefit of both sections, including a more amicable working arrangement between the engineers and the workmen.

Only this week certain corporations have turned down our demand for a reasonable advance. What is our remedy?

One of the Corporation officials' answer was: "You will receive nothing except by using force." Now this policy, to my way of thinking, leads to the use of drastic remedies, and so long as many undertakings are managed by clerical managers and corporation committees a strong union is the only means whereby the technical engineering staff will ever be recognised.

Plain Speaking.

December 2nd, 1918.

Smooth versus Undercut Commutators.

The following remarks, based on personal observation over considerable periods, may be of interest to your readers.

Motors of 460-500 volts, 10-50 h.p. running day and night at from ¾ to full load, shutting down for an hour or so every 24 hours to enable examination of brushes, &c., to be made, having commutators undercut to about ¼ in., have never given the slightest trouble. In fact, the only trouble I ever experienced with this type of commutator was on a 50 h.p. motor, and this was caused by rain leaking through the roof on to the commutator, which must have caused the carbon dust lodged between the bars to become damp and caked, but as the motor was on very urgent work it was allowed to run through the night on full load, with the result that a number of segments were badly burned, necessitating the commutator being rebuilt.

Motors of the above ratings, running under exactly similar conditions, with smooth commutators, always seemed to be in trouble.

1. Mica would get high, resulting in bad sparking and the burning of "flats" on the commutator, and in some cases I have known a motor with high mica actually wear a full inch off a new set of carbon brushes in a run of 24 hours at full load.

2. Dust seems to settle on smooth commutators with remarkable rapidity, and getting under the brushes soon gives rise to sparking.

3. Overoiling of motors seems to cause considerable trouble with smooth commutators to a much greater degree than with those of the undercut variety.

Commutators should be built up with mica, and the various grades of micanite and mica substitutes should be avoided, as my experience has always shown that 75 per cent. of commutator breakdowns occur on those commutators insulated with substances other than mica.

Most commutator troubles are due, not so much to the actual running conditions as to the starting conditions, and as soon as the makers of starting apparatus come to the conclusion that a properly graded resistance is the most important part of a starter, coupled with a slow motion device, in such a manner that it is impossible for the most unskilled operator to start the motor under any but sparkless conditions, the greater part of commutator troubles will cease. This applies more to smaller motors, which in many cases are installed with very little thought about the starter, and the starting up is usually done so rapidly that the starter might be ignored and starting effected merely by the closing of a double-pole switch.

I consider the ideal combination to be a motor with commutator undercut to a depth of ¼ in. for large machines, and just below the surface for small machines, connected to a starter fitted with no-volt and overload release and a slow-motion device, which would make it impossible to start up the smallest motor so that the slightest spark could be observed on the commutator.

P. Hayes.

Leytonstone, *December 2nd*, 1918.

Having made a very close study of this particular question, which I see is being debated in your "Correspondence" column, I have pleasure in placing the following data at your disposal:—

Commutator trouble, *i.e.*, sparking at the brushes and over-heating of the commutator of D.C. generators and motors, including the single-phase repulsion motor, is due in most cases to the mica between the segments swelling as the commutator becomes heated, consequently the carbon brushes may not be hard enough to scour the mica away, and the result is violent sparking.

To permanently overcome this contingency, manufacturers began to turn out machines with the segment mica slightly reduced below the level of the commutator segments. They also supplied a particular grade of brush to suit these conditions, which should not be altered for any other grade or quality.

A carbon brush suitable for machines with undercut mica needs to be exceptionally tough, and of dense texture, otherwise the channels in between the segments will break away the heel or toe of the brush, particularly so in the case of reversible motors. As regards motors, the totally-enclosed type should always have the mica slightly reduced, owing to the difficulty of getting at the commutator.

As regards generators, the practice of slightly reducing the micas is practically adopted in most generating stations. I have seen as many as twelve 400-kw. machines running continuously, all of which had undercut micas.

Any machine which is being worked at heavy load, and which has level micas and soft brushes, will have sparking trouble. If brushes of a harder grade were substituted to scour away the rising mica, they would probably not carry the necessary current, and become red hot, as I have often seen where this remedy has been tried.

Any machine having reduced micas, and which becomes clogged in the channels with carbon dust and paraffin wax applied very often in desperation by the attendant, has most certainly the wrong type of brush for the job.

If the cutting down of the micas is performed on the spot, great care should be taken to cut the exact width of the mica; a hard steel cutting tool with a curved hook end should be used in conjunction with an arched piece of sheet steel the full width of the commutator to act as a straight edge to cut along.

Unless this work is done by a practical man it will not be successful, and probably will make the trouble worse. Also after it is done, apply a full-width, curved wood block, covered with carborundum cloth, until the commutator is perfectly smooth. Change the brushes if too soft.

The Morgan Crucible Co., Battersea, supply the proper grade of brush for this class of machine.

Henry Fowler.

Liverpool, *December 2nd*, 1918.

Motor Problems.

With regard to the letter from Mr. Ernest F. Butler which appeared in your issue of November 29th, under the above heading, I note the statement that the problem of taking care of the sudden strengthening of the field of a variable speed motor, when stopping, is a new one. If Mr. Butler cares to look through the Patent Office records for, say, 1910 and 1911, he will find there that the problem even at that time was receiving attention.

The solution of the problem which Mr. Butler proposes certainly does not overcome the difficulty, even with two handles, as if we assume for a moment that a 4 to 1 speed regulation is used on a motor, and that the motor is running at full speed on, say, a fly-wheel load, then if the operator suddenly throws his field regulator over to the "full field" position there will be a heavy surge back on to the line, and in many instances I have seen the motor flash over on the commutator.

I am sending you herewith an illustration of a form of combined starter and speed regulator operated by a single handle, made by Messrs. Allen West & Co., of Brighton,

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This form of starter does all that Mr. Butler requires, and is, in addition, fitted with an accelerating relay, which prevents too violent speeding up, and also has a decelerating relay, which entirely overcomes the troubles both when slowing down suddenly and when stopping the motor. Curiously enough the form of decelerating relay is somewhat similar to that proposed in your foot-note, and forms the subject matter of a patent applied for by Mr. Victor Breeze.

These two relays are built at Messrs. Allen West's own works, and, of course, will not be open to the criticism which Mr. Butler makes on other makes of relay, which I am sorry to say nearly all emanate from America.

I think this form of control may claim to be a solution of the problem as far as its technical side is concerned. As regards the editorial requirements of cheapness and simplicity, the scheme is certainly simple, but the term cheapness is a relative one. For the material in the controller, and the way in which it carries out its work, the form of controller offered is certainly cheap, but I am afraid it will not compete in actual cash price with the ordinary form of manually-operated, face-plate starter, although if compared with some of the more elaborate pillar panels, it comes out very well with regard to price.

F. N. Pickett.

Hove, *December 2nd*, 1918.

[Unfortunately the illustration was not suitable for reproduction. We are pleased to see that our problem is being so seriously tackled, and that the relay solution which we suggested had already been introduced.—Eds. Elec. Rev.]

THE USE OF HIGH-PRESSURE AND HIGH-TEMPERATURE STEAM IN LARGE POWER STATIONS.

On Tuesday evening last week, Mr. J. H. Shaw, A.M.I.E.E., read his paper (an abstract of which appeared in our issue of July 19th, 1918) at Manchester before the North-Western Centre of the Institution of Electrical Engineers.

Prof. Stoney, discussing the paper, said he was very much interested in the slide of the valve which failed at such a low temperature as 450 deg. What happened with cast iron was that the steam seemed to get in beside the crystals. The steam seemed to get in beside the flakes of graphite, and caused rusting; he had known cast iron grow as much as 3 per cent. in its dimensions, which, of course, totally upset the proportions of the turbine. The cast iron also became quite brittle. He had come to the conclusion that 470 deg. F. was probably a safe temperature to which to subject cast iron, but cast iron growth occurred at 450 deg., showing that not more than 400 deg. was safe. Personally, he had never seen trouble with cast iron at 100 deg. superheat, which gave a temperature of about 450 deg., but he had seen a good deal of trouble with 150 deg. superheat. In order to get higher efficiency the range of temperature would have to be increased. Mr. Shaw had shown very well what benefits could be got from that. Prof. Stoney pleaded that more attention should be paid to the lower limit, that was the minimum potentiality. One should not have more than 20 deg. between the temperature of the cooling water and the temperature of the steam; it was often 30 deg. or more. He was rather surprised to see that in Schedule I Mr. Shaw took the quantity of cooling water as only about 45 times the steam condensed. That meant a difference of 21 deg., or, allowing 6 deg. loss, say 27 deg., between the temperature of the steam and the temperature of the cooling water, except in exceptional cases. Where there was a large lift—as there was sometimes in cooling towers—he would have thought 65 deg. to 70 deg. would have been very much better for the circulating water. It should be remembered that every three degrees saved in the temperature of the condensers meant about 1 per cent. of the steam consumption, and that 12 deg. saved would mean the difference between 365 lb. and 500 lb. It was most important to have clean condensers and efficient air extractors, and a large margin should be allowed for air leaks. Without a steam jet it was impossible to get really efficient air extraction. It was also most important to avoid air getting in the boiler. Semi-steel contained graphite, and wherever one had graphite one was sure to get trouble due to high temperature. Those troubles could be got over by using a good design and suitable material, but the price would be high. A great deal of trouble with turbines had been caused by the almost universal practice of taking the lowest tender. There were several makers of turbines in this country who were thoroughly reliable, but if they were cut down to the last penny by competitive tender the result was sure to be a bad job. He believed the turbine of the future would be a tandem or cross-compound one; it would have a small high-pressure cylinder where the high temperature was taken out. It would be made of steel castings and forgings. With big turbines one came up against the low gauge of the railways, which limited to a very large extent the size of the parts which could be carried; the size of turbines now was a very serious consideration. A point which would have to be very carefully considered was the effect on steels of high temperature. At temperatures such as 1,400 deg. the ductility of steel became similar to that of lead. At temperatures between, say, 600 deg. and 800 deg., there was a certain amount of evidence that the ductility went down to a very large extent. Practically nothing was known about the effect of high temperatures on the shock-resisting properties of steel. The question of glands would have to be carefully considered; he had known a good deal of trouble with certain glands exposed to high-pressure high-temperature steam. Some arrangement might have to be made to cool the steam going into those glands. Upon the whole, he thought that high temperatures and pressures were quite practicable from the turbine makers' point of view provided prices were not cut, and the best designs, materials, and workmanship were used.

Mr. Bauman agreed with the author that it would be much better if energy was spent in improving the steam prime-mover instead of the gas turbine. Every 3 deg. at a lower temperature in the condenser saved so much per cent. of the steam consumption, whereas 25 deg. F. was necessary on the upper limit to get the same improvement. That showed the importance of getting a very low vacuum and keeping the temperature in the condenser low, but more especially one had to get the vacuum through to the open blades. It was no use having it in a condenser if it could not be got through to the moving blades, because that was where the thermal energy was transformed into mechanical work. In order to do that it was necessary to have a large-sized exhaust efficiently designed so as to get a stream-line flow of steam through the blades into the condenser. In addition, it was necessary to have a large leading area, because unless that was so a large leading loss would result, which, again, meant energy thrown away. In Schedule I he noticed that for 500 lb. steam pressure the author took higher efficiency than for 365 lb. pressure; in the last column he took an efficiency of 80.2 per cent. for a superheat of 268 deg. F.; in the third column from the side, with 365 lb. pressure and practically the same superheat, he took an efficiency of 78.9 per cent. That required some explanation. Where small differences were the result of a calculation it was very risky to make a calculation of that kind all the way through without considering step by step the differences due to the various factors. Comparing columns 3 and 5 in Schedule I, one found there was a difference in favour of the higher temperature of 0.8 per cent. in steam consumption. There was a further difference in respect of the power for the auxiliaries. For every 25 deg. increase at the higher temperature—between 650 deg. and 750 deg.—there was 1 per cent. saving in steam consumption. Therefore, as far as the temperature was concerned, he thought it would be safe to say that the highest temperature which the material would stand should be adopted. As far as turbines were concerned, he was certain that 700 deg. F. was quite safe. He accepted the figures given in Schedule II as being reasonable. As far as the heat drop was concerned there was a difference of 5.67 per cent.; a change in efficiency of nearly ¾ per cent.; that meant that between 215 lb. and 365 lb. there was a difference in the heat consumption of 5½ per cent. If those figures were correct the figures which were given in the paper required to be corrected. Comparing 365 lb. and 500 lb., Mr. Shaw gave a difference in favour of the higher pressure of 5.2, whereas Mr. Bauman made it 3. There was an improvement between 215 and 365 of 5½ per cent., and between 365 and 500 of 3 per cent. That alteration was very important, because it meant that it was safe to say that 350 lb. should be adopted, because a saving of over 5 per cent. would result, whereas between 365 and 500 it was much smaller. It was very questionable whether with ordinary conditions with a temperature of 750 deg. F. it would pay to go beyond 500 lb. He thought it would pay where the load factor was very high. In the case of a linked-up system with a power station which would work at full power the whole time, it might pay to adopt a much higher pressure. Some alteration was required in Schedule V as well. There it was stated that with the same total temperature there was a difference in the capital which one could afford to expend as between 215 lb. and 365 lb. of £14,500, and between 315 lb. and 500 lb. of £22,000. The speaker maintained that it was just the other way about. He agreed with the author and Prof. Stoney that for very high pressures—anything above 400 lb.—a two-cylinder machine ought to be used. Moreover, it was very desirable that cylinders subjected to very high pressures should be small in diameter. One method of dealing with it was to have a single-shaft turbine, or, alternatively, a cross-compound arrangement. Personally, he thought the former arrangement was preferable, being simpler in many ways. The higher the pressure the smaller the steam pipe, the better it was to build up flexible steam pipes, the easier it was to allow for expansion. It had very great advantages. In conclusion, he said that as far as temperature was concerned, 700 deg. was quite feasible, and turbine makers were willing to guarantee turbines at 750 deg. temperature maximum. He thought there was a good deal to be said in favour of increasing pressure at least to 350 lb. There was very little difficulty as far as turbines were concerned, and from what he gathered there was very little alteration required as far as boilers were concerned.

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Mr. S. L. Pearce thought that at the present time there was no source open to them for improving the economy of steam plant other than by increasing the heat range with the prospect of, say, 10 per cent. theoretical gain by so doing. He thought it might be said that with the experience which had been gained, notably at Rugby, the standard water-tube boiler could, with slight modification, be made to operate safely at 375 lb. pressure. If it was desired to go above that pressure very serious modifications would have to be introduced into the boiler. A great deal of experimental and pioneer work remained to be done. He thought it was very debatable whether it would pay to go beyond that figure. Messrs. Babcock & Wilcox were at the present time building boilers at 470 lb. pressure for a station on the Tees-side, and presumably a working pressure of round about 450 lb. was being adopted. The results from that station when it was at work should be of enormous importance. Personally, his own view was very much as summed up by Mr. Bauman, and it was on those lines that they were hoping to develop their new station at Barton, namely, to adopt a working pressure on the turbine of 350 lb., and superheat somewhere approaching 250 deg. He thought it would be agreed that there were thermo-dynamic considerations which would favour high initial pressures rather than high superheats, but the economy would be greater if they kept up the superheat as well as the pressure. He fully agreed with previous speakers that the use of higher pressures would entail the use of pipes of much smaller diameter. At Connor's Creek, the conditions were more or less comparable with those with which the author had been dealing. The results were 1.42 lb. of coal per KW.-hour. That was substantially less than the author's figure of 1.82 lb., and one naturally asked how was it done? Probably the answer would be, "Concentration of plant in large and few units." He thought that was a mistaken development. In the Connor's Creek station they were using some very large boilers. Each of those boilers had 23,500 sq. ft. of heating surface, and they had no economisers. That was a direction in which the British engineer might well give a useful lead. In connection with the Barton station, they were proposing to use boilers of large capacity, the heating surface of the boiler and the economiser together being practically the same figure as he had given for the Connor's Creek boilers—of such capacity that he estimated three boilers would easily supply steam for a turbine of 25,000-KW. capacity. It seemed to him that a turbine of 25,000-KW. capacity at 1,400 or 1,500 R.P.M. could be built of one cylinder so long as the working pressure did not exceed 350 lb. On the other hand, he agreed that high-speed machines lent themselves better to the adoption of very high working pressures, say of the order of 500 or 600 lb. It became a question of balancing the extra capital cost involved in two-cylinder turbines and tandem alternators as against the possible saving that would accrue therefrom.

Mr. Mackenzie said they must feel their way and not make too big a jump at once. They had ample evidence that temperatures about 650 deg. F. could be safely carried without causing serious trouble with turbine blading. The B.T.H. Co.'s experimental plant had proved that 680 deg. could be safely carried, which closely approximated to the temperatures given in Schedule II. It would not pay to attempt to increase the pressure to anything less than 350 lb., and very few cases could be made out where such a course could be economically adopted. With the 20,000-KW. sets that they were installing at Stuart Street with 28 in. of vacuum (not 28½ in., as given in the paper), the condenser maker was stipulating for 800,000 gallons of circulating water per hour as against 940,000 given by Mr. Shaw; he must have got hold of a very good condenser if it was going to give 28½ in. with that quantity of circulating water. In Schedule II the maximum possible saving on the 365 lb. over the 215 lb. was shown as £1,900 per annum, based upon running the plant at full load for 365 days in the year. Overhauling and examination were not provided for. On the 60 per cent. load factor the saving would be reduced to £1,140. This sum would not equal the annual charges on the difference in capital cost between the 215-lb. and the 365-lb. schemes. The maximum possible saving on the 500-lb. scheme over the 250-lb. scheme on the 60 per cent. load factor was £5,100. Allowing sinking fund at 3⅛ per cent. and interest at 5 per cent. this would justify an additional capital outlay on the 500-lb. scheme of £35,000. The present-day cost of one 215-lb. pressure, 20,000-KW. turbine, together with its boilers, economisers, feed pumps, and piping—those parts that would be affected by the high-pressure steam—was about £160,000. The sum of £35,000 was 22 per cent. increase on the £160,000. Mr. Pearce stated that the cost of a 350-lb. boiler would be 20 per cent. greater than that of a 200-lb. boiler, and he would like to know what the percentage increase was likely to be for the 500-lb. boiler. However, the present price of coal was at least double the basis price given in the schedule, and this, of course, meant double saving. It was extremely unlikely that it would ever get down to the 10s. per ton that was taken as a basis price. It all rested upon that question. If the boilermakers and turbinemakers were going to charge 25 to 30 per cent. more for the higher-pressure plant than for the 215-lb. plant, he would far rather keep to the 215-lb. pressure. The cooling tower scheme shown in schedule 3 showed a saving of £4,800 by raising the pressure to 350 lb. per sq. in. Clearly in such cases it would undoubtedly pay. The steam pipes for high pressure would have to be very carefully designed; the days of steam pipes 16 in. and 18 in. in diameter were certainly numbered. They would have parallel steam connections from all the marine boilers, and would have to keep those sizes down to a minimum of 10 in. to 12 in. He had had some very unfortunate experiences with steel bolts. When they had been subjected to temperatures of 600 deg. or 700 deg. F. for any length of time they could frequently be broken by dropping a few feet on to the floor. Unless they were very carefully annealed it was likely that most of them would break if used again to make a joint. He was in favour of using good Low Moor iron bolts instead of steel for such high temperatures. With regard to steam valves, at Stuart Street all the internal parts that were made of cast iron had broken and had had to be replaced, and they had also had considerable trouble from valve-makers using for valve-seating material which had a different coefficient of expansion to the valve bodies, so that, after having been subjected to these high temperatures for some time, all the valve seats had worked loose and had to be renewed. The growth of cast iron under these temperatures made it almost impossible to keep the casing joints tight at the high-pressure end. All turbines used for high pressures should dispense altogether with jointing material. The joints should be faced joints with a smearing of graphite or boiled oil. He hoped the time was not far distant when they would dispense altogether with water economisers, using the gases from the boilers for heating the air that would be required for the combustion of the fuel. He knew several large turbines badly designed for low-pressure work. One particularly large turbine gave a difference of 2 in. between the vacuum at the low-pressure end and that actually obtained in the condenser.

Mr. P. Peakman, speaking as a metallurgist, said that the turbinemaker and the boilermaker were quite safe in going up to the temperatures and pressures suggested by Mr. Shaw if they used very carefully selected material. For those high pressures and temperatures they must eliminate cast iron. The oxidation of silicon in cast iron caused growth plus disintegration. At those higher temperatures and pressures non-ferrous metals up to the present were quite a failure. Such materials disintegrated very rapidly and became very brittle indeed. At various temperatures steel was very ductile, but there was no danger whatever in going up to the temperatures that had been suggested. Impact figures at high temperatures would be published very shortly. Low Moor iron bolts undoubtedly gave better results on work where they were going to be subject to fatigue. Vibration or fatigue would not be absorbed so readily by mild steel as by Low Moor iron.

Mr. Bayliss said that Mr. Pearce seemed to know as much as he did about boiler making. Boilermakers to-day had no hesitation in constructing a boiler for pressures up to and including 275 lb. per sq. in. That pressure was being adopted at the station on the Tees-side which Mr. Pearce had mentioned. Apart from central station work, there were several industries in this country, and in Lancashire particularly, that were adopting 275 lb. as their standard boiler pressure for electric generation. There was no economy to be derived from the boiler installation itself in response to those pressures. One direction for progress was that of feeding the boiler with a suitable feed water. In one station, comparatively small, but highly efficient, where the total feed make-up was in the neighbourhood of 7 or 8 per cent., the engineer evaporated water by means of live steam, so that he was practically feeding into the boiler pure distilled water. He must look out for corrosion, but that he was aware of. The result was that he always had a boiler with heat surfaces at maximum efficiency. Under those circumstances 77½ per cent. efficiency was not impossible. Apart from increased efficiency one was able to use the boiler more hours in a year under actual service than otherwise, consequently using capital to better advantage, and perhaps running the station with fewer stand-by boilers than in ordinary working conditions. Too little attention was paid to the coal consumption per shift in relation to the units generated. Each boiler should be fitted with a coal-measuring machine, and each turbine unit should have allocated to it its proper number of boilers. During ordinary working each turbine unit and each set of boilers and the records should be carefully separated. This enabled them to analyse carefully the figures obtained, and set up a healthy competition among the station staff. He thought the failure of bolts connecting steam pipes was due to fatigue in the material set up by stress rather than to the temperature. Such bolts could be readily brought to the original state by annealing. Mr. Pearce was correct in putting the percentage of increase in the cost of high-pressure plant, in the neighbourhood of 350 lb., at 20 per cent. Up to 475 lb. that increase would not go up proportionately, as the temperature difficulty had been dealt with, and it was merely the pressure which had to be estimated.

Mr. Bircham thought they must expect some trouble if they took steps that were too big. Cast iron in an economiser at 350 lb. pressure was a thing he did not want to have much to do with, especially if superimposed upon a water-tube boiler. For these high pressures he strongly advocated that the economiser should be of steel. The expansion of feed pipes had a good deal to do with the trouble which had been experienced.

Mr. Shaw, in reply, held that the quantity of circulating water he had mentioned could be attained. The larger

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quantity was quoted by condenser makers to give them a margin. Schedule I was only the cost of running a set, not the cost of running a power station. At the Connor's Creek station they got 1.42 lb. of coal per KW.-hour, the calorific value being 14,200 B.TH.U., which gave a consumption of 20,400 against his 22,110. He did not see why the larger boiler should be more efficient than the smaller boiler. A small furnace was easier to handle than a big one. The schedule gave 4,380 hours in a year if they ran at full load the whole time. He could quite easily take care of the longitudinal expansion in the steam pipes. His remarks with regard to the steel bolts *versus* wrought-iron bolts related to commercial wrought-iron bolts as sold, not to Low Moor iron.

TRAMWAY TRACK WATERING.

By H. P. M. D.

Now that so many of our tramway departments have reduced the number of motormen to the least possible, it has, in a great many cases, been found impossible to spare a driver to go out with the water cart, and it has, therefore, become necessary to find other means for the very necessary work of watering the track. The simplest means by which this can be done in those districts where the conditions of the track are such that suitable hills dominate large sections of the route—and these are found in a great number of

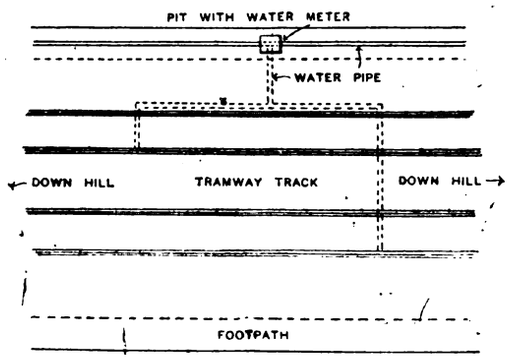

Fig. 1.—Plan of Hill Top.

our towns—is the method described below, which has met with considerable success on a system which the author has had under observation.

In fig. 1 a plan of the arrangement is shown ; a suitable pit is built round the water main on the footpath, in which are placed a valve and a branch pipe running through a water meter. From this branch pipe are taken two sub-branches for feeding each set of rails, the water running down hill on

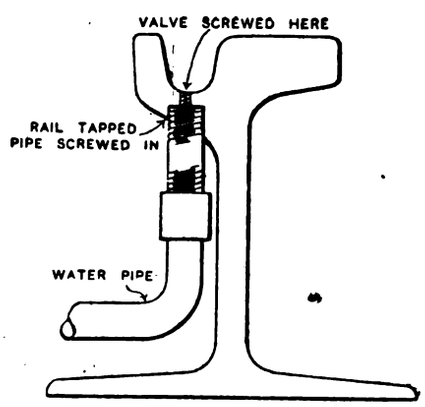

Fig. 2.

each track, through a hole drilled in the groove of the rail. The valve on the rail consists of a brass screw with one side filed with a flat, and a slight unscrewing of this allows the water to trickle through in just sufficient quantity to keep the track properly watered. This system needs very little maintenance, and is applied to the climbing sides of the track. Fig. 2 shows the method of fixing the pipe to the rails.

Another system which can be adopted, if the crest of the hill is sufficiently steep to get the necessary head of water, is to build in the footpath a small cistern with an overflow pipe at the top, as shown in fig. 3, and simply let the water siphon down into the rails ; the outlet at the rail in this case is taken a few yards down hill, the distance being in accordance with the amount of fall necessary to give a steady flow of water. This alternative system has a considerable advantage over the system just described, inasmuch as the water is supplied to the rails at very little pressure, whereas with the first method the dirt which at times accumulates round the top of the screw will occasionally reduce the opening to such an extent as to cause the water to squirt out to a height of several feet, which is very undesirable ; but it has been found in actual working that this does not occur very often, as the constant flowing of the water tends to keep the hole quite clear from all obstructions. With

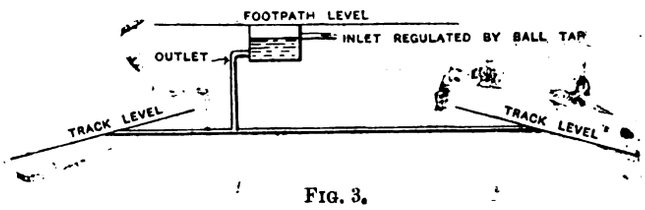

Fig. 3.

the second system the opening into the rail can be left much larger, so there is practically no trouble with obstructions. With this method of track watering it is found that very little water is required, as all the water is used usefully, and not, as in the case of a water tank, splashed out over the setts at the sides of the rail. Both these systems are, however, subject to the usual "human troubles" in the shape of small boys, who will interfere wherever possible. But, as in all such cases, the attraction soon wears off, and it is found that considerable lengths of track can thus be treated at a cost for water of only a few shillings per quarter, which is considerably less than the wages which would be paid to men for driving out a water tank. A survey of a great number of tramway routes would show that the greater portion of them could be treated in the manner described.

A BREWERY ELECTRIFICATION.

Messrs. Ansell's Brewery, Ltd., Aston, is one of the oldest establishments of its kind in the Birmingham district. In 1899 the firm first experimented with the electric drive, and also

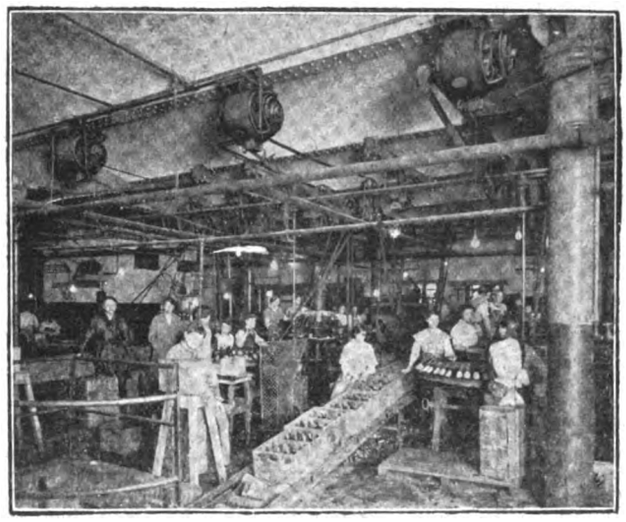

Fig. 1.—Group Drive in Bottling Stores.

installed a small lighting plant. Since that date the firm has consistently extended its installation, until to-day there is very little plant that is not electrically driven.

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The electrification of a brewery calls for machines of no very great size. Most of the motors have outputs varying from 5 to 15 H.P., and rarely is a machine of any larger capacity wanted. Messrs. Ansells laid down their plant on the continuous-current system, and the switchboard distributing the power throughout the works is of the "Witton" type, each circuit being controlled by hand-guard fuses. The motors employed throughout the works are standard machines, and, with one or two minor exceptions, are of

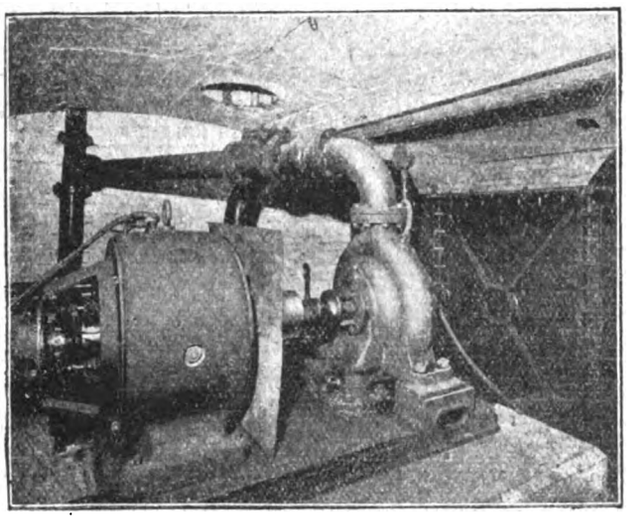

Fig. 2.—Motor-driven Pump.

the General Electric Co.'s manufacture. Quite a large proportion of the load in the works takes the form of pumping, and centrifugal pumps are invariably adopted. In the pure-air plant room in the brewery there are a number of motors, averaging about 5 H.P. apiece, circulating the air through the fermenting rooms.

Electric motors of 5 H.P. are to be found driving pulp-cleaning machines, the pulp being used as a filtering medium in the production of chilled and filtered beers, and the yeast-drying machines. The grain driers (fig. 3), where the grains are passed through heating furnaces, are operated by 4-H.P. motors; 5-H.P. motors are used to circulate the brewing water in the brewery water tanks, and also for driving the malt blowers.

The bottling store is one of the most difficult places in the brewery to secure a satisfactory drive with individual machines. This is, however, desirable in some instances, and the motors must then be of the water-tight pattern, as the amount of liquid thrown about the place is considerable. In Messrs. Ansell's brewery the bottling machines are group-driven, as shown in fig. 1, the 6-H.P. motors being mounted on the ceiling.

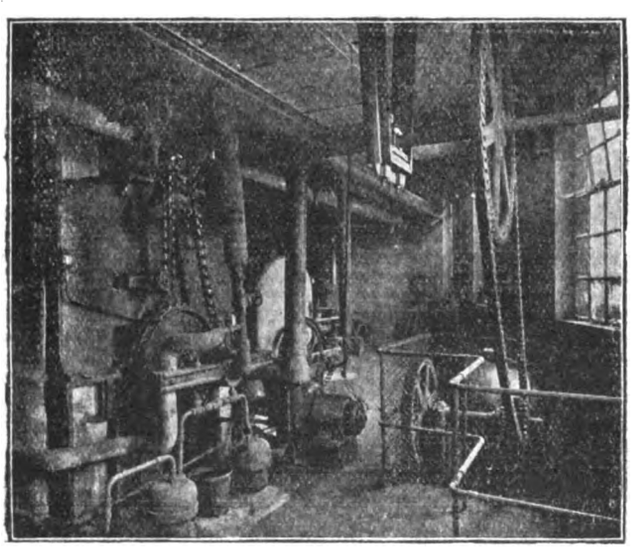

Fig. 3.—Motor-driven Grain Driers.

The hoisting of the raw material about the works is carried out by electric hoists driven by motors of various sizes. A typical instance is a sack-hoist driven by a 7½-H.P. motor. In the stable equipment, dust extractors and chaff-cutters are electrically-driven as well. In fig. 2 is seen a motor-driven pump, which raises water from a well 563 ft. deep.

The installation aggregates some 520 H.P., there being 120 "Witton" motors in different parts of the brewery.

Thanks are due to Messrs. Ansells for permission to take the photographs and publish this description.

ELECTRICITY ON THE FARM.

Those who do not appreciate that the era of "electricity on the farm" is here are behind the times. We have only to look at the money that one American electrical company is spending on a farmer's electrical handbook, a finely-produced publication answering the farmer's questions about electricity, and a catalogue on electrical appliances and machinery applicable to farm use, and, again, at the Southern California Edison Co.'s expenditure of well over 5½ million dollars in 1917 to meet the demands of agriculturists. We cannot imagine that companies of this size would spend their money in such fashion unless they knew for a fact that it would pay.

According to the *Journal of Electricity*, electrical machinery, appliances, and supplies sold to farmers in California aggregate 15 to 20 million dollars annually. In December, 1915, a survey to determine the actual use to which electricity was being put on the farm showed that 14 companies supplied energy to 10,583 installations totalling 190,441 connected H.P. This means in round numbers about 200,000 H.P., which represents approximately 12,000 motors, of which 80 per cent., or 160,000 H.P. is for irrigation reclamation, and 20 per cent., or 40,000 H.P., for miscellaneous purposes. If this latter load is obtainable in such a widely scattered community as California, is it not possible that this character of load would be very much greater in a more densely populated community?

A small motor is an invaluable adjunct to the farm, and with the use of light-armoured cable and a safety-first switch can be moved from place to place where needed. In the same journal referred to above several interesting illustrations are given, one of which refers to a 5-H.P., 1,200-R.P.M., 60-cycle, 220-volt, 3-phase motor belted to a cross-cut circular saw. The owner has a small electrical distributing system on the farm which reaches the principal points, from

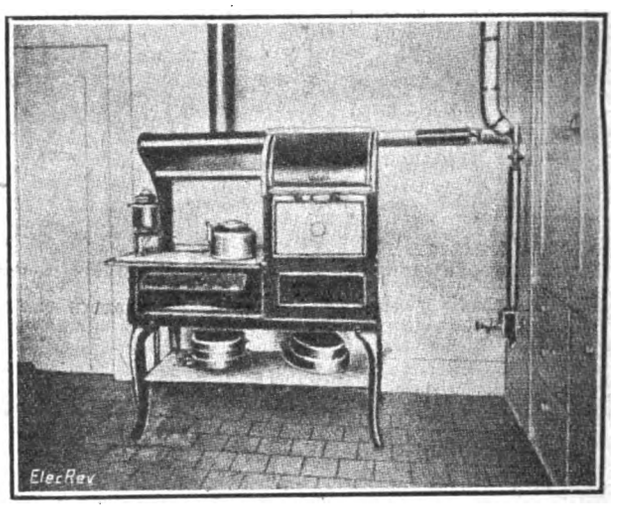

Fig. 1.—Electric Range on a Farm.

which he then runs a temporary line to the spot where the motor is needed. Another interesting farm appliance is a semi-portable creek pumping plant. A 15-H.P., 1,800-R.P.M., 220-volt, 3-phase, 60-cycle motor is belted to the pump, which runs 10 hours a day, costing less than $2.0, and pumping enough water for two acres. When flood waters come the owner takes the pump and motor out of the creek and stores them in his barn.

Electricity is needed in connection with practically all the modern improvements on the farm. A 50-H.P. installation mentioned is used mostly for irrigation purposes, but there is also a small refrigeration plant, and motors are used for driving feed cutters, &c. The use of electric lighting in the barn is easily understood, together with the ease with which electric drive is applied to the needed machines.

The encouragement and development of electricity in agricultural and dairying work should not be a difficult matter, where there are many new uses to which it could be put. Wherever there is a gas or oil engine there is a prospect for an electric motor. Farmers in California use electrical appliances, such as electric ranges, irons, percolators, toasters, washing machines, sewing machine motors, &c., more generally and readily than do city people. The farmer is indicating his desire for electricity by the large sales of farm-lighting sets which several large manufacturers have shown. The fact that it is reported they are selling 75 or 80 equipments a day indicates that the rural communities are anxious to have electricity. That a very large percentage of California houses are using electrical appliances is evidenced by the following annual sales in California:—Irons, 17,000; toasters, 2,700; percolators, teapots, &c., 6,700; portable vacuum cleaners, 5,500; washing machines, 5,000; cooking ranges (estimated), 1,500. In addition, small motors are purchased for driving sewing machines, &c. In the kitchen, where heat is required in varying quantities throughout most of the day, the advantages of the electric range are being rapidly appre-

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ciated. The women on the farms seem to appreciate the electric range even more than do those in the city.

Fig. 1 shows an actual installation in a ranch at Sunnyvale, California, where, with the range and a 3,000-watt water heater, electricity bills average $5.75 per month. Some time ago there were 1,750 electric ranges in use in California homes. This phase of the business is barely in its infancy, and if in a couple of years the public sees its way clear to purchase this number of ranges, it is not so difficult to imagine the amount of range business which is awaiting the manufacturer in the next few years.

A great effort is being made to increase the output of the rice fields of Arkansas in order to save wheat, says the *Electrical World*, and electric pumping for irrigation purposes is making great headway. The local company is supplying electricity for this purpose to 48 rice farmers near Pine Bluff. Rice crops need an almost continuous supply of water, from the time the rice is a few inches high until it is ready for harvest; in Arkansas artificial irrigation methods are necessary for 90 to 120 days in the year. The power for this irrigation work is supplied from 40 miles away by three-phase, 33,000-volt transmission, distributed at 6,600 volts, and finally stepped down to 220 volts for use at the motors, which average 60 H.P. each. The consumption this season is expected to reach 40,000 to 50,000 KW.-hours.

According to *Der Ingenieur*, which reports a lecture by Mr. A. W. C. Dwars dealing with drainage of marshes, electric pumping machinery has several advantages for such work. The level of the sub-soil water in the marsh can be effectively controlled, and the cost of electrical methods is not excessive.

The standard three-phase, motor-driven centrifugal pump is specially adapted to drainage work. Tests over 13,600 acres showed an excess in cost for electrical pumping of only £72 per annum—about 1¼d. per acre—as compared with the very cheapest methods available. This estimate assumed a not very favourable cost for electric energy, and in any case the small margin in cost is of small account compared with the much greater reliability of electrical methods. The author thinks that there is a great future for electric drainage of marshes in Holland; there are, however, considerable opportunities for improvement in the overall efficiency of electric pumping stations, which is not too high.

LEGAL.

Electric Lamp Re-fills.

In the King's Bench Division on Monday, Mr. Justice Darling sitting without a jury had before him an action brought by the Electric and General Stores Co., carrying on business in the electrical trade at Newcastle, against the Anglo-Continental Sales Co., carrying on business in the City of London, to recover damages for alleged breach of contract. Defendants did not appear.

Plaintiffs' counsel said the defendants contracted to supply them with a large quantity of electric light re-fills. The first instalment was to be a lot of 20,000, and payment was to be at the rate of £23 per thousand. The date of the contract was May 15th, 1916. When the goods were delivered it was found that not a single re-fill came up to the specification. Plaintiffs, therefore, suffered damage, for they paid £460 and lost the profit which they otherwise would have made.

Mr. J. Wm. Dodds, partner in the plaintiffs' firm, gave evidence to the foregoing effect, and Mr. W. T. Mundell (in the plaintiffs' employ) and Mr. John Bruce Branting, of Sunderland, spoke to examining and testing the re-fills.

His Lordship gave judgment for plaintiffs for £460 and for £400 damages.

Workmen's Compensation Case.

Judgment was given in the Court of Session, Edinburgh, in an appeal in which Thomas Logan, brought under review a decision by Sheriff Substitute Lee, at Airdrie, fixing the amount of compensation to be paid under the Workmen's Compensation Act to the pursuer, who was injured while employed by the Shotts Iron Co., Ltd., as an electrical coal-cutting machine contractor.

The Defenders admitted liability, and paid compensation down to August, 1917, when the pursuer partially recovered, and took employment as a check weighman, with the wages possible to him of £4 4s. a week. In January he made the present claim, and said his average weekly wage as a mining contractor prior to the accident was £5 8s. He was still partially incapacitated.

The Defenders maintained that the contract was composite, and that a distinction must be drawn between what he earned as a workman at the coal face and the profit he made out of his business relation with them as a contractor.

The Sheriff-Substitute held that this was something more than a contract of service, and the pursuer's income for the year from the whole transaction represented something more than his earnings as a workman. He accordingly assessed the compensation, on the footing that the pursuer's earnings were £220 a-year, at 5s. to July, 1918, and thereafter at 6d. weekly.

The Court of Session held (Lord Skerrington dissenting) that the matter had been rightly decided by the Sheriff, and found pursuer liable in expenses.

BUSINESS NOTES.

Our Letters from the Forces.—A Corporal in the R.E. writes:—"I have pleasure in thanking you for the regular receipt of the Electrical Review during the past year. During my four years in France with the Infantry and Engineers you have sent me your paper unfailingly, and to say I am grateful is not sufficient—I feel under a deep obligation to you. I must say a word, too, in appreciation of your most excellent leading articles. I only hope they are read by those in authority both in the electrical and political worlds."

"Magnet" Football Club.—This club has been formed by the Commercial Apprentices of the General Electric Co., Ltd. Mr. H. Hirst is the president, and the ground is at the Borough Polytechnic, Turney Road, Dulwich, S.E. We have received a copy of the fixture card for the 1918-19 season. Six matches have been played already, with fair success. On Saturday last the club played the Waygood A.A. (Waygood-Otis) at Bellingham, and on a heavy ground succeeded in defeating them by 2 goals to 1. Goals were scored for the "Magnets" by Sansom and Curtis, and Fuller played exceedingly well at right half.

Relaxation of Export Restrictions.—Certain relaxations with regard to the existing prohibitions against the exportation of electrical materials are announced by the Board of Trade. Thus magnetos and sparking plugs have been removed from List A to List B, and searchlight carbons and carbon electrodes for electric furnaces from List A to List C. Under List A exports to all destinations are prohibited, under List B, to all destinations outside the British Empire, and under List C shipments only to countries neighbouring enemy countries are prohibited.

Iron and Steel Prices.—*Pig Iron Prices.*—The Minister of Munitions gives notice that he is fixing export prices of pig iron applicable to all exports of pig iron on and after December 2nd, 1918, until further notice. The existing maximum prices of pig iron for home delivery remain in force until further notice.

Steel Prices.—The Minister of Munitions gives notice that he is fixing new maximum prices of steel for delivery in the United Kingdom on and after February 1st, 1918. Until that date the existing maximum prices remain in force.

Bar Iron Prices.—The Minister of Munitions gives notice that he is fixing export prices of bar iron applicable to all exports of bar iron on and after December 2nd, 1918, until further notice.

Particulars of the above may be obtained on application to the Ministry of Munitions (C.I.S.P.), Room 104, 8, Northumberland Avenue, W.C. 2.

During the war, while the Government was practically the sole purchaser of iron and steel products, the Ministry of Munitions adopted the policy of stabilising prices in the iron and steel industries by paying direct to the makers certain increased costs due to war conditions.

Now that the Government is no longer the sole purchaser, it is desirable to place the industry on an economic basis as early as possible, but the great increase in prices which would result from an immediate withdrawal of all subsidies would seriously prejudice the resumption of ordinary commercial work, and induce dislocation not only in the iron and steel trades, but in the wide field of engineering and other activities dependent on iron and steel.

The Government has, therefore, decided to remove the subsidies in two stages. Those applicable to steelmaking will be removed on January 31st, 1919, when a revised schedule of maximum prices for steel will take effect. Those applicable to pig iron will continue to April 30th, when it is proposed that all subsidies should cease entirely. This will involve a further re-adjustment of steel prices, but post-war conditions are not yet sufficiently stable to warrant the fixing of prices after that date.

Arrangements have been made in consultation with the trades concerned to secure an equitable distribution of pig iron and steel so long as any subsidies continue. The powers possessed by the Government under the Defence of the Realm Act will, if necessary, be exercised to prevent any undue holding of subsidised material.

It is not, however, intended that Government subsidies should be used to enable exports to be made to oversea markets at less than the full cost. The Ministry has, therefore, issued lists of export prices for both iron and steel calculated to include the full amount of the subsidies. The Government will levy, as a drawback on exported iron and steel, the difference between the home and export prices.

Book Notices.—"The Excess Profits Duty." By E. E. Spicer and E. C. Pegler. Pp. 220. London: H. Foulks Lynch and Co. Price 10s. 6d. net.—This is the fourth edition, revised and brought up to date, of a useful publication, containing information which will be needed by taxpayers for a long time to come after the declaration of Peace. It includes the provisions of the Finance Act, 1918.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVII, No. 11. November, 1918. New York: The Institute. Price $1.

"The Business World." Vol. I, No. 6. August, 1918. Madras. Price 8 annas.

Trading with the Enemy.—The *London Gazette* for November 29th contains further lists of persons and bodies in the following countries with whom trading is prohibited:—Argentina and Uruguay, Brazil, Ecuador, Haiti and Dominican Republic, Mexico and Spain.

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Agencies Wanted. — The Secretary of the British Chamber of Commerce of Sao Paulo reports that a firm of importers of electrical specialities and machinery desire to act as exclusive agents for U.K. manufacturers of these goods. Reference No. 365. Particulars from Department of Commercial Intelligence, 73, Basinghall Street, E.C.

Coventry Ordnance Works.—At a special meeting of debenture stockholders in the FAIRFIELD S/B AND ENGINEERING CO., LTD., called for December 9th, proposals will be considered for the sale of shares in the Coventry Ordnance Works, Ltd., and for the sale of the assets of the Coventry Works to a new company, and respecting amalgamation of the Coventry Works with Dick, Kerr & Co., Ltd., and Phœnix Dynamo Manufacturing Co., Ltd.

Catalogues and Lists.—HANS RENOLD, LTD., Didsbury, Manchester.—A useful pamphlet (No. 200/1) giving illustrations, prices, and notes on the selection of and hints upon the erection and care of chain gear.

MESSRS. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham. —24-page illustrated catalogue of Simplex industrial lighting fittings for street, railway, factory, shop, and other illumination. Prices are given.

VISLOK, LTD., 3, St. Bride's House, Salisbury Square, E.C. 4.—Descriptive pamphlet on the Vislok self-locking nut, with many testimonials.

THE WARDLE ENGINEERING CO., LTD., 196, Deansgate, Manchester.—Catalogue No. 11, which, in addition to giving full particulars and prices of the Wardle lanterns, reflectors, and other fittings, contains an excellent section on the theory and practice of illuminating engineering, and gives prices in shillings and decimals of a pound, in anticipation of decimal coinage and to facilitate conversion to any decimal coinage; the English weights are stated entirely in lb., and the metric equivalents for weights, dimensions, and volume are included. Code words are provided for all items. The catalogue is intended to be useful to all traders at home and abroad, as well as to the light-user himself, and is a model of its kind.

AUTOMATIC AND ELECTRIC FURNACES, LTD., 6, Old Queen Street, S.W. 1.—Heat Treatment Bulletin No. 5, on the practical checking of pyrometers; an ingenious method of using the magnetic change-point of iron, as indicated by the Wild-Barfield system, is described, which facilitates the checking of thermo-couples at the temperature of 768° C.

Liquidations and Dissolutions.—BRITISH ELECTRON CO., LTD.—Winding up voluntarily for the purpose of reconstruction. Liquidator, Mr. S. Lingard, of Manchester. Meeting of creditors, Manchester, December 11th.

VULCO MAGNETO CO., manufacturers of magnetos, 11, Long Acre, E.C.—Messrs. D. A. V. Rist and H. Rothwell have dissolved partnership. Debts will be attended to by Mr. H. Rothwell, who will continue the business.

TOWNSON & FAIRHURST, electrical engineers, 118, Bark Street, Bolton.—Messrs. E. Townson and E. Fairhurst have dissolved partnership. Debts will be attended to by Mr. E. Townson, who will continue the business.

Removal of Restrictions on Non-Ferrous Metals.—The Ministry of Munitions announces that in the disposal and allocation of stocks of non-ferrous metals in its possession to consumers, it will be prepared to pay brokers and recognised intermediaries a commission of ½ per cent., subject to cash payment for the material.

Trade Announcements.—THE STANTON IRONWORKS CO., LTD., has opened a branch office at Manchester at Grosvenor Chambers, Deansgate, under the management of Mr. G. W. Turner; all matters relating to pig iron, cast-iron pipes, special castings, ironstone and slag sales in that district will be conducted from that office. Telephone, 4945 City; telegraph, "Spigot, Manchester."

MESSRS. NAPIER-KIMBER, LTD., say they have been appointed sole selling agents for Lancashire and Yorkshire for the Associated Battery Co., of London. All communications and inquiries to be addressed to St. George's Hall, Bradford.

Bankruptcy Proceedings.—E. HODGSON & SONS, engineers, Cleckheaton.—First meeting, December 11th. Public examination, December 18th, both at Bradford.

C. O. UNER, engineer, Bolton.—Third dividend of 5s. in the £, payable December 13th, at 27, Brazenose Street, Manchester.

The public examination was held on December 3rd, at the London Bankruptcy Court, before Mr. Registrar Mellor, of EDMUND CHARLES SPARKES, electrical manufacturers' agent, 118, Wardour Street, W., who returns liabilities £352 14s. 9d. and assets valued at £1 1s. 3d. In reply to the Official Receiver, debtor said he commenced business in 1906, under the style of Sparkes & Co., with a capital of £200. The rent of the premises was £165, rising to £180 per annum. He acted at various times as agent for Messrs. H. Davis & Co., Ltd., Birmingham; Messrs Peyton & Peyton, Birmingham; Messrs. S. N. Woolf & Co., Weevelinghoven, Germany; Messrs. Samuel Heath and Son, Birmingham; and Messrs. J. and W. Stokvis, Arnhem, Holland. When the war broke out in 1914, he held the last two mentioned agencies, and that of Messrs. Stokvis was immediately terminated, but he retained that of Messrs. Heath & Son until September, 1915. Witness attributed his failure to the outbreak of hostilities and the consequent termination of his agencies and restriction of trade. The whole of his liabilities were for goods supplied for trade purposes. His drawings for household and personal expenses averaged £5 weekly. The examination was concluded.

LIGHTING AND POWER NOTES.

Accrington.—PROPOSED NATIONAL E.S.—The Electricity Committee has passed a resolution disapproving of the recommendations of the B. of T. Power Supply Committee, particularly the suggested terms of purchase of generating stations by the State. The Committee expressed the view that no Bill would be acceptable which did not give municipalities the option of retaining ownership and control, and an exhaustive inquiry was called for by an unbiased and impartial Parliamentary Committee.

PRICE INCREASE.—From the end of the current quarter the Electricity Committee is increasing the charges for electricity by a further 10 per cent., making a total of 20 per cent. over pre-war charges.

Argentina.—STRIKE.—At the beginning of October a strike of the employés of the German Electricity Co. occurred. In anticipation of the strike, the company engaged about 300 men to replace the strikers, and, later, 600 substitutes were employed. Some cables were cut, but no serious interruption of the lighting service took place. A large proportion of the substitute workmen were Germans and Turks. Some shots were fired in the streets, and a police guard of 120 and 50 mounted men kept order at the power stations.—*Review of the River Plate.*

Ashton-under-Lyne. — SHOP-WINDOW LIGHTING. — Sir Albert Stanley, President of the Board of Trade, announced to a deputation of shopkeepers at Ashton-under-Lyne, on Wednesday, that shopkeepers would be allowed in the immediate future to have as much light as they liked in their windows, provided they kept within their rations.

Ballymoney (Co. Antrim).—PROPOSED E.L.—A local company has been formed for the purpose of installing an electric light and power station in the town.

Barrow-in-Furness. — EXTENSIONS. — The Electricity Committee has entered into agreements for the supply of electricity to the carriage and wagon works and engine-shed of the Furness Railway Co., the works of the Barrow Hematite Steel Co., and the new works of Messrs. Ward. The necessary switchgear and transformers are estimated to cost £1,500.

BATTERY MAINTENANCE.—Applications from the Tudor Accumulator Co. and the D.P. Battery Co., requesting the revision of their agreements, have been referred to the Lancashire and Cheshire Association, with a view to uniform terms being obtained for the various undertakings affected.

Bolton.—PRICE INCREASE.—The following increases will be made in the electricity charges from the commencement of the current quarter:—Ordinary or power consumers, ·15d. per unit; lighting consumers, ·35d. per unit; special power consumers, 7½ per cent. on existing prices; bulk consumers, ·015d. per unit.

Bootle.—PRICE INCREASE.—The T.C. has decided to increase the charges for electricity for lighting and power from 30 per cent. to 40 per cent. over pre-war rates, and in cases where the charges are adjusted according to the price of coal, by a further 2½ per cent., making 15 per cent. over pre-war rates. The increases are to take effect from the end of the year.

Continental.—SPAIN.—Our Special Correspondent in Spain writes as follows:—

"Among recent water-power concessions are the following:—The Bores Tobalina Co. has been granted powers to use a waterfall on the River Ebro, in the district of Miranda de Ebro, giving 20,000 litres per second during the eight months from November to June inclusive, and 10,000 litres per second during the four months of drought. There is a useful head of 8 metres, so that 1,700 H.P. will be available nearly all the year round. The Vasco Alavesca Co. has been given permission to enlarge its existing hydro-electric plant up to 10,000 litres of water per second, at a useful head of 2½ metres. The Huici y Pajares Co., of Pamplona, has been granted the use of 3,000 litres per second on the River Najerilla, for the production of electricity.

"Messrs. Pendis & Cernuda, of Villamayor, have applied for the use of 1,000 litres per second on the River Color (Pilona), at a useful head of 39 metres.

"Don Armando A. Pumarino has applied for permission to use 10,000 litres per second from the River Aller, to construct a dam, two tunnels, and a siphon, and to erect a central station for the production of electricity.

"The Compania Catalana de Gas y Electricidad, of Barcelona, has just inaugurated its power plant at the Rum Falls, on the River Esera, and has also erected a transmission line 225 km. long. The energy generated is transmitted to distributing stations at Tarrasa, Sabadell, San Adrian, and Barcelona. Now that this central station is completed, the company will be able to make more rapid headway on its second plant—Puente Argnoé—on the same river. It is hoped to finish this second plant during the coming winter, which will bring the total energy installed by the Catalana Co. in the Barcelona district up to 50,000 H.P. The company is still further extending its generating capacity, and has lately placed a contract with Messrs. Piccard, Pictet & Co., of Geneva, for a 4,250-H.P. turbine and one of 2,800-H.P. capacity.

"A new central station for the supply of energy for lighting purposes has recently been started at Camicosa de la Sierra (Burgos).

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"The company 'Energia Electrica de Asturias' has almost finished its new hydro-electric plant on the River Aller, near the town of Casomera, and will soon be in a position to supply energy to the extent of 1,900 H.P., and, later on, up to 5,000 H.P. Contracts have been signed for the supply of electric power to various industrial firms, including cement manufacturers, 'Tudela Vequin,' and the coal mine, 'Hullera Espanola.' A reserve steam plant has been erected near the above-mentioned mine for use during the dry season."

GALICIA.—The Governor of Galicia, acting with a group of engineers, has bought from the Germans all the electric plant constructed by the army in East Galicia, on the River Seret, while this was a theatre of war. The German army built an electric power station on the Seret, and constructed a network of high-pressure cables extending from Tarnopol to Borszczow. Transformers set up in towns and villages reduce the pressure to 220 and 110 volts. The energy was supplied either by water or by special steam engines.

SWEDEN.—The question has been to the fore in Sweden whether it would not be advisable to introduce State control of the prices charged for electrical energy. The matter has been before the Royal Waterfalls Board, which has declared the introduction of State control: at the same time, the State is urged to push forward the generation of electricity as much as possible, whereby the State, in a different way, will exercise a certain control over the prices in question.

GERMANY.—Owing to the increase in wages and the price of raw materials and coal, the charge for electricity in Berlin has been raised by an additional 25 per cent., making the total increase 50 per cent. The additional charge according to area is also being raised.

Epsom.—PROPOSED BULK SUPPLY.—The T.C. is considering the question of shutting down its electricity undertaking and purchasing electricity in bulk; there has been a loss of £5,313 on the working of the department during the past three years.

Glasgow.—REFUSE DESTRUCTORS.—The Partick destructor has been transferred to the Electricity Committee, at a value of £6,260.

In view of the cost, the improvement of the electric lighting of the Kelvinhough destructor is not to be proceeded with.

Greetland.—PROPOSED E.L.—The U.D.C. is considering the question of installing electricity for street lighting and other purposes.

Huddersfield.—STRIKE.—On Thursday, last week, the enginemen and stokers at the Corporation electricity works handed in notices to cease work in 48 hours, owing to a dispute over an award of 3s. 6d. per week granted by the Committee on Production. The employés demanded that the award should be operative as from August 10th, and the Corporation offered to date it back to the first pay day in October. This the men refused, and struck work on Saturday night. The Municipal Employés' Association, of which the men are members, advised them to remain at work and submit the matter to arbitration; but this proposal was rejected. On Saturday and Sunday clerks and other Corporation servants took the strikers' places, and the supply was not seriously interfered with.

On Monday the situation became more acute, owing to the demand for energy for power purposes. The supply for lighting purposes was maintained by voluntary labour, but the supply to industrial works had to be discontinued, involving the unemployment of 2,000 persons.

The strike came to an end on Tuesday, when the Wages Committee, in view of the dislocation which had occurred in other industries, decided to grant the men's demands. The strike was conducted against the advice of the Municipal Employés' Association, and the employés who were members have now seceded from that association.

Kingston-on-Thames.—RESTRICTED SUPPLY.—The Corporation has informed its consumers that, "owing to serious machinery difficulties at the electricity works," energy is not to be used for lighting in private houses until 7.30 p.m.

Letterkenny (Co. Donegal).—PROPOSED E.L.—It is proposed to install an E.L. scheme for the town and the local lunatic asylum; the cost is estimated at £2,500.

London.—ST. MARYLEBONE.—YEAR'S WORKING.—The net profit of the B.C. electricity department for the year ended March 31st last was £61, against the estimate of £1,821, and a profit of £6,964 in the preceding year. The report states that, owing to delay in the delivery of the underfeed stokers, the expected economy in fuel was not effected. The two stokers which were fitted, however, and the use of coke breeze during the latter part of the year, checked the upward rise of the cost of fuel. Wages and salaries increased by £2,526, and repairs by £4,290, chiefly due to the renewing of ash-handling plant and economisers, and repairs to pumping machinery, turbines, and converters. The value of apparatus on hire on consumers' premises was £12,888, an increase of about £1,000. The total capital expenditure amounted to £2,149,482, of which £1,662,428 is still outstanding. The revenue for the year amounted to £216,846, compared with £215,034 in the previous year, and the expenditure to £117,320, against £105,790; interest and special charges absorbed £66,091, and repayment of loans £46,503. The generation cost per unit sold was '783d., against '684d.; total working cost, 1·323d. against 1·216d.; and the over-all cost, 2·793d., against 2·773d.; the average price charged, excluding meter rents, was 2·59d., against 2·65d. The number of consumers increased from 10,800 to 11,006. The capacity of the plant is 19,000 KW., and the maximum load for the year was 10,817 KW.; 24,451,990 units were generated, against 24,159,759, and 18,387,268, against 17,647,146 were sold.

KENSINGTON.—PRICE INCREASE.—The Brompton and Kensington E.S. Co. has applied to the B. of T. for permission to increase the charge of 13s. 4d. for any quantity up to 20 units per quarter, and 8d. per unit over 20, to 16s. 8d. up to 20 units, and to 10d. per unit above that amount.

Morocco.—The Sociedad Electras Marroquies has applied for a concession to erect an electric generating station in the city of Arcila. It is proposed to supply three-phase current, at 50 periods, the aerial lines distributing at 500 volts to the transformer stations, where it will be stepped down to 220.

New Zealand.—WATER POWER.—The chief electrical engineer's hydro-electric scheme for the North Island, as submitted to the House of Representatives, provides for three generating stations in the Auckland, Wellington, and Hawkes Bay districts of 96,000, 24,000, and 40,000 H.P. respectively. The total capital expenditure will be £7,599,441, which, it is estimated, will be recoverable in seven years by the amount of coal which will be saved.—*The Times.*

CHRISTCHURCH.—Owing to a recent failure of Lake Coleridge electricity supply, the Council has decided to have plans prepared for the rearrangement of the station and the provision of a stand-by set of about 600 KW.—*B. of T. Journal.*

Stoke-on-Trent.—PRICE INCREASE.—Arising out of the recommendations contained in Sir John Snell's report, the T.C. has adopted a revised scale of charges for electricity, which it is anticipated will increase the annual revenue by £800 or £1,000.

The new charges are as follows:—Lighting, 7d. per unit for the first 73 hours per quarter, and 2½d. per unit beyond; heating and cooking, 1d. per unit; kinemas, 2½d. per unit, less 5 per cent. for payment in seven days; churches, 4½d. per unit. For small power consumers the charge is 2d. per unit up to 250 per quarter, 1½d. per unit between 250 and 500, and 1d. beyond, and for large consumers £1 per KW. per quarter, plus ½d. per unit consumed. All accounts at the general rates are subject to a discount of 5 per cent. for payment within 14 days. The minimum charge is £1 per annum per meter.

Walton-on-Thames.—L.G.B. INQUIRY.—At a L.G.B. inquiry with reference to the cost of electricity, the inspector intimated that he would recommend that the E.L. Co. be allowed to charge 1d. per unit extra, subject to revision at the end of six months.

TRAMWAY AND RAILWAY NOTES.

Argentina.—The Sociedad Anonima Tranvia Eléctrico y Balneario de Quilmes has been formed at Buenos Aires to take over and work concessions granted for the development of Quilmes beach, including an electric tramway system.—*Review of the River Plate.*

Ashover.—PROPOSED LIGHT RAILWAY.—Messrs. T. H. Jackson, G. M. Jackson, and J. Steen have applied to the Light Railway Commissioners for authority to construct light railways from Stretton to Ashover, and from Brackenfield to Ashover.

Birmingham.—PROPOSED EXTENSIONS.—The Tramways Committee has referred to a Sub-Committee the question of constructing tramways in the Selly Oak, Northfield, Longbridge, and Rednal districts.

Bradford.—WAGES.—From December 1st the war bonus of Corporation tramway workers has been increased by 5s. per week for men and 3s. for women, making a total of 30s. and 21s. per week respectively.

Chile.—WATER POWER.—The Government has authorised a private company to erect a transmission line from Los Condes to Santiago, for the purpose of conveying electricity to the amount of 15,000 H.P. from hydro-electric works on the River Mapocho.—*Review of the River Plate.*

Continental.—SPAIN.—Don Luiz Gonzalez de Rivera y Montoro has applied, on behalf of Don Cristino Martos, for a concession for an electric tramway, to run from Castellon to Salon, in the province of Tarragona.

Glasgow.—GOODS TRAFFIC.—The tramway department has decided to experiment with a parcel-carrying tramcar on the Uddington route.

Halifax.—PROPOSED EXTENSIONS.—The B. of T. has extended the time for the extension of certain sections of the Corporation tramways to August 18th, 1919.

Leeds.—WAGES.—From November 1st last the war-wages of tramway workers are to be increased by 5s. per week. This makes the total wages for first-class drivers £3 7s. 6d., and for women workers £2 11s. 6d.

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Railway Restrictions.—Season Tickets.—The Railway Executive Committee has withdrawn the restrictions on the issue of season tickets both within and without the 12-mile radius from Charing Cross. Season tickets for over 12 miles to any person not already a holder will be issued for not less than three months, instead of six. Certain concessions will be allowed to those who surrender their tickets before they expire.

Rossendale.—Fare Revision.—The representatives of Bacup and Rawtenstall have agreed to certain fares on the Rossendale tramway system being increased. The system is owned by the Bacup T.C. and leased to the Rawtenstall T.C.

Wages.—In the recent award of the Committee on Production, increasing the war bonus of tramway workers by 5s. per week, it is officially pointed out that the principle of equal pay for men and women was not established.

TELEGRAPH AND TELEPHONE NOTES.

Germany.—The German Government has announced that all the wireless stations have been seized by the Independent Socialists, and declines to accept responsibility for messages.

Italy.—The Pope, says a message from Rome, will ask the Peace Conference to effect a settlement between the Vatican and the Quirinal. He desires greater liberty of movement, and the installation of wireless at the Vatican to enable him to communicate with foreign Governments and the Papal nuncios without using the Italian telegraph lines.—*Daily Sketch.*

United States.—Mr. Theodore N. Vail, president of the American Telegraph and Telephone Co., is to advise the United States Postmaster-General in regard to the organisation of the telephone and telegraph systems under Government control.—*The Times.*

Reuter messages state that the Postmaster-General has authorised the amalgamation of the Western Union and Commercial Cable Companies and the marine cable systems under the direction of Mr. Ward, the vice-president of the Commercial Cable Co.; and that the Commercial Cable Co. has brought a suit to enjoin the P.M.G. from assuming control of the company's cables.

Wireless Telephony.—According to the *Daily Chronicle*, Mr. Godfrey Isaacs recently said that wireless telephony from here to New York might be contemplated in the near future. At present commercial developments were held up owing to Government control, but when the need for this had passed, wireless telephony was expected to take a big part in the conduct of the world's commerce. "I don't think we need be limited by distance at all," Mr. Isaacs said, "and as soon as our hands are free and we can get on with the work, there is no reason why we should not be able to introduce a wireless telephone between here and New York or Buenos Aires, or even Australia, 12,000 miles away."

CONTRACTS OPEN AND CLOSED.

OPEN.

Bootle.—Corporation. Supply of ½-watt-lamp street lighting equipment (4 miles) for tramway routes. Mr. T. D. Clothier, Borough Electrical Engineer.

Leeds.—Extensions to boiler house, switch rooms and circulating pump house at the Electricity Works, Whitehall Road. Mr. G. W. Atkinson, 1, Mark Lane, Leeds.

Spain.—The municipal authorities of Ocana (Province of Toledo) have lately invited tenders for the concession for the electric lighting of the town.

Warrington.—December 10th. Corporation Electricity Department. 10,000 or 20,000 tons of slack coal. Mr. F. V. L. Mathias, Engineer (returnable deposit of £1 1s.).

CLOSED.

Stepney.—The Electricity Committee has accepted the following offers of coal: Bradbury, Son & Co., 5,000 tons, at from 27s. 9d. to 30s. 1d. per ton; E. Foster & Co., 13,000 tons, at from 27s. 4d. to 28s. 7d. per ton; A. Blackman & Co., 80 tons slack, at from 23s. 3d. to 27s. 1d. per ton.

Willesden.—U.D.C. Ransomes, Sims & Jefferies, Ltd. Three 2-ton electrically-operated tipping wagons, at £1,151 each.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, December 7th. Visit to the Union Coal Storage Co., Ltd.

Saturday, December 7th. At the Royal Technical Institute. At 7 p.m. Annual meeting.

London Association of Foremen Engineers.—Saturday, December 7th. At 7 p.m. At the Cannon Street Hotel, E.C. Annual meeting, election of officers, &c.

Chief Technical Assistants' Association.—Saturday, December 7th. At Anderton's Hotel, Fleet Street, E.C. At 3 p.m. Discussion on "Testing of Plant."

Junior Institution of Engineers (North-Eastern Section).—Tuesday, December 10th. At the Mining Institute, Newcastle-on-Tyne. At 7.15 p.m. Paper on "Pumps, Condenser Systems, &c.," by Messrs. T. W. Stewert and H. J. Aldis.

(North-Western Section).—Monday, December 9th. At the Manchester Photographic Society. At 7.30 p.m. Paper on "Pressure Gauges," by Mr. G. A. Napier.

Industrial Reconstruction Council.—Wednesday, December 11th. At the Saddlers' Hall, Cheapside. At 4.30 p.m. Lecture on "Science and Industry," by Sir W. S. McCormick.

Institution of Electrical Engineers.—Thursday, December 12th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Discussion on "Electric Welding."

(North Midland Centre).—Tuesday, December 10th. At the Metropole, King Street, Leeds. At 7 p.m. Paper on "The Supply of Single-phase Power from Three-phase Systems," by Prof. Miles Walker.

(North-Western Centre).—Tuesday, December 10th. At the Engineers' Club, Manchester. At 7 p.m. Address by the President, Mr. C. H. Wordingham, C.B.E.

(Scottish Centre).—Tuesday, December 10th. At 207, Bath Street, Glasgow. At 7.30 p.m. Paper on "The Use of High-pressure and High-temperature Steam in Large Power Stations," by Mr. J. H. Shaw.

(Irish Centre).—Friday, December 13th. At the Royal College of Science, Dublin. At 7 p.m. Paper on "Heating," by Mr. S. L. R. Price.

Electro-Harmonic Society.—Friday, December 13th. At 8 p.m. Smoking concert at the Holborn Restaurant (Venetian Chamber).

Manchester Association of Engineers.—Saturday, December 14th. At 6.30 p.m. At the Grand Hotel. Paper on "Wood Testing," by Mr. J. E. Hurst.

Birmingham and District Electric Club.—Saturday, December 14th. At the Swan Hotel. At 7 p.m. Annual general meeting.

NOTES.

Electric Power Supply and the Election.—At a meeting of the Electrical Section of the Newcastle-on-Tyne Chamber of Commerce, last week, it was resolved that Mr. Herbert Shaw should send a letter to each local candidate for the coming Parliamentary elections, making the following inquiries:—

1. Do you agree with the policy of extensive development in the supply of electric power as a means of increasing production from the home industries, and thereby improving the prosperity and welfare of the people? In which case, are you prepared to press forward immediate legislation to give effect to the necessary reform?
2. What are your views upon the recommendation of the Board of Trade Committee on Electric Power Supply (Report Ref. Cd. 9062/1918)?

or the alternatives—

1. State ownership and control.
2. Municipal ownership and control.
3. Ownership and control by private enterprise.
4. State ownership leased to private enterprise for operation.

Volunteer Notes.—Royal Engineers (Vols.), London Army Troops Companies.—Headquarters: Balderton Street, Oxford Street, W. 1.

Regimental Orders No. 50, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Sunday, December 8th.—The competitions between the Companies will be held at Esher Bridge.

Monday, December 9th, to Saturday, December 14th.—Drills as usual.

C. Higgins, *Capt.* R.E., *Adjutant.*

Waste of Fuel.—A correspondent ("U.S.A.") writes to draw attention to a direction in which will be found coal wastage to a very serious extent. He refers particularly to temporary installations of steam plant, especially those of small contractors and second-class firms, who are almost invariably associated with very inefficient steam engines, such as steam cranes and winches, direct-acting steam pumps, pile-drivers, and well-sinking and drilling plants. The boilers used are usually of the less efficient types, often of that worst and most wasteful order, the small vertical type. Such installations are rarely well set up to begin with, and leaking joints are often met with; to render wastefulness complete, the boiler, the steam pipes, and the engine cylinders are exposed to wind and weather, and not the least trouble is taken to guard against loss of heat by insulating any portion. He ran against one of these wasters not long ago, who professed to be an engineer—"an example of that misuse of the term engineer which ought not to be possible or allowed to men with not a spark of the spirit which ought to actuate every man who so describes himself. Such wasters of fuel ought to be controlled. The coal they waste may easily run up to 100 or even 200 tons annually on a single small plant."

We hope to see something done by the Coal Controller to limit the extravagance which goes on in the directions indicated, amongst others. Few have any idea of the enormous excess of fuel consumption by plant of uneconomical types carelessly put together, carelessly worked, and wholly unprovided with protection against loss of heat.

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Institution and Lecture Notes.—Electrical Power Engineers' Association.—A meeting of the Dundee Section of the Association was held at Lamb's Hotel on November 23rd, for the appointment of a Committee for the ensuing year. Owing to the near formation of the Scottish Division (December 1st), Mr. Holt, Hon. Assistant Secretary, Northern Division, Manchester, travelled North to address the meeting. Mr. Wright took the chair and introduced the speaker. Before a good attendance Mr. Holt delivered an excellent address on the Association's affairs to date.

At the Synod Hall, Edinburgh, on November 25th, the formation of this Section took place. The chair was taken by Mr. Wright, Dundee Interim Publicity Secretary, Scotland. Mr. Holt, of Manchester, gave an interesting *résumé* of the doings of the Association from its inception. A representative attendance of engineers was present, among whom were several local chief engineers. After the appointment of a Committee the meeting was thrown open to discussion.

Institution of Electrical Engineers.—A meeting of the Institution will be held at the Institution of Civil Engineers, at 6 p.m. (light refreshments, 5.30 p.m.), on Thursday, December 12th, to discuss the subject of "Electric Welding." Copies of "Notes on Arc Welding Regulations" (by Mr. H. M. Sayers) can be obtained on application to the secretary. It is not intended, however, to limit the discussion to "Regulations," but that it should cover "Electric Welding" in general. Those wishing to take part in the discussion are invited to send their names to the Secretary before the meeting, if possible.

The syllabus of meetings for the new session of the Scottish Centre, which opened on November 12th at Glasgow with the chairman's inaugural address, contains the following :—

December 10th (Glasgow).—"The Use of High-Pressure and High-Temperature Steam in Large Power Stations," by Mr. J. H. Shaw.
December 16th (Glasgow).—Visit of President, Mr. C. H. Wordingham, C.B.E.
January 14th (Edinburgh).—"The Supply of Single-Phase Power from Three-Phase Systems," by Prof. Miles Walker.
February 11th (Glasgow).—"Carbon Brushes: Considered in Relation to the Design and Operation of Electrical Machinery," by Mr. P. Hunter-Brown.
February 25th (Glasgow).—"The Navigational (Magnetic) Compass as an Instrument of Precision," by Mr. M. B. Field.
March 11th (Edinburgh).—Ordinary meeting.
April 8th (Glasgow).—Annual general meeting.

Leeds Association of Engineers.—A lecture was given by Prof. G. F. Charnock, of the Bradford Technical College, on Friday last, on the reports of the Coal Conservation Committee and the Board of Trade Committee on Electricity Supply. The lecturer, while agreeing with the principles set forth, complained of the lack of details in the reports, and said the Government should institute further inquiry before the matter was taken before Parliament for consideration. No national scheme of coal supply conservation would be complete without some economical provisions for heating. Electric heating, he affirmed, was not practicable, at least, for manufacturing purposes. Mr. W. B. Woodhouse, of the Yorkshire Electric Power Co., advocated the institution of big supply stations in centralised positions. Only by such means could labour and fuel be saved.

Liverpool Engineering Society.—At a meeting on Nov. 20th, an address on "Education in Relation to Industry, with Particular Reference to Engineering," was given by Mr. Algernon E. Berriman, O.B.E. The lecturer, whose aim was to assist the work of the Engineering Training Organisation, premised that industry required its higher staff to be educated both in the theory and in the practice of its operations, and that the two-part education could not be provided solely by experience in the works or solely by a college course. Further, that applied science was now so far advanced that any attempt to acquire full theoretical knowledge solely by spare-time work was liable to jeopardise health, and was certain to result in the neglect of those proper human interests that were an essential part of a broad education. Broad education was essential to success in any position of responsibility in industry. Time off from work for the purpose of study was, therefore, an essential principle of industrial education, and should be applied to all, without distinction of class, in order that industry might choose leaders from the widest possible field. Theory was best studied by most students under organised tuition in the form of part-time "classes" or a whole-time "college course." In general, higher education was only available in the latter form, and the "college course" thus became identified with the higher grade of industrial training, and in particular should this assistance be regarded as a virtual necessity by those who set out from the start to acquire the status of an engineer. With these premisses, the author dealt in detail with the training of boys of all grades of ability.

Institution of Mechanical Engineers.—Owing to the elections, the meeting on December 13th has been abandoned. The next meeting will be on January 24th, when a paper on electric welding will be read by Mr. T. T. Heaton.

Physical Society of London.—At the meeting held on October 25th, a discussion took place on "The Case for the Ring Electron." Dr. H. S. Allen discussed the arguments in favour of an electron in the form of a current circuit capable of producing magnetic effects. Then the electron, in addition to exerting electrostatic forces, would behave like a small magnet. The assumption of the ring electron removed many outstanding difficulties, including the following :—

There is no loss of energy by radiation as in the case of a classical electron circulating in an orbit.

Diamagnetic atoms must have a zero resultant magnetic moment. This is difficult to account for with electrons in orbital motion.

The ring electron gives a good explanation of the facts of paramagnetism.

The asymmetry of certain types of radiation can be accounted for.

The forces of cohesion in a solid are similar in nature to chemical forces, both sets of forces having an electromagnetic origin.

The questions of the mass and magnetic moment of such a ring electron were discussed. It was pointed out that the adoption of this hypothesis would lead naturally to the acceptance of an atomic model with a magnetic core, as previously suggested by the speaker.

Dr. D. Owen said that the evidence, on the whole, scarcely impressed him as convincing. Whilst from the point of view of certain phenomena a strong case might be made for its acceptance, it seemed equally true that in regard to other phenomena a strong case might be made against it.

Prof. Hale (of Mount Wilson Observatory) referred to some solar phenomena which were of interest in connection with the theory.

The general magnetic field of the sun was so small that the total displacement of spectrum lines was only about 1/1,000 A.U.—*i.e.*, the maximum intensity was about 50 units. Its polarity was the same as that of the earth, and the magnetic poles were 6½° from the axis. The field diminished rapidly above the surface. It was undetectable at a height of 1,000 to 2,000 miles.

At the meeting held on November 8th, a paper on "Low-Voltage Arcs in Metallic Vapours" was read by Prof. J. C. McLennan, F.R.S. The paper described experiments by Messrs. Hamer and Kemp, students of the author's, at Toronto University. The experiments showed that increasing the température of the incandescent cathode lowered the voltage necessary to produce arcs in the vapours of mercury, zinc, and cadmium. With mercury it was found possible to strike arcs with voltages as low as 4·75 volts, and to maintain them at 2·84 volts. Corresponding figures for cadmium were 5 and 2 volts. To obtain these very low arcing voltages it was necessary to use intensely hot cathodes and a copious supply of highly heated metallic vapour.

Electricity in Reconstruction.—In a letter to the *Times Engineering Supplement* for November, Mr. S. E. Fedden pointed out that the industrial reconstruction of Britain, both immediately after the war and during the subsequent period of from five to ten years, was bound up with a plentiful supply of electric power being available with the least possible delay at the existing industrial centres. A very large amount of manufacturers' private steam and gas power plant, he said, was on the point of breakdown through the strain of continuous day and night working during the last 4½ years, and through inability to find time and labour to maintain it in proper repair. Within a short time it would be necessary to scrap this worn-out plant and quickly replace it by electric motors. The aggregate horse-power for this work alone would be hundreds of thousands, and further huge supplies would be required for the equipment of new works and extensions of existing works.

Steps should be taken at once to equip the power stations of the country with the necessary generating plant to supply the increased demand for electricity; big electrical generators took from two to three years to manufacture and install, and he suggested that the Government should forthwith place on order 25 generating sets, each of 25,000 kw. capacity, with the necessary boilers and accessories. The orders should be allocated with a view to the most expeditious completion of the contracts and according to the capacity for production of each particular firm. The orders would provide employment for a vast amount of machinery and for thousands of workmen during the interregnum between the cessation of war production and the time when general reorganisation rendered it possible to resume the industries of peace times.

If this scheme could be put in hand at once, the manufacturers of the country would be assured of an ample supply of power at reasonable rates, at a time when the need would be most apparent. Further, the adoption of this or any similar idea need not in any way prejudice, but could be made complementary to, the large Government schemes for the wholesale supply of electricity foreshadowed in the various reports which had been issued. The one purpose of the suggestion was to avoid any possible delay in the provision of abundant supplies of electricity, which, in Mr. Fedden's opinion, were vital to the best interests of the community at large.

Ramsay Memorial Fund.—The hon. treasurers of the Ramsay Memorial Fund announce that it is now just over £40,000. The aim of the appeal was £100,000. Contributions may be sent to the hon. treasurers, Lord Glenconner and Prof. J. Norman Collie, at University College, Gower Street, W.C. 1.

Parliamentary.—*Applications for Powers.*—The following notices of applications for powers have been published in the *London Gazette* :—

Shrewsbury.—Shrewsbury and Market Drayton Light Railway Co. New company to construct light railways, &c.

Oldham.—Corporation. Powers to construct new tramways in the borough and urban district of Chadderton.

Thornaby-on-Tees.—Corporation. Powers to construct new tramways.

Patent Regulations Revoked.—Paragraph 18 B of the Defence of the Realm Regulations, relating to the prohibition of publication of inventions and designs and the filing of applications for the grant of patents and registration of designs abroad, has been revoked.

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Royal Naval Division: Relief Committee.—A Relief Committee was formed in November, 1914, in connection with the Divisional Engineers of the Royal Naval Division by members of the Institution of Electrical Engineers, in whose premises the recruiting was carried out, assisted by members of the Institutions of Civil and Mechanical Engineers.

Necessitous cases, mainly due to delay in the payment of separation allowances, were at first investigated and relieved by the Soldiers' and Sailors' Families Association. The late Mr. Wm. Duddell took an active interest in this. A fund was subscribed in anticipation of further need for assistance, but the Divisional Engineers afterwards became dispersed, and while nominally belonging in some respects to the Royal Naval Division, ceased to exist as the Divisional Engineers.

Meanwhile, the Royal Naval Division Comforts Fund, with offices at 11, St. James's Square, S.W. 1, had been actively engaged in sending food to Prisoners of War in Germany, and is now winding up its organisation with a financial deficit.

The surviving members of the Committee and contributors to the Divisional Engineers' Fund have agreed to hand the balance over to the Royal Naval Division Comforts Fund, and the sum of £31 18s. 2d. has accordingly been thus dealt with.

International Research.—The *Times* states that at the second meeting of the Conference of Inter-Allied Scientific Bodies, at Paris, it was decided that the Conference should provisionally fulfil the *rôle* of International Research Council, the creation of which was voted at the Inter-Allied meeting in London.

The Electrical Contractors' Association.—On and after the 9th inst. the address of the three Associations, namely :—The Electrical Contractors' Association (Incorporated), the N.E.C.T.A., Ltd., and the National Federated Electrical Association, will be 11 and 13, Southampton Row, W.C. 1, instead of 20, Bucklersbury, London, E.C. 4. The new telephone number will be Museum 4088, and the telegraphic address will be "Nafecta Phone London." Owing to the increased work of these three Associations, the Council has decided to have its own offices, and has come to an agreement with Mr. Leonard G. Tate, the General Secretary, to devote his whole time to the work of the three Associations.

A New Governor.—In *L'Industrie Electrique* for September 25th M. J. Barbillion gives particulars of a new speed regulator depending for its action both on the amount of departure from the normal speed and on the rate at which the speed is changing. In principle (see figure) it consists of a centrifugal speed indicator A and an acceleration indicator B, to both of which is connected a lever C, at the points *a* and *b*. A link coupling the lever to a servomotor which controls the sluice gates or valve gear is adjustable in a slot at *c*. When the speed of the machine rises, the end *a* of the lever is lifted in proportion to the change of speed, and the end *b* in proportion to the rate of change; if the speed is too high and rising, *a*, *b*, and *c* are lifted, and the servomotor is set in operation to close the valve; if the speed is too high but falling, *a* is raised but *b* is lowered, and whether *c* is raised or lowered depends upon its position in the slot and the relative movements of *a* and *b*. Similarly when the speed is low, the movement of *c* depends upon all three factors, and owing to the introduction of the acceleration

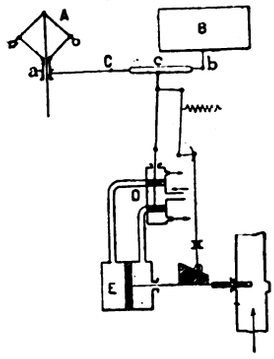

Diagram of Regulator.

factor, the action of the regulator is not only very rapid when necessary, but also very "judicious." It can be shown, says the author, that with this arrangement theoretically perfect regulation is attainable, and speed oscillations are completely suppressed. Regulation is very rapid, and the adjustment to maintain a given speed is very easily made, either by hand or automatically. In the figure D is the pilot valve of the servomotor E, and it will be seen that the position of *c* in the slot is controlled by the position of the valve gear or sluice gate.

State Help for Universities.—Mr. Bonar Law and Mr. H. A. L. Fisher recently received at the Board of Education a large and representative deputation from the Universities and Institutions of University rank of Great Britain and Ireland, which desired to lay before the Government the need for further financial assistance to enable the Universities to maintain the standard of their work and to develop their activities.

The Chancellor of the Exchequer, in replying to the deputation, said that the Government was fully alive to the vital importance to the nation of maintaining the efficiency of the highest education in the country, and promised that he would consider sympathetically any recommendations which might be made to him by the President of the Board of Education.—*The Times.*

The E.T.U. in a New Guise.—At a meeting held in the Albert Hall on Sunday last, at which Mr. Lansbury presided, according to the *Times* report, Mr. Robert Williams (National Transport Workers' Federation) said that no insurrectionary or revolutionary movement could be conducted successfully by any single section of the working class. If the Electrical Trades Union were prepared "to go over the top" they would require millions of effective reserves. The time might come during the next month, or six months, when some Union might be called upon to take considered and determined action in the interests of the working classes, and that Union might require the assistance of every other Union in London. It was not a matter of cheering for the revolution—it was what they were going to do for the revolution.

The Coal Shortage.—Figures issued by the Coal Controller show a further serious falling-off in the estimated output of coal during the first 40 weeks of this year, compared with the output during the corresponding period of last year. The net shortage is nearly 16½ million tons, or about 8·4 per cent. Although miners will shortly be returning to the mines at the rate of 5,000 a day, there is a large leeway to be made up, and some little time must elapse before the increase in the output of coal is felt.

Electroculture.—According to the *Daily Chronicle*, a row of savoys of enormous dimensions has been grown from electrified seed by Mr. W. Guy on an allotment at Parkstone. It is stated that one plant measured 4 ft. 1 in. across, and weighed 12½ lb.

Electrolytic Extraction of Copper from Pyritic Ashes.—A new method for the electrolytic extraction of copper from pyritic ashes was described in *l'Industria* for July 15th. The method is based on the electrolytic conversion of sulphide or sulphate of copper into cupric or cuprous chloride by the action of chlorine at the anode. If in an electrolytic bath containing hydrochloric acid in solution the anode is surrounded by a mass of pyritic scoria, the chlorine liberated by the hydrogen attacks the oxides, sulphates, or sulphides of copper more rapidly than the oxides of iron, and combines with them to form cupric chloride. This reaction extends to the entire mass of scoria, so that the latter acts as an electrode. The copper loss by this method is said to be only 0·1 per cent.

Demobilisation in Germany.—"The main principle of demobilisation, according to *Vorwärts*, will be that: 'Every wage-worker and official shall return to the situation which he had in 1914.' This general principle shall also apply to the demobilisation of the 'home army, several hundred thousands of whom will be left without employment by the closing down of concerns which are working solely on war contracts.' Of course the principle—'Back to your old situation'—will not be rigidly applied, but due care will be taken to avoid unnecessary changes and personal inconvenience. No foreign workman shall be allowed to deprive a German of work and food. Facilities will be given to Polish, Belgian, and Dutch workmen to return to their homes. The reinstatement of the workers in their old employment will doubtless be seriously interfered with; by the fact that many concerns have been closed down. Labour Exchanges, unemployment benefit, and public relief works will help to solve any difficulties arising in this way. There will be no great difficulty in establishing public relief works of permanent economic value. There is no lack of opportunities for work. An enormous amount of repairing work is urgently required. But it is very questionable if contracts for the requisite installation work will be distributed so long as prices remain at their present height. A dangerous vacuum may arise owing to want of coal and raw material, and it will be the duty of the Imperial Authorities to make the necessary provision. Deliberations are still in progress regarding these questions, and the elimination of profiteering from public contracts. Soldiers will be discharged according to the economic value of the trade to which they belong. At the same time special facilities will be given to employers for obtaining the release of particular men, and it seems probable that they will be controlled by trade union secretaries in the exercise of these facilities. The organisation for demobilisation will be devoid of all bureaucratic formality. It will be guided by the advice of the existing industrial associations, and will depend on the energy, discretion, and sense of responsibility of the officers of these associations, who will be entrusted with full powers to make all the necessary arrangements without loss of time. The Imperial Economic Department is at the head of this organisation, and the work will be divided up among local committees, who will also have extensive powers. Industry as a whole will have to bear part of the social burdens of demobilisation. It is possible that the periods for terminating agreements will be extended, or regulations will be made regarding the rates of wages and the hours of labour."—*Labour Gazette.*

Conductivity of Aluminium Conductors.—According to a new regulation published by the Ministry of Public Works in Austria on August 21st, 1918, it is now permitted to use aluminium conductors of lower conductivity than was specified in the regulations in force hitherto. The highest limit for the resistivity is now 31 ohms for an aluminium wire of 1,000 m. length and 1 sq. mm. section at 15 deg. C. instead of 20 ohms, as previously specified. The change is necessitated by the impossibility of meeting the earlier specification with the grades of aluminium now obtainable on the market. —*Elektrotechnik und Maschinenbau.*

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The Premier on Reconstruction.—The Prime Minister opened the provincial campaign of the Coalition by addressing a big meeting at Wolverhampton on Nov. 23rd. He said that in preparing for a new policy we must sweep aside prejudices. He was afraid more of vested prejudices than he was of vested interests. A systematic effort must be made to bring the population back to the land, and an intelligent agricultural policy was the true basis of a great industrial policy. The land must be cultivated to its fullest capacity; that should be an essential feature in the new Britain.

Above all, we must have an improved system of cheap and rapid transportation if we were to carry out the agricultural policy. He might go into that later on, because he attached great importance to it. We must have good services, tramways, light railways, lorries, and whatever enabled people and goods to pass along great spaces in order to make use of the surface of the land. Before the war, agricultural produce could be got from foreign countries hundreds of miles away, more cheaply than the farmers could bring it 50 miles to a market. With a cheap, quick transportation, England could be regenerated in a way which could not be done by any other means, and he considered, therefore, that meant one of the most important of matters. He would also like to develop the importance of canals. The Midlands ought to have canal communication with the sea. In Germany, in France, great towns and cities would certainly be in communication with the main waterways that communicated with the sea. There was no country that had made less use of its water power. There was plenty of water in this country, that was not what we were short of, and we had got the canals.

British Scientific Products Exhibition.—In view of the wide public interest taken in this exhibition, held at King's College, London, during the past summer, the British Science Guild has decided to organise another exhibition next year. The main object of the exhibition will be to stimulate national enterprise by a display of the year's progress in British science, invention, and industry. Further particulars will be available in due course. A large part of the recent exhibition has been transferred to Manchester, where it will be on view at the Municipal College of Technology towards the end of this month.

Training for Officers.—A Committee to be known as the Officers' University and Technical Training Committee for Scotland has been appointed by the Ministry of Labour, to advise the Scotch Education Department, the Board of Agriculture for Scotland, the Ministry of Pensions, and the Ministry of Labour, as to what course of education and training it may be desirable to arrange for the benefit of officers and ex-officers of His Majesty's Forces and men of like standing, particularly with a view to finding for them suitable employment after the war. The work of the Committee will be closely associated with that of the Appointments Department of the Ministry of Labour. The Committee will be under the chairmanship of Sir Alfred Ewing, Principal of Edinburgh University, and the secretary is Major G. F. Young, of the Appointments Department, Ministry of Labour, Balmoral Hotel, Princes Street, Edinburgh, to whom any communications in regard to the work of the Committee should be addressed.—*Daily Telegraph.*

The Fleming Valve.—In the Chancery Division the petition of Dr. J. A. Fleming for the prolongation of his patent No. 24,850, 1904, for "Improvements in Instruments for detecting and measuring alternating electric currents"—the well-known "valve" used in wireless telegraphy—came on for hearing before Mr. Justice Sargant on Wednesday. There were several objectors. The case is proceeding.

Coal Economy.—At the Royal Technical College at Glasgow on November 16th, Mr. David Wilson, technical adviser to the Coal Controller, delivered an address before the Association of Mining Electrical Engineers and Colliery Managers on the subject of coal economy so far as it applies to collieries. He explained that up to the present collieries had not been included in the economy campaign; first, because no transport was involved; and secondly, because collieries used, or rather, should use, very low-grade coal. He had, however, now received instructions from the Coal Controller to include collieries in his investigations. Whilst there were many efficient collieries in the country, it was a fact that collectively the inefficiency of the steam-generating plant was notorious—due, no doubt, to the fact that coal costs had been of little or no relative importance—and some plant had been so neglected that reconstruction or electrification was the only ultimate solution.

The total coal raised in the British Isles during 1917 was 248,000,000 tons, and the consumption at collieries about 18,000,000 tons. According to the Coal Conservation Committee, complete electrification of all collieries would result in a saving of 75 per cent., reducing the above figure to, say, 5,000,000 tons—thereby releasing 13,000,000 tons per annum for use elsewhere. It would be said that the coal used at collieries was not worth sending out to industrial firms. Mr. Wilson maintained that if they could raise steam with it, other people could do the same, although, of course, from a national point of view it would not be economical to send the very low-grade coal to firms remote from the pits. Whilst complete electrification would no doubt be the ultimate solution of colliery inefficiency, they recognised that owing to the difficulty of obtaining materials, very little could be done in that direction at the present time. In order to get some up-to-date evidence of the relative efficiency or inefficiency of collieries, he had recently investigated on behalf of the Controller, 24 selected cases in England. He exhibited tables showing the estimated saving which should be immediately possible—first, without any additional plant; secondly, by electrification; and thirdly, by installing new plant other than that required for electrification. He showed that the consumption of coal used under the boilers varied from 4.5 per cent. to 16.5 per cent. of the total production, the average being 9.5 per cent., and that the annual saving for only 24 collieries was estimated at 10,486 tons, or 97,666 tons if electrification was included. He did not suggest that a pro-rata saving would be possible for the 3,000 odd collieries in the British Isles, but he believed a figure of one million tons would certainly not be a high estimate, and a possible saving of 12 million tons per annum if all collieries were electrified.

Mr. Wilson then enumerated the principal reasons for the low efficiency of the steam plants at collieries, and distributed copies of his address (see ELEC. REV., October 25th, 1918, p. 406) recently delivered before the Association of Engineers-in-Charge, in which definite suggestions regarding the operation of power plant were set out.

Appointments Vacant.—Working foreman to inspect consumers' installations, &c. (91s.), for the Salford Corporation Electricity Department; manager and engineer (£400), for the Mexborough and Swinton Tramways Co.; charge engineer (£191), for the City of York Electricity Department; chief instructor for the Ceylon Government Technical Schools (£450 to £600). See our advertisement pages to-day.

For Sale.—The Edinburgh Corporation Electric Supply Department has for sale two Bellis engines and one Willans engine coupled to Siemens dynamos; the Central Electric Supply Co. has for sale one 1,050-KW. Oerlikon turbo-generator and one Richardsons, Westgarth condenser, with air pump and circulating pump.—See "Official Notices" to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Ilford U.D.C. Electricity Committee has recommended that the salary of Mr. GREGORY, the new chief technical assistant at the electricity works, be increased to £300 per annum at the expiration of six months, if his services are in every way satisfactory.

Glasgow Corporation has increased the salary of Mr. W. LACKIE, chief engineer of the Corporation electricity works, from £1,250 to £1,500.

Mr. F. M. FLETCHER, A.M.I.E.E., assistant electrical engineer at the Rochdale Corporation electricity works, has been appointed electrical engineer to the Darwen Corporation in succession to the late Mr. Charles Garnett.

Burnley Electricity Committee has recommended that the salary of the electrical engineer, Mr. STARKIE, be increased from £500 to £600.

Coventry T.C. has adopted the recommendation of the Salaries Committee to increase the salary of the electrical engineer, Mr. G. TOUGH, from £900 to £1,050 (see ELEC. REV., November 29th), and has referred back for further consideration the recommendation referring to the salaries of other members of the electrical staff.

Lancaster E.C. has granted a bonus of £100 to Mr. J. B. PATTERSON for services as acting electrical engineer in the absence of Major G. C. Milnes on service with the K.O. Royal Lancs. Regiment.

Mr. R. L. ACLAND, electrical engineer and tramway manager at Chesterfield, has accepted an appointment in London, and leaves his present position early in the New Year.

Barnstaple T.C. has increased the salary of Mr. J. W. HADFIELD, borough electrical engineer, by £50 a year.

Mr. GEORGE WILKINSON, the Harrogate Borough electrical engineer, has received a bronze wreath of oak leaves which some Russian officer prisoners in the German prison at Guadeufrai, Silesia, had made in commemoration of his son, the late Lieut. J. R. Wilkinson, upon whose grave the wreath reposed in the Moravian Cemetery. The wreath has been forwarded through the kindness of the Crown Princess of Sweden, along with a letter of eulogy and sympathy.

For the appointment of tramway general manager at Bury (Lancs.) there were 42 applicants; the following are to be interviewed by the Tramways Committee:—Mr. C. J. BAKER, traffic manager, Blackpool; Mr. H. BEESTON, chief clerk, Bury; Mr. F. BUCKLEY, general manager, Wigan; and Mr. A. B. HAYNES, depôt superintendent, Wigan.

Mr. WM. SANDERSON has relinquished his appointment as electrical engineer to Uphall and Broxburn electricity undertaking, having accepted a similar appointment in Fochabers electricity undertaking. Mr. ALEX. BROWN has been appointed electrical engineer to the former undertaking.

General.—Mr. S. M. HILLS, A.M.I.E.E., has resigned his position in the sales department of the West Ham Corporation electric supply to join the staff of Messrs. Greenly's,

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Ltd., specialists in business propaganda. Mr. Hills has had special experience with the publicity side of engineering in the U.S.A., Australia, New Zealand, Japan, Ceylon, and elsewhere which should be of considerable value in planning export campaigns.

Coun. Kosky has been appointed chairman, and Coun. Keefe vice-chairman, of the Stepney B.C. Electricity Committee.

Ald. R. A. Smithson and Ald. H. Brown have been appointed chairman and deputy-chairman of the Leeds Tramways Committee, and Mr. H. Lupton and Mr. J. Clark chairman and vice-chairman of the Electricity Committee.

Coun. W. A. Wadham has been appointed chairman of the Barrow T.C. Electricity Committee, and Coun. Barrie vice-chairman.

Mr. G. H. Browne, A.M.I.E.E., has severed his connection with the Mexborough & Swinton Tramways Co.

Roll of Honour.—Sergeant H. Beaumont, K.O.R. Lancs. Regiment, who has been killed in action, aged 31, was formerly in the employ of Mr. George Cotton, electrical engineer, of Blackpool, but held an appointment at the Magic City in Paris when war broke out.

Mr. Harry Shaw, who has died in hospital at Bloemfontein, South Africa, was on the staff of the Blackpool electricity works as mains superintendent.

Corporal A. Shether, A.S.C., who has died from wounds sustained last June, was employed by Mr. Philpot, electrical engineer, of Canterbury.

Private C. Smith, formerly on the staff of the Barnstaple Corporation electricity works, has been killed in action.

Bombardier G. Todd, R.F.A., an apprentice at the Carlisle Corporation electricity works, has been awarded the Military Medal.

Private B. Castle, London Regiment, who fell in action, was on the staff of the Telegraph Construction & Maintenance Co., of East Greenwich, S.E.

Private R. Browne, who has been killed in action, was formerly employed in the drawing office of the British Thomson Works, at Rugby.

Flight-Sergeant F. R. Peel, who has died from gunshot wounds in the head, was formerly in the electrical department of Messrs. C. Pratt & Sons, Ltd., aircraft constructors, Bradford.

Lieutenant Cyril F. Barrow, R.E., has been awarded the Military Cross "for conspicuous gallantry and fine leadership in action." He joined the Motor Machine Gun Corps in December, 1914, and after serving in France received his commission. He was formerly employed in the Bolton Corporation electricity works.

Private H. Wood, Manchester Regiment, who has been killed in action, was formerly employed at the British Westinghouse Co., Ltd., Trafford Park.

Corporal H. Shaw, Wiltshire Regiment, who has been killed in action, was formerly employed by Messrs. Charles Macintosh & Co., Ltd., cable manufacturers, Manchester.

Captain G. R. D. Prince, A.M.I.E.E., who died from pneumonia on November 24th, was formerly with Callender's Cable & Construction Co., at Erith, and joined the staff of Henley's Telegraph Works, at Gravesend; on the outbreak of war he volunteered for foreign service, being gazetted on October 30th, 1914, second-lieutenant in the Kent (Fortress) Royal Engineers (T.). After service in the Isle of Grain and at Sheerness, he served for two and a half years as chief assistant to the Chief Engineer at Chatham, being gazetted captain in 1915, and staff officer. He subsequently transferred to a Field Company, and, after service with the Salonica Force, contracted malaria; while waiting to be transferred home he succumbed to broncho-pneumonia.

Obituary.—Mr. H. C. Walker.—The death has taken place from pneumonia, following influenza, of Mr. Henry Cecil Walker, director of Messrs. Waygood-Otis, Ltd., and eldest son of Mr. H. C. Walker, chairman of the company. Deceased was 41 years of age, and had been associated with the firm for 25 years, being connected with the electrical side of the concern, and was the firm's chief electrical engineer.

Mr. A. E. Denman.—The death occurred on November 23rd of Mr. Arthur Edward Denman, who was for over 30 years with Messrs. Siemens Bros. & Co., of Woolwich.

NEW COMPANIES REGISTERED.

British Floating Exhibitions, Ltd. (151,993).—Private company. Registered November 21st. Capital, £500 in £1 shares. Exhibitors, agents for manufacturers, charterers of ships for exhibition of goods, furniture dealers, importers, carpet dealers, drapers, ironmongers, earthenware dealers, gas fitters, sanitary and electrical engineers, timber merchants, Manchester warehousemen, paper and paper bag manufacturers, &c. The subscribers (each with one share) are:—F. Sidney, Broad Street House, E.C.2, solicitor's clerk; Ivy E. Fisher, Broad Street House, E.C.2, solicitor's clerk. The subscribers are to appoint the directors. Solicitors: W. T. Hick, Broad Street House, E.C.2.

J. H. Tucker & Co., Ltd. (152,031).—Private company. Registered November 26th. Capital, £150,000 in £1 shares. To take over the business of a manufacturer of electric lighting and power accessories carried on by J. B. Tucker at King's Road, Hay Mills, Birmingham, as J. H. Tucker & Co. The subscribers (each with one share) are:—J. B. Tucker, Lynwood, Ashleigh Road, Solihull, manufacturer; C. F. J. Tranter, 38, Silverbirch Road, Erdington, Birmingham, accountant. First directors: J. B. Tucker (chairman) and C. F. J. Tranter. Solicitor: A. H. Coley, 63, Temple Row, Birmingham.

Logie, Ashmole & Co., Ltd. (152,033).—Private company. Registered November 26th. Capital, £3,000 in £1 shares. To take over the business of a mechanical and electrical engineer, &c., carried on by R. W. Logie as R. W. Logie & Co. at New Street, Burton-on-Trent, also to deal in all goods ordinarily supplied by Sheffield, Coventry, and Birmingham manufacturers and warehousemen, and to carry on business as aeroplane manufacturers, &c. The subscribers (each with one share) are:—R. W. Logie, 152, New Street, Burton-on-Trent, engineer; J. W. Ashmole, 38, Belvedere Road, Burton-on-Trent, electrical engineer. The first directors are: R. W. Logie and J. W. Ashmole. Registered office: 152, New Street, Burton-on-Trent.

James Booker, Ltd. (152,065).—Private company. Registered November 28th. Capital, £1,500 in £1 shares. Factors of jewellery and fancy goods, manufacturers of and dealers in electrical appliances, &c. The subscribers (each with one share) are:—E. Cripwell, 55, Temple Row, Birmingham, solicitor; G. A. Parker, The Chalet, Hall Green, Birmingham, company director. Table "A" mainly applies. Registered office: 27, Hilton Street, Birmingham.

Orbit Electrical Co., Ltd. (152,080).—Private company. Registered November 29th. Capital, £60,000 in £1 shares (30,000 cum. participating pref.). To purchase the business of manufacturers of and traders in electrical batteries, pocket and other flashlamps, and general electrical appliances, fittings, and accessories, carried on at Electric Works, Station Road, Chadwell Heath, Essex. The subscribers (each with one ord. share) are:—H. B. Stocks, 2, Coleman Street, E.C., engineer; R. D. Browne, 2, Coleman Street, E.C., merchant. The first directors are:—H. B. Stocks, R. D. Browne, and T. T. Rankin, B.Sc. (all permanent). Registered office: 2, Coleman Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

James Keith & Blackman Co., Ltd.—Issue on November 19th, 1918, of £2,000 debentures, part of a series already registered.

Electric Supply Co. of Victoria, Ltd. (66,059).—Return dated October 30th, 1918. Capital, £325,000 in £1 shares (175,000 pref. and 150,000 ord.). 175,000 pref. and 125,000 ord. shares taken up; £50,007 paid; £240,993 considered as paid. Mortgages and charges: £134,862.

National Electric Construction Co., Ltd. (53,364).—Return dated June 13th, 1918. Capital, £125,000 in 10s. shares. 170,000 shares taken up; £75,574 10s. paid on 151,149 shares; £9,425 10s. considered as paid on remainder. Mortgages and charges: £75,000.

Halifax and Bermudas Cable Co., Ltd. (28,972).—Return dated October 10th, 1918. Capital, £50,000 in £5 shares. All shares taken up; £50,000 paid. Mortgages and charges: Nil.

CITY NOTES.

Ferranti, Ltd. The net profit on trading for the year to June 30th last was £35,174, after making provision for general establishment charges, bad debts, repairs and renewals, income tax and interest on debenture stock, five-year notes and loans, and making the usual allocation to depreciation reserve, but no provision has been made for excess profits duty, which has not yet been ascertained. The net profit for the previous year was £7,650. The outlook for the company's ordinary manufactures shows signs of improvement, although facilities for export trade are meantime limited. Substantial reductions have been made in the amounts outstanding in respect of debenture stock and loans from bankers, and arrangements made for the renewal of the five-year notes until 1922. The directors recommend payment of a dividend of 6 per cent., less tax, on account of arrears of dividend accrued on preference shares, and hope at the conclusion of the war to bring forward a scheme for the funding of these arrears and to readjust the capital. Annual meeting, December 13th, in London.

Spain.—Our correspondent in Spain sends the following notes on some small Spanish companies.

S.A. El Tibidabo.—This company exploits a tramway on the outskirts of Barcelona, and a funicular railway up Mount Tibidabo, and also owns land and houses in the same district. There is a paid-up capital of £60,000. The directors in their report for 1917 lament the effect that wartime has had upon the business by reducing the number of tourists. The dearness of materials, the increase in running costs, and the August strike of last year also had a bad effect. A net profit of £4,402 is shown, and a dividend of 6 per cent. is recommended, also a payment of £792 to the directors, while £10 goes to the reserve fund.

Co-operativa Eléctrica Bilbao.—This company reports total receipts of £13,531 for energy sold, meter rents, &c., and total expenses £9,202. The profit for the 12 months' working —£4,329—is sufficient to declare a 6 per cent. dividend, free of tax.

Sociedad Eléctrica Santa Teresa, Jabago, province of Huelva.—This company has just held its annual general meeting to consider the 1917-18 report. The undertaking has a capital of £50,000, and supplies electrical energy to about a dozen small towns and villages in the district. It also owns a flour mill (driven by water power), and the report declares that in spite of the impossibility of obtaining cereals at the maximum price decreed by the Government, and in spite of increased costs in all directions, the mill shows a larger income than during the previous year. Receipts for the supply of electrical energy also show an increase of £326 on the preceding year, but this was just balanced by increased costs. This cost increase was owing to the hydro plant being insufficient to carry the load throughout the dry season, and

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the steam plant had to be put in service. The company states that the average running cost per H.P.-hour at the steam plant was 1.3 pence, while the maximum at the hydro-electric plant was .2 pence. There is a total income of £7,065, and a dividend of 8 per cent., free of tax, is recommended.

Swiss Companies.—*The Société Franco-Suisse pour l'Industrie Electrique* has just offered for subscription bonds for £240,000. The issue is reported to have been only partly taken up.

The Omnium Electrique, of Geneva, proposes to pay a dividend of 12 per cent. for 1917-18, and a bonus of 12 per cent. out of the reserve funds, these comparing with a rate of 8 per cent. in the previous twelve months.

The accounts of the *Maschinen Fabrik Oerlikon*, which increased the share capital in October, 1917, from £320,000 to £640,000, indicate net profit of £66,000 for 1917-18, as compared with £43,000 in the previous year. The directors recommend a dividend of 7 per cent., in which the new capital will participate to the extent of one half, being the same rate as in each of the two preceding years.

The Watt A.G. fur Elektrische Unternehmungen, of Glarus, which is closely associated with the Zurich Bank for Electrical Undertakings, states that the company's activity in 1917-18 was restricted to investments already in portfolio. The receipts from interest and commissions increased from £14,000 in 1916-17 to £16,000 last year, but after defraying working expenses and taxes the accounts show a loss, and no distribution is possible, as was the case in 1916-17.

Prospectus.—*Siemens Bros. & Co., Ltd.*—The list of applications was to close on or before yesterday (Thursday) in an offer of £500,000 4½ per cent. debenture stock at £87 10s. per cent., and 80,000 shares of £5 each at par. The issue is offered by the British Bank for Foreign Trade, Ltd. In the course of an explanatory letter by Mr. G. Mure Ritchie, the chairman, published with the prospectus, it is stated that Siemens Bros. & Co., Ltd., owns the whole of the share capital and the debenture stock in Siemens Bros. Dynamo Works, Ltd., and the two companies together possess freehold land and buildings at Stafford covering an area of 62 acres, and works at Woolwich covering about 17½ acres, and a factory is rented at Dalston which has been equipped for the manufacture of metallic filament lamps and has a capacity for an annual output of 2,500,000 lamps. In all the chief classes of manufacture the companies are doing an extensive and increasing business.

In addition to their selling departments at Woolwich and London, the companies have established selling branches for their products at Birmingham, Cardiff, Glasgow, Manchester, Newcastle, Sheffield, and Southampton, in Australia at Sydney and Melbourne, in India at Bombay, Calcutta, and Madras, in the Straits Settlements at Singapore, in South Africa at Cape Town, and in Canada; further, they have representatives or correspondents in the chief towns of South America, New Zealand, China, and Japan. They are thus in a position to secure and carry out a fair proportion of the profitable orders for electrical work which it is anticipated will be obtainable from all countries as soon as manufacturers are free from their war contracts.

The assets and the liabilities of the two companies taken from the audited accounts at December 31st, 1917, being the close of the last financial year, and after providing for the reduction of the liability to the Public Trustee and the 4½ per cent. debenture stock now issued to £1,000,000, resulting from the sale of the 80,000 shares and £500,000 4½ per cent. debenture stock, are as follows:—

Assets: Freehold and leasehold properties and works, machinery, tools, s.s. *Faraday*, stock and work in progress, debtors, investments, cash and treasury bills, &c.	£3,227,282
Less Liabilities: 4 per cent. debenture stock, 4½ per cent. debenture stock, creditors, &c.	£1,942,003
Surplus, subject to payment of excess profits duty	£1,285,279

Nothing has been included in the above figures for the valuable goodwill of the business or in respect of the very large number of patents belonging to the companies. The cable steamer *Faraday* was built at a cost of about £150,000, and is classed 100 A1 at Lloyds; her gross tonnage is 5,028; her value is taken in the above figures at £18,000, but at the present time she is insured for £200,000.

The dividends paid by the company in recent years have been 5 per cent. for 1913, 7 per cent. for 1914, 6 per cent. for 1915, 7 per cent. for 1916, 10 per cent., free of income tax for 1917, and an interim dividend at the last-named rate has been declared in respect of the half-year ended June 30th, 1918. The profits of the two companies for the year 1917 before deducting interest on capital debts and debenture stock and provision for excess profits duty, amounted to £338,462. The interest on the 150,000 4 per cent. debenture stock and the interest and redemption fund on the £1,000,000 4½ per cent. debenture stock together will amount to £73,439 per annum.

Whilst going to press we learn that the issue was oversubscribed.

Auckland Electric Tramways Co., Ltd.—The total revenue for the year ended June, 1918, was £301,434. Traffic receipts were £294,564, an increase of £11,866. After providing for expenses chargeable to revenue, including debenture and other interest, also payments to Auckland City Council (£5,131), putting £25,000 to renewals and depreciation, the surplus on working is £53,430, plus £5,292 brought forward. After paying the preference dividend, and putting £10,000 to reserve, a further dividend of 1s. per share (making a total of 1s. 6d.), less tax, is paid on the ordinary shares, leaving £5,972 to carry forward. No capital was issued during the year; the capital expended was £3,944. Passengers carried 44,823,967, against 43,351,032 last year; average receipt per passenger 1.58d., against 1.57d.; average expenditure per passenger 1.04d., against 1.00d.

Fuller Accumulator Co., Ltd.—The report to October 31st, 1918, states that the amount of available profit is ample to pay dividends for the year of 10 per cent. on the preference and 15 per cent. on the ordinary shares of the company, as against 10 per cent. last year, after making liberal allowances for depreciation of buildings, plant, and patents. Further additions have been made to the company's equipment in machinery, plant, buildings, land, &c., and the prospects continue to look most promising.

Napier-Kimber, Ltd.—The annual general meeting was held on November 7th; a dividend of 10 per cent. has been paid on the ordinary shares, free of income tax, and, after making provision for excess profits tax and debenture interest, &c., a balance of £350 is carried forward. During the year the capital of the company has been doubled out of accumulated profits by the issue of one bonus share for every share held.

STOCKS AND SHARES.

Tuesday Evening.

Few fresh features have developed in the Stock Exchange during the past week. Until the New Year, members of the House do not look for anything substantial in the way of business. As the General Election draws nearer, interest drifts more into politics and more away from markets, while the inevitable preparation for window-dressing makes its influence felt even at this distance from December 31st. In no part of the Stock Exchange is there anything like activity.

The Home Railway market was not encouraged by the meeting at the Albert Hall last Sunday. Labour's attitude towards the railways, if it cannot be called hostile, is not calculated to drive money into stocks and shares connected with this industry. The market enjoys occasional slight spurts, but they turn out to be short-lived. The sharp rise in Metropolitans last week has been fairly well held, the reaction being moderate; Districts have shed 10s. Underground Ordinary shares weakened to 3⅜, but the Income bonds are better at 89½, and London Electric ordinary at 3½ are ⅛ up.

It is satisfactory to be able to dwell upon the continued strength of home electricity shares. Nearly all the recent improvements, material as they were, have been maintained. The only decline in the list this week is one of 5s. in City of London ordinary, making the price 13½. London Electrics have risen to 30s. Dealers in the market report that buyers still outnumber the sellers, and that there is not enough stock to go round for those who want to get in at anything like the middle prices. The latest issue of Newcastle Electric Supply ordinary shares keep strong at 2s. 3d. premium above the 10s. 6d. paid on the shares, which were offered, it will be recalled, at 20s. 6d. The fully-paid are quoted 22s. 6d. Notting Hill preference changed hands the other day at 9¼ and over, but the ordinary shares have not been dealt in since July, the last-recorded bargain being at 53s. 9d. General and Electric Investment preference are 10s. higher at 22.

Victoria Falls ordinary shares are a trifle easier at 21s. 6d., in sympathy with the heaviness of South African mining shares, due to the influenza outbreak amongst the natives which has seriously diminished outputs during the past two months. Amongst the manufacturing shares, Cromptons are attracting a little attention in the neighbourhood of 16s., and, on Monday, 18s. 9d. was paid for the preference, 94½ for the 6 per cent. debentures. British Westinghouse preference at 2⅝ are ⅛ down, although the result of the meeting was regarded as fairly satisfactory. Electric Constructions at 25s. xd show no particular change, allowing for the deduction. General Electric ordinary have eased off to 17½. Brush ordinary stock at 60 shows a gain of 2 points.

Siemens have now issued the prospectus of new shares and debenture stock, and, on the information supplied, the latter looks a good security, while, as regards the shares, these may be considered a fair speculative investment. The price of the existing issue gave way a little to 6 3/16 on the offer of the new capital. One bargain was marked as low as £6 0s. 10½d. Babcock & Wilcox are a feature of strength in their particular department, a rise of 5s. lifting the price to 3⅞, and the market being still a good one.

Marconis have gone back to 4⅛ after their recent rapid rise, the decline being due to the general conditions prevailing in most markets. With the reaction in the parent shares, the preference have also given way to 3⅝, while of the subsidiaries, Americans dropped back to 31s. 3d., and Marines to 3⅞. Canadians remaining more or less lifeless in the neighbourhood of 14s. The list of cable stocks as a whole is abnormally quiet. Eastern ordinary has gone back to a shade under 160, so that the return on the money comes to a few pence over the round 5 per cent., the dividend being paid, of course, without deduction of the income-tax. Anglo-American Telegraph deferred stock eased off to 23¼, and the return at the present price is practically 6½ per cent. on the money; rather more, in fact, if allowance is made for the

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fact that the full year's dividend is due in February, so that the current price includes some ten months' dividend at the rate of 30s. per annum. Considering the security, and the stock, it looks reasonably cheap. Direct United States shares are also a little easier at 6½.

The foreign list is noticeable for a further rise in British Columbia Electric preference to 67½, although the deferred at 47½ is a point down. The Argentine group is scarcely so good, some little hesitation being introduced by the recent allusions in Argentine railway reports to the question of expense in the Republic. Anglo-Argentine Tramways first preference have lost 1/16 at 4⅛, but the second preference are maintained at 3 13/16, the last business being marked in these shares at 3⅝ nearly a month ago. Mexican securities hold their prices, and Mexico Trams have risen to 42, although Mexican Light first bonds at 72 are a trifle lower. Rio Tramway bonds are good at 92, and the seconds at 85, while San Paulo firsts went ex dividend on Monday, and are now 90, the 5 per cent. consolidated debenture stock being easier at 79. London United Tramways 4 per cent. debenture stock is marketable at about 42½, and London and Suburban Traction ordinary at 4s. 3d.; the preference, at 9s. 3d., have come in for a little notice during the past few days. British Electric Traction is steady at 48½, and the preference at 78½ is now ex dividend. A rise of 5 points lifted River Plate Electric ordinary to 160.

In the telegraph manufacturing list, Telegraph Constructions have lost the 10s. which they gained last week, but otherwise there is no alteration. The rubber market is quiet. Armaments have strengthened in sympathy with activity in the explosives group, aroused by publication of the terms of the Combine. The base-metal market is heavy, and post-war problems continue to exercise the minds of those interested in such companies.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Dec. 3, 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	7½	—	£7 0 6
Charing Cross Ordinary	5	4	3⅜	—	5 14 4
do. do. do. 4½ Pref.	4½	4½	3⅝	—	6 13 4
Chelsea	8	8	8¼	—	6 9 0
City of London	8	8	13½	— ¼	6 0 9
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 5
County of London	7	7	11½	—	6 5 7
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 5
Kensington Ordinary	6	7	5⅜	—	6 7 3
London Electric	Nil	Nil	1⅛	+ ⅛	Nil
do. do. 6 per cent. Pref.	4	5	4	—	6 5 0
Metropolitan	3	4	3½	—	6 3 1
do. 4½ per cent. Pref.	4½	4½	3½	—	6 18 6
St. James' and Pall Mall	8	9	7⅛	—	6 6 4
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	7⅛	—	6 6 4
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	99	—	6 1 0
do. Def.	1½	1½	23½	— ⅛	6 9 0
Chile Telephone	8	8	7⅛	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	15⅝	—	*5 1 7
Eastern Tel. Ord.	8	8	159⅜	—1	*5 0 5
Globe Tel. and T. Ord.	7	7	14⅜	—	*4 16 5
do. do. Pref.	6	6	10½	—	5 14 3
Great Northern Tel.	24	22	83	—	6 13 5
Indo-European	18	18	58½	—	5 11 0
Marconi	15	20	4⅜	— ⅛	4 6 7
Oriental Telephone Ord.	10	10	3½	—	2 17 2
United R. Plate Tel.	8	8	7	+	*5 4 0
West India and Panama	6d.	1/3	1	—	*3 12 6
Western Telegraph	8	8	16½	—	*4 15 7
Home Rails.					
Central London Ord. Assented	4	4	65½	—	6 2 2
Metropolitan		1	29	— ½	3 9 0
do. District	Nil	Nil	25½	— ⅜	Nil
Underground Electric Ordinary	Nil	Nil	8⅝	— ⅛	Nil
do. do. "A"	Nil	Nil	9/-	—	Nil
do. do. Income	6	4	89½	+1	*4 9 5
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅜	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	4⅜	+	—
do. do. 2nd Pref.	5⅜	—	3	—	—
do. do. 5 Deb.	5	5	76½xd	—	6 9 0
Brazil Tractions	—	—	57½	— ½	—
Rombay Electric Pref.	6	6	10⅜	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	67½	+1½	7 11 5
do. do. Preferred	Nil	Nil	52½	—	Nil
do. do. Deferred	Nil	Nil	47½	—1	Nil
do. do. Deb.	4½	4½	63		6 17 8
Mexico Trams 5 per cent. Bonds	Nil	Nil	67	—	Nil
do. 6 per cent. Bonds	Nil	Nil	55	—	Nil
Mexican Light Common	Nil	Nil	40	—	Nil
do. Pref.	Nil	Nil	50	—	Nil
do. 1st Bonds	Nil	Nil	72	—1	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅞	— ⅛	3 17 6
British Aluminium Ord.	10	10	1⅜	—	5 14 4
British Insulated Ord.	20	20	2½	—	4 9 0
British Westinghouse Pref.	7½	7½	2	— ⅛	5 14 1
Callenders	20	25	9	—	6 9 10
do. 5 Pref.	5	5	5	—	—
Castner-Kellner	22	20	3	—	5 10 4
Edison-Swan, "A"	—	—		—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	10	1½xd	—	8 0 0
Gen. Elec. Pref.	6	6	10⅜	—	6 2 4
do. Ord.	10	10	17½	— ½	*5 12 8
Henley	25	25	2½	—	5 11 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17⅜	—	*5 14 8
Telegraph Con.	20	20	48	— ½	*5 0 0

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, December 4th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£100	..
a Ammonia, Muriate (large crystal)	"	£77	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£48	..
a Copper Sulphate	"	£60	..
a Potash, Chlorate	per lb.	2/4	..
a " Perchlorate	"	2/-	..
a Shellac	per cwt.	£17 10/-	..
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	"	£34	..
a " Lump	"	£26	..
a Soda, Chlorate	per lb.	1/1	..
a " Crystals	per ton	170/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 3" to 12" basis)	per lb.	..	..
c " Tubes (solid drawn)	"	..	..
c " Wire, basis	"	..	..
c Copper Tubes (solid drawn)	"	1/8½ to 1/9	..
g " Bars (best selected)	per ton	£161	..
g " Sheet	"	£161	..
g " Rod	"	£161	..
d " (Electrolytic) Bars	"	£137	..
d " " Sheets	"	£161	..
d " " Wire Rods	"	£147	£2 inc.
d " " H.C. Wire	per lb.	1/5½	..
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/6	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	2/10	..
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£37	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	9d. to 4/6	..
e " " " medium	"	5/- to 10/-	..
e " " " large	"	12 6 to 25-/& up.	..
d Silicium Bronze Wire	per lb.	1/10	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	..	..
a " Wire, Nos. 1 to 16	per lb.	5/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Instruments for Testing Electric Welds Needed.—There is a great and urgent need for a simple workaday instrument or means for properly determining the relative strength or value of an electrically welded joint, according to J. G. Dudley, who is a member of the electric welding committee of the Emergency Fleet Corporation and of its research sub-committee, which is now affiliated with the National Research Council. According to the *Electrical World*, he says: "To those who have gone deeply epough into the question of electric welding such a testing machine would not seem to be vitally necessary, but in the shipbuilding industry all work of any sort must be so done as to pass the approval of the so-called classification societies. Chief among these is the British Lloyds, whose ultra-conservatism is blocking somewhat a wider use of electric welding. The principal reason probably is that its inspectors, in widely separated localities, naturally cannot be all-round technicians, and, lacking some simple means of satisfying themselves that an electrical weld is strong, they take the stand that it is wrong and disapprove it or condemn it. Some of the most eminent specialists and the best laboratories in the country have been attacking this problem for many months, but they have not yet solved it." It is suggested that those who have ideas on the subject communicate directly with Mr. Dudley, in care of Chester Shipbuilding Co., Finance Building, Philadelphia, Pa.

The Commercial Value of Exhaust Steam.—In *Power*, of October 22nd, an abstract is printed of Mr. F. C. Ruck's paper on this subject, which was read before the National Association of Stationary Engineers at Cincinnati on September 12th. The operating-cost data from a 250-H.P. isolated plant are given, showing the importance of utilising exhaust steam and the need of such economy. It is stated that a saving in fuel of 10 per cent. to-day is equal in money to that of 20 per cent. two years ago. There is hardly an establishment to-day where steam power is used, where some exhaust steam is not required for heating or drying or for heating water. In such concerns there is no excuse for using live steam at low pressure when exhaust steam is available.

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REVIEWS.

Telegraphy, Aeronautics and War. By Charles Bright, F.R.S.E., M.Inst.C.E., &c. Pp. 384, with Appendix and Map. 1918. London: Constable & Co., Ltd.

You might put it either way: "A Board of Imperial Communications" or "An Imperial Board of Communications." But whichever way you put it, or whatever you call it, the need for such a board is the main argument of Mr. Bright's latest book.

The book is not the happiest piece of book-making we have encountered, because it is made up of addresses on the same subject, or set of subjects, delivered at different places and times, so there is an amount of repetition which at times becomes irksome. Also, Mr. Bright carries the foot-note habit almost to the point of a vice; nearly every page has its string of foot-notes, with the result that the symmetry of the printed page is constantly marred, and the sequence of the argument frequently interrupted. The book is well printed and bound, and has a good index. This being said, and these small criticisms are made in the ordinary course of the reviewer's duty, purely from the literary point of view, let us go on to say that with Mr. Bright's main argument—the need for an Imperial Board of Communications—we are in hearty accord. In fact we would like Mr. Bright to produce a book—condensed to about a third of the present volume, with foot-notes rigidly barred, and such side issues as aeronautics and war treated as part of the general subject—exclusively devoted to developing the argument for an Imperial Board of Communications.

The I.B.C., to adopt the official slang of the day, would deal with the study and development of means of rapid communication throughout the Empire. The I.B.C. would be a sort of Imperial General Staff, devoted not to the study of war, but to the study of peace and the development of civilisation and commerce through the perfection and security of communications. It is a very fascinating subject. Undoubtedly highly organised and efficient means of communication are one of the greatest needs as well as one of the most striking attributes of civilisation. Even the most superficial traveller judges the stage of development a country has reached more or less by the efficiency of its communications. If the roads are bad, the railways slow and unpunctual, the post infrequent, telegrams long delayed and inaccurate, the telephone sparse and exasperating—then the state of civilisation is obviously indifferent. Big industrial communities like the United States and Great Britain need highly efficient communications, and, in the main, have them, though each country has a certain amount of leeway to make up in some directions—the United States in roads, and Great Britain in telegraph and telephone systems and in electric railways.

But if great countries need efficient communications, how much more does a great Empire need them, to bind together its many parts strung all round both hemispheres, and scattered from pole to pole? This is Mr. Bright's main theme—Imperial communications occupy three-quarters of the book, and in Imperial telegraphy, cable, and wireless, he is well versed, having had many opportunities of gaining first-hand knowledge, and having been an untiring student of the subject for many years.

The book will interest all those who are concerned in telegraph engineering and in the development of electrical communications, and it should interest also those who have at heart the sound development of the British Empire, which may be so much aided and vitalised by efficient communications. It should also interest statesmen and military men who appreciate the strategic importance of communications, a branch of the subject on which Mr. Bright wrote a good deal before the war. The high importance of communications has been exemplified to such an extent during these four hard years, that it seems almost inconceivable that when peace returns no concerted and persistent effort shall be made to put Imperial communications on sound lines of development, thought out in a truly Imperial way.

The telegraph part of Mr. Bright's book is interesting and contains many suggestions tending to improved methods and more broad-minded organisation. The aeronautical part, and the section devoted to a collection of addresses on the general subject of the war, are a little out of date. Mr. Bright served on the committee which inquired into the organisation of the Royal Flying Corps in 1916, and made many useful suggestions in a special report; in fact Mr. Bright seems to have been one of the hardest-working members of the committee. The development of the Flying Corps, now merged into the Royal Air Force, has been so prodigious during the past two years, and the art of flying has reached such heights and intricacies that this part of the book has now merely an historical interest.

As an engineer and traveller, a stout Englishman, and a student of politics, Mr. Bright had naturally much of interest to say to his fellow villagers when he addressed them on the subject of the war in general. This part of the book is outside the scope of a technical journal, but we cannot forbear from quoting one short passage, because it expresses the views of the great majority of practical men, as follows:—

"The experts have been to a great extent subservient to the will of the inexpert politician, which has, amongst other things, introduced serious delays at vital moments. To faulty organisation—or to lack of organisation—by the politicians must be laid the responsibility for a far greater loss of life and treasure than need have been or ought to have been."

Handbook of Mechanical and Electrical Cost Data. By H. P. Gillette and R. T. Dana. London: Hill Publishing Co., Ltd. Pp. xviii. + 1,734. Price $6.

This remarkable work, forming the latest of a long series of similar handbooks associated with the names of the authors, should fill an important place amongst the engineer's works of reference. The authors claim, we believe with justice, that it is the sole representative of its class in the particular field concerned; and for a first edition it covers an astonishingly wide range, containing a vast amount of detailed information. It is intended to be a companion volume to two others by the same authors acting separately, dealing respectively with costs of engineering works and costs of construction plant. The present volume commences with a valuable chapter on general economic principles, followed by one on depreciation, repairs, and renewals. The remainder of the book is devoted to the detailed costs of buildings, moving and installing machinery, coal handling, power generation by steam, gas, and hydroelectric plant, initial and operating costs of electrical installations, overhead and underground mains, lamps, motive power, pumping, cranes and conveyors, electric railways, &c. All these subjects are dealt with in great detail, the data being derived from actual practice; the particulars given are by no means confined to costs—on the contrary, a very large proportion of the matter consists of mechanical or electrical data which, indeed, are helpful in determining costs, but have only an indirect bearing on that factor. The book is freely illustrated, mainly with curve diagrams, but many of the figures serve to show the precise character of the buildings and installations of which particulars are given in the text; for instance, one vertical and five horizontal sections of a 220-ft. reinforced-concrete chimney are given, with details of the cornice and base, and similar details of a steel chimney 400 ft. high are provided, together with an account of the method of erection of a smaller one. No fewer than 20 curve diagrams are given for the cost of steam power under a variety of working conditions. In connection with electrical transmission an interesting point is brought out in the application of Kelvin's law, which neglects the fact that the sale price of energy may be many times the cost of generation; hence a greater outlay on copper than is indicated by that law is usually justified. The book is a mine of information as regards not only engineering practice, but also the principles involved, and to those engaged in the design, lay-out, and installation of plant, tramways, &c., it should prove of invaluable assistance.

ELECTRIC WELDING.*

By H. A. Hornor.

The Electric Welding Committee of the Emergency Fleet Corporation of the U.S. Shipping Board is composed of representatives covering broadly the whole field of welding activities in America, and, although electric welding has been the subject of all the investigations up to the present time, it is now proposed to include gas welding, with representatives from all the gas-welding associations and companies connected with this industry.

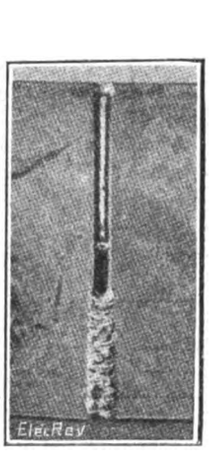

Fig. 1.

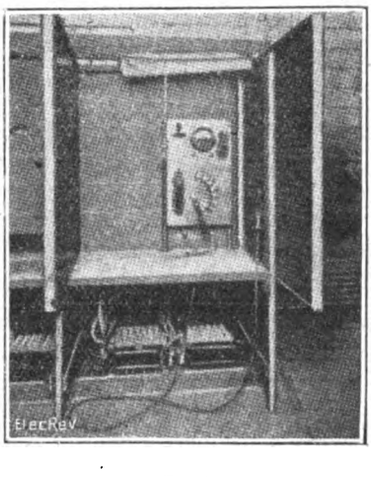

Fig. 2.

Fig. 1.—Partially Completed Arc-Welded Seam, showing Tack Welds.

Fig. 2.—Welding Booth.

A very comprehensive set of symbols has been approved by the Committee, and is in daily use.† The approved nomencla-

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†Elec. Rev., p. 352, October 11th 1918.

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ture introduces the subject to the designing and calculating engineer, and gives him the instrument by means of which he is able to place his thoughts rapidly and conveniently on drawings.

The manufacturers of apparatus joined the practical man in the study of the problems of electric welding. The manufacturer, in his eagerness to meet the problem, naturally encountered many difficulties. These difficulties increased until a point was reached where he demanded some standards upon which his apparatus could clearly be rated. Therefore the manufacturer was only too pleased to co-operate with the Welding Committee, and is to-day conscientiously aiding in straightening out the difficulties in which he was involved prior to last year.

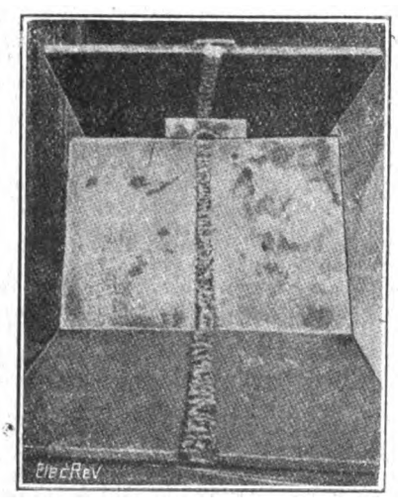

Fig. 3.

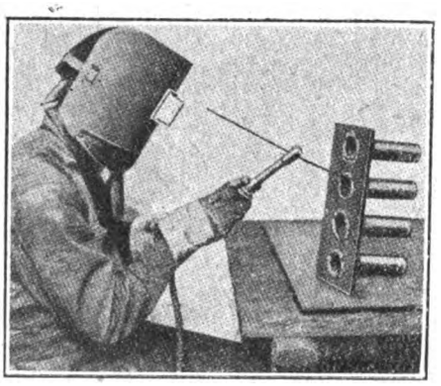

Fig. 4.

Fig. 3.—Arc Welding in Flat, Vertical, and Overhead Positions.
Fig. 4.—Arc Welding Boiler Flues.

Arc welding in America has largely been done in the railroad repair shops. It was discovered that the process was much cheaper, and could be performed more rapidly than by any of the gas welding methods. It also could be applied without preheating, and in many cases without the expense of dis-assembling complicated pieces of machinery. Spot welding, besides being used in many different industries, was sought for by the railroad man, and there has been built a gondola car, which has seen some seven or eight years' service. It is interesting to note here the difference in practice between Great Britain and the United States. The former, knowing little or nothing about spot welding, had the practice and application of arc welding very well under way; the latter exactly the reverse.

Apparently the attempts to train operators were rather crude, and it was early observed that the reliability of the electric weld depended substantially upon the skill of the welder. There existed in this respect a great deal of groping in the dark.

Investigations were immediately undertaken to answer the question whether spot welding could be successfully accomplished using 1-in. thick steel plates. Experimental results showed that no difficulty was encountered with ½-in. and ¾-in. plates. The same remark applies to 1-in. steel plates. In fact, the experimental machine was successful in welding three thicknesses of 1-in. plate, a condition which far exceeds the requirements of merchant ship construction. The practical application of a large 5-ft. gap spot welder will be made at a demonstration of a 40-ft. section of a standard 9,600-ton ship to be built at the plant of the Federal Shipbuilding Co., Kearney, N.J. This is the largest portable spot welder ever built. The consensus of opinion is that the large stationary spot welder of 5- or 6-ft. gap will undoubtedly increase the speed of fabricating sections of standard steel vessels.

The first stage of this investigational work is now almost completed. Sample welds of ½-in. ship-structural steel were taken by a special sub-committee to 14 different places where electric welding was being performed. This sub-committee saw the welding done, noted the conditions of current, voltage, electrodes, operators, &c., and then prepared the welded samples for tests. The samples were forwarded to the Bureau of Standards in Washington, so that the tests should be conducted by parties absolutely disinterested and without knowledge of how the samples were obtained. The results of these tests showed a remarkable similarity, especially when it is realised that they were made by several firms with different electrode materials, and under varying conditions of the electrical circuit. Practically all of the welds pulled at over 50,000 lb. per sq. in., and several at over 60,000 lb., the average being about 58,000 lb. On the bending test one of the samples was bent to an angle of 78 deg. before a crack started, and final failure occurred at 80 deg. In another case the sample was bent to 65 deg. before the crack started, and final failure did not occur until 86 deg. The point of importance here is that all the welds showed a reliability and satisfactoriness which makes conclusive the opinion that electric-arc welding is applicable for the joining of steel where the structure is submitted to live loads, bending strains, static pressure, or the like. The Sub-Committee on Research is pursuing this subject, and practical samples are being prepared for similar tests using ¾- and 1-in. stock material. It is also preparing various types of joints in heavy plating. A number of other large-size practical tests are being carried out at the present time.

There has been a large increase in output of apparatus, and it may be unhesitatingly stated that there are no difficulties in the way of obtaining all the electrical welding apparatus that is needed. Certain manufacturers who were decidedly of the opinion that direct-current was the only proper current to use for arc welding have within a very recent period changed their point of view, and are willing to admit that alternating current may have certain advantages.

The practice in America in manufacturing establishments of any size has been toward an increase in the supply voltage, so that very few large manufacturing plants use less than 220 volts direct current. With this voltage the only economical method of transformation is in the use of a motor-generator set. The efficiency in this case is in the neighbourhood of 50 to 60 per cent. It is possible to use a supply voltage of 110 volts with a variable resistance, which cuts down the voltage to the arc volts. This gives a very poor efficiency. In the case of alternating current the supply voltage can be reduced by a transformer, which will supply, as in the case of direct current, a sufficient voltage for striking the arc and a satisfactory reduction when the arc has been struck. On the other hand, if a low-voltage alternating current is provided a simple reactance may be introduced which has some of the same wasteful characteristics of the resistance used with the direct current. The average apparatus will permit of electric-arc welding consuming about 6 to 8 kw. per welder, but if low voltage is provided there are certain outfits which will reduce the consumption as low as 3.5 kw. per welder, or even less.

Fig. 5.

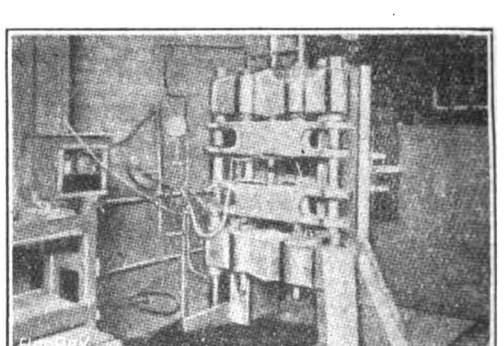

Fig. 6.

Fig. 5.—Section of a Smoke Stack. Seams Arc-Welded. Metal, ½-in. Boiler Plate.
Fig. 6.—Experimental Heavy-Steel Welding Machine. Current, 100,000 amps.; Pressure, 36 tons.

Without entering into an elaborate analysis of the relative costs of electric welding, it may be broadly stated that there is hardly any question that the electric process is cheaper than any other. The same may be said as regards speed, and also reduction of man-power. In a recent discussion on this subject President Adams stated that at one of the Eastern shipyards the total number of parts on the welding programme of the standard, riveted ships now building at that yard amounted to 225,000. The labour cost for riveting those pieces was about 245,000 dollars, and for welding about 99,000 dollars, making a saving of 146,000 dollars. But this is only a drop in the bucket when compared to what might be profitably done in this line. He stated, further, that in certain particular instances the saving was as great as 90 per cent.

One of the interesting questions discussed with some fervour by the members of the Welding Committee is the advan-

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tages of the bare and covered electrode. Regarding this discussion no definite facts can be stated. In England the practice has been to use the covered electrode; the practice in the United States up to the present time has been largely bare wire. Recently, American investigators have discovered that there are advantages in the covered electrode, and many experiments are now being made, some with results. It is important to observe that in the above-mentioned tests of welds, the best one of these samples was made with a coated (not an asbestos covered) electrode using alternating current. The point in this case seems to rest upon the question of the ductility of the weld, and it would seem that the bare electrode does not make as ductile a weld, or at least one as easily bent, as the coated or covered electrode. The question of the ductility of the weld is one of much importance in the application of welding to ship construction, and will doubtless be of importance in other allied industries.

No matter what the type of electrode, its composition, the kind of shank material to be welded, or the kind of apparatus employed, the reliability of the weld rests mainly upon the man who makes it. The work of training electric welding operators early became a part of the functions of the education and training section of the Emergency Fleet Corporation; the men connected with this work are members of the Welding Committee. The objects held in view by the training department are first to give the man intensive practice work so that he becomes a good craftsman. The methods are simple to start with, as the exercise of the right arm muscles must become flexible enough to permit the operator to give the required movement to the electrode. By a graduated series of exercises this is accomplished in about eight weeks. The man is allowed to do production jobs in the shop, which gives him confidence through responsibility. It becomes desirable at this time to give the man some outside work on ships, and where this is practicable it is done. The man is then turned over to an instructor, who gives him an intensive course in pedagogics lasting from five to six weeks. At first sight it would not seem necessary to so instruct a man, but it is not generally understood that teaching after all is itself a trade. The experience with the men in this respect is most interesting. In nearly every case the man has resented this course at the start, but at the end has turned completely around, and in many cases has desired an even more extensive training. What is really accomplished is to give the man the necessary confidence to impart the knowledge that he has gained to another green man. The men under training are taken from the various industries, especially the shipbuilding industry, and are certificated when they have shown themselves to be entirely proficient. The operator must be a conscientious workman or the weld will not be of perfect quality. This brings forward another problem, namely, a practical and scientific method of testing a welded joint after it has been made. There have been a number of suggestions made for the solution of this problem. But at the present time none of these suggested methods have been productive of conclusive results, and recourse must be had to the purely mechanical methods of striking heavy blows on, or adjacent to, the weld, or using a chipping hammer and making intermittent examinations. It would seem by far the best procedure to make the inspector proficient in the art, so that he may closely observe the welders while at work.

The Committee early discovered that the literature of electric welding was very much clouded by mis-statement of fact or half-baked theory, and much of the time of the Committee has been taken up in disproving such statements. In order to spread the results of this work over all quarters a handbook is now being prepared which will contain only definite facts and results of investigations as approved by the whole Committee. This handbook will be made available to all those who desire to acquaint themselves with the proper means of accomplishing good and reliable electric welding.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

MR. A. P. M. FLEMING, Chairman of the NORTH-WESTERN CENTRE OF THE INSTITUTION OF ELECTRICAL ENGINEERS, delivered his inaugural address on Tuesday, November 12th, at the Engineers' Club, Manchester. Choosing for his subject "The human factor in industry," he remarked that the vital interests of all people were bound up with industry, and the future of the electrical industry would be one of accelerated progress of admittedly national importance.

Post-war industrial policy must be characterised by that boldness, freedom, and breadth of outlook to which war had accustomed us, and many war-time expedients would require to be continued in the even more exacting times of peace.

Many problems in industry were now receiving attention, and those of fundamental importance must be solved, if industry was to be built up on a lasting basis, in the light of fundamental principles. The most important problem in industry concerned the human element in it, and since all changes in industrial life were followed by a mental reaction in the mind of the worker, it was essential that possible changes should be arranged so that this reaction would be as favourable as possible.

Fatigue was one of the greatest difficulties with which the industrial worker had to contend, and to minimise excessive fatigue rest periods were required during the day, and all overtime and Sunday labour should be made unnecessary. Elimination of fatigue would result in decreased accidents. Much fatigue sustained in industry was unnecessary, and could be removed by carefully studying each job, simplifying some movements and cutting out others. Much strain could be avoided by good working conditions, heating, lighting, ventilation, and sanitation, by providing medical attention, canteens, &c. The development of works committees would preclude any criticism of welfare work. Extravagance in welfare work and violation of the privacy of home life should be avoided.

Much could be done to make the worker contented by carefully selecting him for the work he was to do, so as to get the "round peg in the round hole." Education should be such as to allow young people to realise the direction in which their special abilities lay, and, when the individual had taken up the work for which he was inherently fitted, he should have every opportunity of rising to the highest position which inherent capacity justified.

For special war services, psychological methods of selecting men had been employed. In the American Army, recruits had been classified after examination as inferior, normal, and superior mental types. The first and last were further specially examined with a view either to rejection or to employment in special capacities. In this country and in France interesting methods of selecting aviators had been devised, in addition to men for gunnery, signalling, &c.

In all grades of industrial employment selection should be followed by appropriate training. In the case of apprentices this might be done in a works school and in the shops. Teaching of economic principles, in addition to ordinary subjects, was advocated as enabling workers to understand the facts about the industrial system. Special attention was required in the training of managers, and at the University of Manchester a new Directorship of Industrial Administration had been established by a few leading business firms and the university to provide university courses in management.

The most important requirement in industrial life was co-operation between management and workers, and in order to secure this it was necessary to secure the confidence and trust of the human element. History showed that, whenever the human factor had been ignored or opposed, strife and dissatisfaction had resulted, and all difficulties in industry could be removed without sacrificing any valuable features of the existing system. The provisions of the Whitley Report provided a means whereby the legitimate desire of the worker to know more about the inner working of his industry might be gratified.

The lines of advance in the future would include the maintenance of high standards of health and home life for all workers and of good housing, so that character could be developed in children. The need for co-operation could be instilled in the schools, and proper training would be given to all grades of workers. There would be a free upward channel of promotion for all workers with the necessary ability. Managers would take the human element into account and have experts who would study it to guide them.

In conclusion, industry required a new spirit, a spirit of patriotism, and a realisation that it was, as the war had shown, a high form of national service. The material and ethical aspects of industry were interdependent, and the material aspect was not an end in itself, but only a means to an end which concerned the higher purposes of human life. The new industrial ideal would include loyalty and citizenship, it would promote a love of art and science and culture. The future of social reconstruction lay in industry rather than politics.

All members of the community were dependent on industrial processes, and all were therefore concerned in and responsible for industrial progress. It would be impossible to reconstruct in future without making use of the experience and knowledge and changed attitude of mind which the war had brought. We had all suffered the same menace, had shared common hopes and fears, been stirred by common sentiments, and the time had never been as appropriate for embarking on a new enterprise demanding united purpose and mutual co-operation. The principles outlined in his paper suggested that in the industrial sphere, that which was ethically right was economically desirable, and if they could seize the opportunity now presented to apply the principles, a measure of life and well being would be assured to the community which it had never previously known.

Ald. WALKER, moving a vote of thanks to the Chairman, said that last session Mr. Fleming outlined a method of education for the engineer. That evening they had heard how the material produced under such a system of education could be best utilised within the works. It was clear, however, that those who went through that course of education would not be content simply to obey orders or instructions without asking the why and the wherefore. It was imperative that employés should be given that amount of knowledge which would make their operations interesting to them. He could conceive nothing more monotonous and more destructive of the human faculty than to be looked upon in the works as merely a part of the machine. There was no doubt that unless there was development along the lines indicated by Mr. Fleming there would be industrial

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unrest in this country, and it behoved those who were anxious for the national prosperity to give heed to the warning conveyed in the Chairman's address. He favoured the formation of works' committees on the ground that they enabled the workman to form some idea of the difficulties which his superiors had to face. In the past the workers had only had opportunities of discussing among themselves their supposed and real grievances, and had never been able to understand their true bearing relative to the organisation itself. By means of these committees, however, they would be brought face to face with those difficulties and problems, which they would find not so easy of solution as they thought.

Prof. MARCHANT, seconding, remarked that the importance to be attached to the human element in industry could not be over-estimated. In the past great attention had been paid to the efficiency of machinery, and far too little to the subtle mechanism which controlled it. In our technical education too much stress had been laid on the technical side of the training to the neglect of the human element, which, to his mind, had been the salvation of this country. He agreed with the views expressed by Mr. Fleming.

Mr. J. F. NIELSON opened the session of the SCOTTISH CENTRE of the I.E.E. at Glasgow on November 12th with his inaugural address as chairman to a large attendance, and gave a general survey of the Institution's activities during the last session, the growth in the application of electric power in shipyards during the last 30 years, and recent applications of electrical science to the equipment, navigation, and propulsion of ships.

On the first point Mr. Nielson said it was unfortunate, but nevertheless true, that this war had undoubtedly helped to bring home to the non-engineering populace the widespread power of the engineer. It had done more than years of peace could have done towards improving the engineer's status. But there remained much still to be done by propaganda and education on right scientific lines to raise the average intellectual level of the people of this country above its present low state. Engineers were partly to blame for that state of affairs; they had been guilty of hiding their light under a bushel, and the country was unfortunately reaping the consequences thereof to-day in the lamentable spectacle of the waste in men, money, and material through disregard, by those responsible for the conduct of the war, of the technical qualifications of much of the trained intellect of this country.

After a reference to the influence of the Institution on Government opinion in relation to questions of national importance, Mr. Nielson proceeded to a consideration of the growth in the application of electric power to shipyards during the last 30 years. He pointed out that 30 years ago electricity was generated almost, if not entirely, for lighting of workshops, wharves, and ships under construction, and even then only on a small scale. To-day the position was entirely different. The demand for power was in the neighbourhood of 90 per cent. of the total consumption of electrical energy for all purposes in shipyards, and tended to increase, while the lighting load continued relatively to diminish with the introduction of improved and more efficient sources of light. In the case of a certain shipyard, 25 years ago the total number of motors installed was fifteen, with an aggregate horse-power amounting to 40. To-day there were over 600 motors, aggregating not far short of 15,000 B.H.P. The largest motor which that particular shipyard then possessed was one of 8 B.H.P.; to-day motors of 600 B.H.P. would soon be in operation. Last year over 13 million units of electricity were consumed for all purposes. The steam engine had almost entirely disappeared. It was perhaps in the matter of lifting machinery that the greatest improvements, both in increased facilities for operation and in the speeding up of the transport of material, had taken place during the period under review.

A striking feature was the increasingly large proportion of the total demand for electric power taken by air compressors. The uses to which compressed air was being put at the present time in our shipyards, and the rate at which the demand was increasing, must, if he was not much mistaken, be giving municipal and other authorities cause for serious consideration. It had come to his knowledge that during the last few months, orders had been placed in this country for not less than 95,000 H.P. in motors for driving air compressors alone. He would like to think that the efforts which those in authority were exerting to foster the use of compressed air were in every case justified. Whether they were, or not, the power producers would at least benefit thereby, for there could hardly be any form of mechanical power so open to abuse and so liable to be wasted as compressed air, at least in a shipyard. Compressed air was so convenient that unless a very careful supervision was kept over its distribution and utilisation, losses by leakages and abuses might easily become a very heavy item in the power bill under that particular heading. At least that had been his experience, and he supposed most shipbuilders would agree with him.

The application of electric welding to ship construction and repair was being widely discussed in shipbuilding circles at the present time. Of course, as had been, and always would continue to be, the case, enthusiasts would be found whose zeal overran their knowledge, prophesying the almost immediate advent of the shipbuilder's millennium—the dawn of the day of rivetless ships. Progress in the application of electric welding to the jointing of steel structural work had undoubtedly been rapid since the outbreak of the war, but while there were now in service some small barges in which riveted joints were entirely or almost entirely absent, yet it seemed very improbable that the present methods of riveting and caulking would be immediately superseded by any other method. Enthusiastic advocates of electric welding ought to be content with the progress that was being made in applying it at present as an adjunct to the work of the riveter, allowing such a period of time to elapse as might be sufficient to demonstrate whether the electric weld was capable of withstanding, equally with the riveted joint, all the stresses to which those portions of a ship's structure, upon which its safety and the lives of its crew depended, were subjected. At the present moment, expert opinion, strengthened by such practical experience as it had been possible to obtain, was apparently against putting the new on an equal footing with the old method. The operators engaged on that work must be specially trained men, experienced and efficient in the use of the system employed, and they must have efficient supervisors of proved ability set over them. All means of welding were alike in the respect that the quality of the work done was not apparent to the eye, and time alone would tell whether the job was well and efficiently done. An imperfectly executed joint in the structure of a ship's hull might spell disaster to the life of the passengers and crew.

Electric-arc welding as an adjunct to the riveting of water and oil-tight work appeared to have great possibilities, and great economies could be effected in the amount of riveting required for that class of work, if electric welding was used to close the seams and otherwise displace hand or machine caulking. From the point of view of the practical shipbuilder, welding by the electric-arc process on board ships under construction presented a problem which did not appear to have been sufficiently realised by those who advocated its universal application. He referred to the difficulty of screening off from accidental view the hundreds of other tradesmen engaged on other work on board ship. In a confined and crowded space, the risk run of eye injury by such men would be practically unavoidable. Electrical engineers were naturally more interested in the supply of power and the necessary transforming plant required for that work than in the actual details of welding. In that connection there was room for careful and independent investigation to determine the most suitable system and pressure of supply for electric welding. Considerable diversity of opinion existed at present on that subject, more particularly with regard to the pressure necessary to maintain the arc and to overcome the resistance of the insulating flux covering the electrodes. When one manufacturer contended that while 30 to 40 volts were taken up in the arc, 90 to 110 volts must be supplied to enable that arc to be properly maintained, another manufacturer was equally emphatic that that extra pressure represented so much needlessly wasted energy. There was considerable scope for independent research, which might very well be undertaken by the Research Committee of the Institution.

Dealing with electric propulsion of ships, Mr. Nielson said that while electric propulsion had its beginning in this country, we had allowed its development to be carried on by others. In particular, America had tackled that problem in no half-hearted fashion, and already there were thousands of electrical horse-power in turbo-generators, either installed or being built for installation on board ships of the U.S. Navy. He had been unable to ascertain what was the actual number of electrically-propelled ships, built or about to be built, on the other side of the Atlantic. There were at least two merchant steamers of 12,500 tons displacement now under construction in the United States, each of which was to be electrically propelled by two motors of 1,500 H.P. That was, of course, quite a small proposition in comparison with what the American naval authorities had in hand, and it was very significant of the confidence which our American friends, rightly or wrongly, placed in that means of marine propulsion, that one electrical manufacturing firm alone had on order complete equipments for turbo-electric propulsion for no less than seven battleships and four battle-cruisers of an aggregate shaft horse-power not far short of one million. The battleships were of 37,000 S.H.P., 32,000 tons displacement, and 22½ knots speed; while the battle-cruisers were of 180,000 S.H.P., 40,000 tons displacement, and 34 knots speed on trial. Both the battleships and the battle-cruisers were designed to have four propelling motors, each motor being in a separate compartment, but while the power units in the former were two in number, four turbo-alternators were to be provided in the latter.

In the event of electric propulsion making headway, three-phase alternating current was certain to follow as a general system of distribution for auxiliary power and lighting, and where large motors were required to operate such auxiliary machinery as capstans, winches, steering gears, and similar reversible machinery, the electro-hydraulic system of power transmission in combination with squirrel-cage induction motors would form an ideal arrangement. For forced draught boiler-room fans, where a direct-coupled, adjustable-speed motor was required, direct-current motors would probably still be found the most suitable type. The future held out great possibilities for an ever increasing usefulness for electric power on board ships.

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SCIENCE AND THE FUTURE.

At the opening meeting of the session of the Royal Society of Arts the Chairman of the Council, Mr. A. A. Campbell Swinton, F.R.S., delivered an interesting address, from which we make the following extracts.

In the future, if the industries of this country are to flourish in the face of the world's competition, it is above all things necessary that science should play a greater part in them that it has done in the past. In arriving at the conditions that are desirable, manufacturers will require all the help they can get, and especially they should be able to look for assistance from the Government of the country. Much in this direction is already under way. Whatever sums, however large, the Government can be induced to spend in promoting the applications of science to industry, provided the expenditure is wisely directed, will quickly repay themselves many times over by the increase of prosperity that they are certain to bring about. At the same time, let us beware of Government control, which in the long run is almost sure to result in political interference, and consequent disaster. All experience goes to prove this, and not least the experience that has been gained during the past four years of war. Signs are now not wanting that at length the claims of science in education are beginning to be recognised.

There is one method of acquiring a scientific education to which, in my opinion, not nearly enough attention is paid. I refer to the private reading of technical books and of periodic scientific literature. In the past many of our leading scientific men have owed their education almost entirely to this method. It is not within the power of many young men to buy books to any great extent, and scientific literature is not only expensive but is notoriously ephemeral, becoming rapidly obsolete and comparatively valueless. Most of the large scientific libraries such as are possessed by the various engineering institutions and other scientific societies are only accessible to their members, and even then only during hours which to a large extent preclude their use by those who have to earn their livelihood. Whenever possible these libraries should be kept open on Saturday afternoons and in the evenings. Members of some of our leading engineering institutions complain that their libraries are useless to them, as they are only open at hours when they are perforce otherwise engaged. I am sure that some improvement is possible in this respect; but what I am anxious particularly to put forward is the desirability of the establishment of lending libraries from which all the latest scientific works could be obtained under suitable arrangements. The Institution of Electrical Engineers has of recent years instituted such a lending scientific library, but only to its own members and on a comparatively small scale; but, of course, to be of any wide use such an arrangement must be on a large scale and throughout the country. It is suggested that something more in this direction might be done by the Patent Office, which has large funds available entirely derived from the fees paid to it by inventors. It is impossible also to exaggerate the utility of public or semi-public lectures on scientific and technical subjects in spreading knowledge in these subjects and stimulating curiosity, thought, and invention. It is by such popular lectures that general interest in science can be roused, rather than by more strictly scientific dissertations.

There have been those who have thought that scientific discovery would before long come to a stop owing to the dearth of subject-matter and to the limitations of the human intellect. Nothing could be more erroneous than this idea, for the reason that every new discovery and invention opens up the path for others, and thus the scientific horizon surely widens year by year. So far from discovery and invention being likely to come to a stop, both are sure to extend at a rapidly increasing rate, particularly if we have more science taught to young people and greater encouragement given to scientific workers, with consequent additions to their numbers. In the comparatively new fields of radio-activity, electromagnetic radiation, synthetic chemistry, chemical catalysis, electrical osmosis, photo-electricity, and corpuscular matter, to mention at random only a few, the prospect seems practically illimitable. Moreover, new materials with new properties afford fresh means for pursuing research. We have also new mechanical appliances of all sorts, and new methods which enable us to obtain on the one hand, in the electric furnace, temperatures approaching in heat to that of the sun, and on the other hand, in special refrigerators to cold quite near to that of space and of the absolute zero—temperatures both high and low, quite beyond reach only a few years ago. Again, we have learnt how to apply prodigious mechanical pressures and how to obtain gaseous vacua on unprecedented scales. We can produce and employ electric currents and pressures, and both electric and magnetic fields, of intensities previously unknown, and measurements of all kinds can be made with a delicacy and an accuracy almost beyond belief. If we turn from pure science and its possibilities to inventions and the science that is applied to utilitarian uses, here again the effects are cumulative, both discovery and invention assisting to bring still further invention within our reach.

During the past five years the improvements made in wireless telegraphy and telephony have been very important, but as yet it is not admissible to discuss them. One matter, however, within public knowledge is the increasing amount of news that we get in the papers that appears under the heading of "Per Wireless Press." Wireless telegraphy appears to be developing at last in what has always appeared to me to be its proper field, which is not so much to communicate between one individual and another, but rather for the communication of intelligence broadcast over the earth. Printing telegraph instruments operated by wire, that record sporting, parliamentary and general news, have long been familiar objects in clubs and hotels; there is no reason at all why similar printing instruments should not be operated by wireless means, not only in large cities, but throughout the country. Special transmitting stations using different wave-lengths could send out the messages, while separate printing machines, tuned each to respond to the wave-length of a particular transmitter, at each required point, would receive and record them.

For the distribution of news to the Press nothing could be better or more economical, while there is no reason why clubs, hotels and private houses everywhere should not also be thus supplied with the latest intelligence. In wireless telegraphy it costs no more to send signals to a thousand receiving stations than to a single one, and there is practically no limit to the number of the stations that can simultaneously receive signals from a single transmitting station. At any rate as concerns an area no larger than Western Europe and the British Islands, it is well within the range of practicability at the present time.

Great things are at present being foretold as to the marvels that we are to see in the way of the electric distribution of energy throughout the whole country from a small number of giant generating stations. Great improvement over our present parochial methods is no doubt possible, but let us not be too sanguine. Some of the most experienced authorities are of the opinion that the limits of economical generation and distribution are already being reached in the case of some of our larger systems, and that when we get above tens of thousands of horse-power, the step to hundreds of thousands does not effect more than a small percentage of saving, either in first cost, or in cost of working.

No one knows what improvement is yet to be obtained in the conductivity of metals by further purification, and especially by freeing them entirely from occluded gases. Electrolytic copper, which is specially pure, has already a conductivity measurably in excess of what was obtainable by the older methods of refining, while it has been found that in the case of palladium the extraction of the occluded hydrogen materially improves the conductivity. Possibly similar treatment might lead to important results with other metals. The subject is still largely unexplored, but if any practical method could be devised for diminishing the resistance of conductors, it would be a most important matter, as the enormous amount of copper at present required for any very large and widespread scheme of electrical distribution presents a very real difficulty.

It would be rash to deny too absolutely the possibility of the wireless transmission of electrical energy in bulk. The fact that enormous quantities of energy come to us in this way from the sun, with a transmission density that near the sun's surface is immense, shows what the ether is capable of doing. Perhaps it may be found that though electromagnetic waves cannot be driven to go exactly and only where it is wished, they can possibly be led there. It is a problem at present beyond our ken, but so many marvels come to pass that one can never be sure of what may be brought about, provided always that no natural law stands in the way.

By far the most important requirement of mankind is energy in its various forms. Nearly all our energy comes to us directly from the sun, only a very small proportion of the whole is intercepted by the earth, but even so, the supply that the earth receives amounts to some 200 billion horse-power, or on the average to some 4,000,000 H.P. per square mile of that portion of the earth's surface that is exposed not too obliquely to the sun's rays. Sooner or later our coal will all be used up, and mankind will have to depend, no longer upon the stored energy of bygone aeons, but on the sun's actual daily supply. Unfortunately nothing better than the heat engine has hitherto been discovered to turn our coal and oil into mechanical work. Methods on the principle of Groves's gas battery, which gives electric energy directly from the oxidation of hydrogen, and others in which solid carbon is used as the oxidised element in a primary electric battery, were at one time considered hopeful, but have accomplished nothing. The thermopile has proved up to now a most ineffective appliance; has anyone, however, of late years investigated the thermo-electric properties of all the new metals that the electric furnace, and other novel metallurgical processes, have recently provided, and of the alloys that these will make, and does anyone know how thermo-junctions, made of these or of the older materials, whose properties we are acquainted with at ordinary temperatures, would behave at temperatures so low that all electrical resistance virtually disappears? Here are problems for the physicist and chemist which have great possibilities. Water power is insufficient to take the place of coal, while the power of the tides, which is enormous, would appear impossible to turn to practical use, except at a cost which is altogether prohibitive. The quantity of oil that appears to be obtainable is only a very small amount compared with coal.

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When therefore the coal is exhausted it would seem that in the main recourse will have to be had to the enormous flood of solar radiant energy that is continually falling on the earth, and the problem is how this can best be utilised. The most obvious method is, of course, to grow plants, stimulating them in every way that science can devise; most likely it will be best to cultivate plants that store the solar energy in the form of starch and sugar which can be converted into alcohol.

As, however, vegetation is an exceedingly inefficient accumulator for the storage of solar energy, and as there is the further inefficiency of the heat engine to be taken into account before mechanical power can be realised, there arises the question whether science cannot devise some more efficient and different method of converting solar radiation into work. Solar engines have never so far proved commercially practicable, even where coal is exceedingly dear. Happily solar heat engines do not exhaust the possibilities of the case. The direct transformation of radiant energy into chemical, or even into electrical energy, is by no means impossible; Becquerel showed some 50 years ago how radiant energy could be transformed into electrical energy. There do not appear to be any theoretical objections to success, nor to much higher efficiencies being obtained in this way than by organic means. No doubt the laws of thermodynamics apply to all photo-chemical actions, but as the temperature of solar radiation is so very great this is of no large importance. Here then in photo-chemistry, perhaps in photo-electric chemistry, we have probably the most important problem that the science of the future has got to solve.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

18,889. "Electric heating elements for kindling." R. K. HEARN. November 18th.

18,891. "Electrical heating and cooking apparatus." C. G. NOBBS & W. W. NOBBS. November 18th.

18,892. "Dynamo-electric machines." N. C. F. JENSEN & M. J. E. TILNEY. November 18th.

18,895. "Direct-driven electric lighting apparatus for cycles, &c." C. F. DUFAUX. November 18th. (France, November 16th, 1917.)

18,905. "Sparking plugs." D. ANDERSON & D. DAPONTE. November 18th.

18,908. "Electro-thermal arsenic refining and manufacturing furnace." H. J. WILSON. November 18th.

18,915. "Wireless signalling apparatus." A. A. HALL. November 18th.

18,916. "Electrically-heated strips or pads." W. H. F. MURDOCH. November 19th.

18,928. "Electric switches." C. C. GARRARD, A. H. RAILING & A. F. SEARLE. November 19th.

18,934. "Magnetically-operated motor-controlling, &c., switches." J. H. COWELL & H. COX. November 19th.

18,951. "Electric switches or circuit interrupters." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO., W. A. COATES & W. B. DALE. November 19th.

18,955. "Automatic telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO. (Automatic Electric Co., U.S.A.) November 19th.

18,957. "Electric dynamos." D. SUCHOSTAWER. November 19th.

18,958. "Method of producing electricity and mechanical power by permanent magneto." D. SUCHOSTAWER. November 19th.

18,979. "Electrical heating elements." A. W. KIMBER. November 19th.

18,988. "Dynamo-electric machines." H. W. DENTON-INGHAM (A. Rolfe). November 19th.

19,000. "Dynamo." J. W. ASHTON & J. H. ASTON. November 19th.

19,005. "Shuttles for weaving in electrically-stopped looms." H. JOWETT. November 20th.

19,015. "Device for electric illumination for theatrical and stage effects." T. H. ROCHFORD. November 20th.

19,021. "Sparking plugs." H. R. WILKS. November 20th.

19,031. "Electrical transformers." J. W. HOWARD, L. D. MORPHEW AND SIEMENS BROS. DYNAMO WORKS, LTD. November 20th.

19,037. "Driving magnetos for internal-combustion engines." J. DAY. November 20th.

19,040. "Electric light fittings." J. A. L. GIMBLETTE. November 20th.

19,058. "Switch-type incandescent lampholders." N. COLLINS. November 20th.

19,069. "Flashlamps." M. F. WILLIAMS. November 20th.

19,099. "Mounting electrical apparatus in frames or cases." H. B. PRENTICE. November 21st.

19,122. "Magnetos for internal-combustion engines." D. C. DINGLEY AND G. MAJOR. November 21st.

19,136. "Device for fixing and holding shades for incandescent and electric lamps." A. E. FIDDES-STOKES. November 21st.

19,145. "Names indexes for attachment to telephone instruments." J. L. SCOTT. November 21st.

19,146. "Alternating-current metallic air-cutting and welding apparatus." C. J. HOLSGAG. November 21st. (U.S.A., September 21st.)

19,147. "Electric arc welding and repairing." C. J. HOLSGAG. November 21st. (U.S.A., June 11th.)

19,150. "Electric relays." A. M. LOW. November 21st.

19,152. "Signalling apparatus." A. M. LOW. November 21st.

19,179. "Obtaining single-phase alternating currents of various periodicities from existing three-phase systems of any periodicity." A. M. TAYLOR. November 21st.

19,180. "Electrical rocket connections." H. J. POOLE. November 21st.

19,193. "Method for recording visually signals received in wireless telegraphy." A. J. GILL. November 22nd.

19,194. "Relay contacts." N. P. HINTON. November 22nd.

19,195. "System of wireless direction finding." N. P. HINTON. November 22nd.

19,205. "Holder for use in electric arc welding." G. DEARLE. November 22nd.

19,234. "Intercommunication telephone systems." J. W. DUNGEY & T. W. WINGFIELD. November 22nd.

19,247. "Electrically-propelled vehicles." F. V. BORNAND & J. P. KEMP. November 22nd.

19,256. "Armature winding machine." L. E. WOOD. November 22nd.

19,305. "Magnetos of internal-combustion engines, and driving provision therefor." R. S. WHALEY. November 23rd.

19,311. "Electrical switches, starters, and controllers." R. H. HARBOUR AND H. R. C. PARTRIDGE. November 23rd.

19,317. "Electric time switch." LANDIS & GYR AKT. GES. November 23rd. (Switzerland, December 18th, 1917.)

19,323. "Combined electric light fittings and ceiling fan." M. J. RAILING & H. W. ROBERTS. November 23rd.

19,326. "Utilisation of wind power for generation of electricity." H. J. READ. November 23rd.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

10,962. ELECTRICAL SWITCHES. E. L. Rankin. July 30th, 1917. (Cognate application 17,311/17.) (120,222.)

11,038. CIRCUIT-EARTHING DEVICES. C. Longhi. July 31st, 1917. (120,224.)

13,070. MAGNETO-ELECTRIC IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. M.L. Magneto Syndicate & C. E. Hulse. March 12th, 1918. (120,229.)

15,612. COOLING ARRANGEMENTS FOR DYNAMO-ELECTRIC MACHINES. P. A. H. Mossey, H. C. E. Jacoby & Enclosed Motor Co. October 26th, 1917. (120,241.)

15,736. HIGH-TENSION DISTRIBUTORS FOR THE IGNITION IN MULTI-CYLINDER INTERNAL-COMBUSTION ENGINES. Akt. Ges. Brown, Boveri et Cie. November 6th, 1916. (111,659.)

15,970. ELECTRIC PLUG FOR STEAMSHIP, FACTORY, AND GENERAL USE. E. H. Kelley. November 2nd, 1917. (120,258.)

16,024. TELEPHONE TRANSMITTERS. S. G. Brown. November 2nd, 1917. (120,260.)

16,053. ELECTRICAL RESISTANCE ELEMENTS. C. G. Nobbs & Falkirk Iron Co. November 3rd, 1917. (120,263.)

18,597. X-RAY TUBES. British Thomson-Houston Co. (General Electric Co., U.S.A.) December 14th, 1917. (120,295.)

1918.

1,897. ENGINE-STARTING DEVICES. A. E. White (Daton Engineering Laboratories Co., U.S.A.). February 1st, 1918. (120,312.)

2,573. CONSTRUCTION OF VENTILATING FANS FOR ELECTRIC MOTORS. W. F. Higgs. February 13th, 1918. (120,320.)

4,091. ELECTROMAGNETIC BRAKES USED ON WINDING GEARS FOR HAULAGE, LIFTS, AND THE LIKE. Waygood-Otis, Ltd. (Otis Elevator Co., U.S.A.) March 8th, 1918. (120,330.)

6,068. INSULATORS FOR SUPPORTING ELECTRIC CABLES. H. Wade (Soc. Metallurgica Italiana). April 9th, 1918. (120,336.)

7,550. APPARATUS FOR CORRECTING ELECTRIC IMPULSES, PARTICULARLY APPLICABLE TO AUTOMATIC TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. & F. C. Tomlins (Automatic Electric Co. in part). May 6th, 1918. (120,175.)

7,629. FLEXIBLE CONDUCTORS. Western Electric Co. (Western Electric Co., U.S.A.) May 7th, 1918. (119,832.)

8,901. MAGNETOS. Etablissements de Dion-Bouton Soc. Anon. May 31st, 1917. (116,290.)

9,056. SUPPORTING MEANS FOR ELECTRICAL CONDUCTORS. L. Joubert. June 4th, 1917. (116,889.)

9,836. UTILIZATION OF HIGH-FREQUENCY OSCILLATIONS IN WIRELESS INSTALLATIONS. D. W. Brown. July 27th, 1917. (Divided application on 10,830/17.) (120,356.)

9,905. IGNITION DEVICES FOR WATER-COOLED EXPLOSION MOTORS. Motosacoche Soc. Anon. & A. Isliker. June 15th, 1918. (119,637.)

10,108. AUTOMATIC TELEPHONE EXCHANGE SYSTEMS. Western Electric Co. (Western Electric Co., U.S.A.) June 19th, 1918. (119,839.)

10,806. FLYWHEEL MAGNETO DEVICES FOR INTERNAL-COMBUSTION ENGINES. Villiers Engineering Co., G. Funck & F. H. Farrer. July 2nd, 1918. (119,842.)

11,779. TROLLEY HEAD FOR ELECTRIC TRACTION. W. Pickersgill, J. H. Pitt and F. Haigh. July 18th, 1918. (120,187.)

13,717. ELECTRIC ADAPTERS AND THE LIKE. N. McLean. October 17th, 1917. (Addition to 112,240. Divided application on 15,040/17.) (120,023.)

Standardisation of Railway Plant.—A report upon the standardisation of railway equipment has been made to the Ministry of Reconstruction by the Advisory Council of the Ministry. The evidence taken showed that competition between the big railways had tended to progress on the whole, but had resulted in a quite unnecessary multiplication of types. On British railways there are two hundred different types of axle boxes; every railway company has adopted different types of tires, springs and axles; there are over 40 variations of the ordinary wagon hand-brake. In no other country has individuality been allowed so much free scope, with the result that British railways are severely handicapped and the working of them not so economical as it might be.

The Advisory Council recommends that the standardisation of wheels, axles, &c., be dealt with immediately by the Engineering Standards Committee, and that when such essential parts have been standardised, the adoption of the standards should be gradually enforced; that a committee be formed to investigate the existing conditions of structural gauges and clearances of the British railways and the loading and unloading arrangements at works and ports, in order to ascertain how far uniformity could be introduced and tares reduced, and at what cost; and that the consulting engineers and representatives of railways financed by British capital in foreign parts and in the Dominions be brought together to confer with the locomotive and wagon manufacturers in this country to determine what standardisation can be effected, and that, with a view to the possibility of effecting partial international standardisation, the separate committees should take cognisance of each other's investigations.—*Board of Trade Journal.*

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ELECTRICAL REVIEW.

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TO "ELECTRICAL REVIEW" READERS.

Owing to the continued increase in the circulation of the ELECTRICAL REVIEW in recent months, an increase which has become accelerated since the signing of the Armistice, we cannot guarantee that casual copies will be available. The only way to make sure of securing a copy regularly as issued, is to place a definite order with a newsagent, or else to subscribe direct to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

ELECTRICITY SUPPLY PROGRESS.

THE war and its service have brought about vast changes in many departments of our scientific and industrial activities, as well as in our political and economic organisations; but there are few spheres, we should think, in which more remarkable progress has been made than in that of public electricity supply. During the war we have of necessity, for military reasons, had little to say upon this subject except in general terms; and, apart from claiming that electric power supply, by enabling our factories and workshops at short notice to turn over almost wholly to the manufacture of munitions of war, had played a leading part—indeed, an absolutely indispensable part—in winning the war, we have scrupulously avoided giving any clue to our enemies which might assist them in identifying the centres where their aircraft could wreak destruction most effectively.

This is the explanation of what must often have puzzled those of our readers who were in possession of certain information—facts which were, indeed, in some cases common knowledge—and found no mention of them in the columns of the ELECTRICAL REVIEW. It was not that we were not cognisant of them, but that it was not expedient to draw attention to them, even if the facts were widely known—for the REVIEW was studied also in unfriendly circles; and while a provincial newspaper might freely enlarge upon the electrical developments within its area, without undesirable consequences, in many cases *we could not do so.*

Now, however, while we must still exercise discretion in some respects, our hands are practically free, and our only serious limitation is due to the continued scarcity of paper, a trouble which is likely to abide with us for months to come, and which compels the exercise of brevity in all our undertakings.

But before we comment on the material progress in the development of electricity supply, we have a duty to perform—a debt to discharge on the spiritual side. Just as the hope of victory with arms resides in the moral of the fighting men, so the success of an industrial undertaking depends upon the human element from first to last. The elasticity of electric power, which is the pride of the electrical engineer, extends to only a limited degree in the case of generating plant and mains; and while imperative demands for power supply have poured into the offices, the staffs of the power stations have been engaged in striving to develop their resources correspondingly, under the greatest difficulties. Generating sets have been run for weeks—or months—on heavy and sustained overloads; boilers have been forced to their utmost capacity, uncleaned and without the periodical overhauling which is essential to their safe and economical working; mains have been hurriedly laid, sub-stations erected and equipped, and the work has been pushed on by night as well as by day, in spite of the lighting restrictions, which had to be suspended in view of the more pressing emergency of the demand for power. Moreover, breakdowns have occurred, as was inevitable under the stress of circumstances which involved

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running without a pause on a continuous overload—in short, the engineers and running staffs, in every branch of the service associated with the supply of power to munition areas, have undergone an anxious and strenuous time practically without a respite during the past four years, and the greatest credit is due to them all, from highest to lowest, for the magnificent fight that they have put up on the home front, while many of them, of fighting age, were burning—and begging—to be released to share in the perils and privations of the trenches oversea. All honour to them—for they have "done their bit," and done it exceedingly well, although deprived of the honour and glory of the stricken field, and lacking the incentive of levying vengeance on the Huns in person.

An examination of the figures regarding electricity works extensions during the war, which we published in our issue of November 22nd, shows that between June 30th, 1914, and October 31st, 1918, the plant installed in 76 undertakings was increased, or in course of being increased, from 851,756 KW. to 1,821,281 KW.—*more than doubled.* The output of energy of those undertakings was increased from nearly 1,500 million units in 1914 to more than 2,500 million units in 1917—an increase of 70 per cent. in three years. Is not this a magnificent record?

We must not omit to award due credit to the manufacturing firms whose efforts have enabled this phenomenal increase to be effected; it must be borne in mind that they have also been busily engaged in fulfilling the requirements of the War Office and the Admiralty and the Ministry of Munitions at the same time as the power supply authorities, and that an enormous output of motors, switchgear, cables, and accessories has been produced during the war. Indeed, in every branch of electrical engineering, except perhaps those which might be described as purely luxury lines, there has been great activity, and as the electrical firms have been largely engaged in turning out their normal products, they are in an exceptionally favourable position to carry on after the war. We must also refer, in passing, to the important assistance rendered by the manufacturers, power stations, tramway authorities, and others to the Ministry of Munitions in the manufacture of shells, fuses, &c., and the heroic efforts of the tramway officials to maintain adequate services under extreme difficulties in the absence of renewals and repairs of track and rolling stock—but all these matters must be left for another occasion.

Elsewhere in this issue we are briefly reviewing the most important changes which have taken place in power station equipment. Most remarkable of these, we think, is the extraordinary upward leap of the Sheffield Corporation's undertaking, which, starting with 23,000 KW., has already reached 96,000 KW., and has obtained sanction for an additional 50,000 KW., making, when complete, a total of 146,000 KW. But that total will not be fully realised till 1920. Hardly less noteworthy is the rocket-like development of the closely adjoining undertaking of the Rotherham Corporation, which has advanced from 5,000 to 65,000 KW. In both cases the demand has arisen very largely from the triumphal march of the electric steel furnace, which was hardly known in Sheffield five years ago, but has now firmly established itself as an indispensable aid to the manufacture of high-grade steel on economical lines; moreover, the furnace has come to stay, and the demand for electrical energy, though temporarily dormant, will undoubtedly return directly normal conditions obtain. Other large increases of plant are recorded at Birmingham (51,650 KW.), Bradford (27,450 KW.), Glasgow (99,050 KW.), Leeds (33,660 KW.). Manchester (46,450 KW.), and Wolverhampton (16,450 KW.), amongst the municipalities; but some of these are only in the early stages of construction.

Turning to the company undertakings, whose plant has increased, on the whole, at a rather lower ratio, and their output at about the same ratio, the most striking development is shown on Tyneside, where the associated companies, starting with 86,000 KW., have added, or are adding, 114,000 KW., making a total of 200,000 KW. These companies, therefore, taken together, have by far the largest undertaking in the kingdom. Clyde Valley has increased from 35,000 to 72,500 KW., the Mersey Power Co. is going to install 24,500 KW. (part of a vast scheme), and the North Metropolitan Co. is putting down 21,068 KW. It is interesting to see how Luton, Redditch, and Stockport have jumped up from modest dimensions to stations of some importance.

One cannot help regretting that there was not in existence before the war a competent central authority, such as that recommended by the Board of Trade Committee, which would have been able to regulate the installation of new plant in accordance with the requirements of a well-considered national scheme. Since the report of that Committee was drawn up, the Ministry of Munitions has endeavoured to direct the flow of new plant into the most suitable positions, and, as we have noted from time to time, has discouraged the extension of installations unfavourably situated with regard to the probable requirements of such a scheme. But these efforts are more or less tentative; and as the scheme has not yet been formulated, it is impossible either to lay down authoritative lines upon which such extensions are to be carried out, or to proceed with new developments outside the scope of existing supply authorities. Hence the urgency of the need for definite action on the part of the Board of Trade, which we have already emphasised.

There is, however, one direction in which action could be taken without waiting for the national scheme to mature. It is perfectly certain that large units of generating plant will be required at an early date, and that if these are not put in hand without waiting for the national scheme, there will be serious delay before the latter can be carried into effect. In a letter to the *Times Engineering Supplement* of November, Mr. S. E. Fedden, of Sheffield, emphasises the importance of commencing the manufacture of the plant at once, and suggests that the Government should authorise the makers to put in hand some 25 complete sets of plant, each of 25,000 KW.; these would provide immediate employment for thousands of men and a large amount of machinery, and would be ready for installation when wanted, as they certainly will be, within the next three years. This is an admirable suggestion, and we trust that the Government will give it serious consideration; if adopted, it will go far towards cancelling the bad effects of the delay which has already been incurred, and there is not a particle of risk involved in the transaction.

Electricity Works Employes.

THE letter which we publish to-day from the Enginemen's Union (Marylebone Branch), regarding the award recently made by the Committee on Production in respect of London electricity undertakings, as the result of months of negotiation between the employers and employed, demands serious consideration. Assuming that the letter represents the views of the employés as a whole, it is a matter for sincere regret that the award, of which a great part was agreed at conferences between the parties, has not resulted in a fair measure of satisfaction. No such award, of course, could be expected to give complete satisfaction to either side, as agreement implies compromise; and a "compromise" which does not involve concessions on both sides is misnamed; but that an award which has been in operation barely a month should be thus emphatically denounced is most unfortunate. It will be seen that the workers are now asking for the total abolition of grading of men in all grades rated at 8½d. per hour, or less—that is, in nearly half the grades to which basic rates were allotted in the award. The list of complaints is a formidable one, but apparently relates entirely to alleged *breaches* of the grading system, and does not necessarily imply dissatisfaction with the grading itself. Apart, however, from those points, a demand is put forward for an all-round advance, which, if we understand it aright, amounts practically to 16s. a week, together with a reduction of the working hours from 54 or 56 to 47 hours a week, and the conversion of the war wages and bonuses into a permanent wage. On the face of it, this is a pretty tall order, and in view of the working conditions which are peculiar to the electricity supply industry, we do not see how it can possibly be acquiesced in by the supply authorities.

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A CARRON CANTEEN EQUIPMENT.

It must be acknowledged that in pre-war days the interest of the average employer in the health and comfort of his staff seldom went very far. It occurred to few that it would pay to look after the well-being of workpeople during the hours of business; employés who are well fed, well clothed, and furnished with the conveniences and comforts that make for self-respect, turn out better work at a faster rate than others situated under less favourable conditions. Many employers have made this discovery only as a result of the changes brought about by the war. Better provision had to be made for personal comfort on the employment of female labour on a large scale, and it became necessary to arrange for feeding them on the spot. Experience shows that as its advantages are realised, and the workers discover that the canteen is run solely in their interests, they abandon their long-established habits and join in good, well-cooked meals taken under comfortable and hygienic conditions.

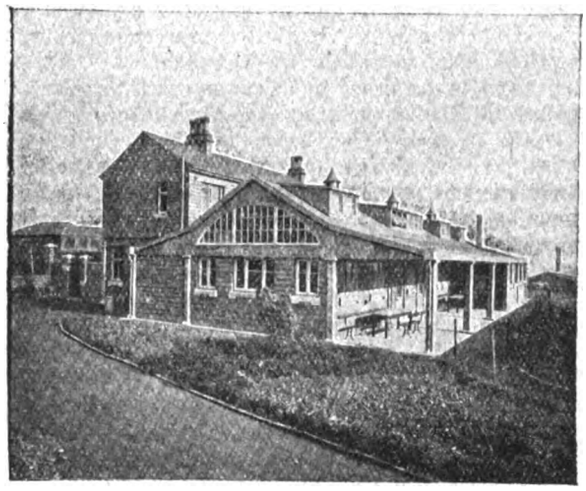

Fig. 1.—Exterior View of the Canteen.

We recently had the pleasure of inspecting the canteen which the District Iron and Steel Co., Ltd., Smethwick, Birmingham, an old-established firm in the district, has erected for the convenience and comfort of its employés.

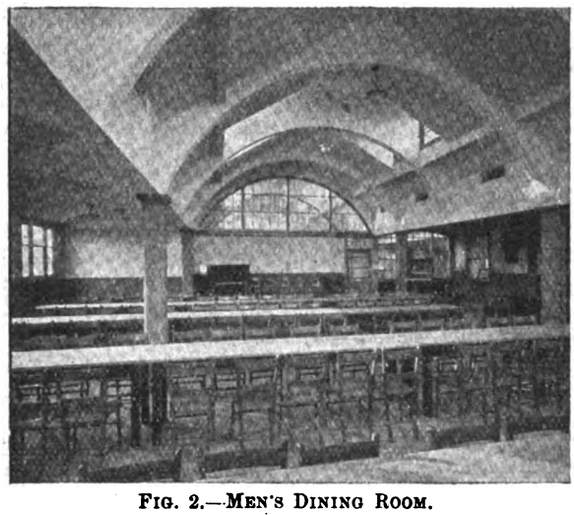

Fig. 2.—Men's Dining Room.

Mr. H. C. James-Carrington, the consulting engineer under whose direction the canteen was built and equipped, and Carron Co., by whom the electrical cooking equipment was supplied, are to be congratulated on the excellence of the appointments of the canteen, which at present does not cater for more than 300 meals at a time, although designed to deal comfortably with 500. Two 12-hour shifts are worked in the steel-rolling mill, the employés being served with three meals during the day shift and three during the night shift. As we had an opportunity of judging for ourselves, we can safely say that the cooking is all that could be desired, and the prices charged are quite low.

The building is well designed both as regards convenience and appearance; the kitchen is situated centrally, and around it are grouped the four dining rooms—two for the use of the staff and one each for men and women employés. Fig. 1 is an exterior view of the building, while fig. 2 shows the men's dining room.

The electrical apparatus installed in the works' canteen was supplied and installed by Carron Co., and is a typical example of a number of similar installations by the same company. The central electric range (fig. 3) comprises two ovens, internally 22 in. wide, 20 in. high, and 22 in. deep, the loading being 5 kw. each, and two ovens, internally 43 in. wide, 25 in. high, and 19 in. deep, loading 8 kw. each. Over one of the 22-in. ovens is fitted a griller having a grilling space 22 in. wide, 15 in. deep, and loaded to 5 kw., and over the remainder of the ovens the company's standard boiler fillings are fitted, each filling being 22 in. × 28 in., and loaded to 6 kw. maximum per filling. A plate-rack is also fitted above the ovens, this rack being 8 ft. × 5 ft., and the controlling switchgear is mounted on this rack. Approximately the overall dimensions of this range are 7 ft. 9 in. long, 5 ft. 3 in. broad, and 3 ft. 6 in. to the top of the hob, the height from the hob to the underside of the plate-rack being 1 ft. 9 in.

Fig. 3.—Central Electric Range.

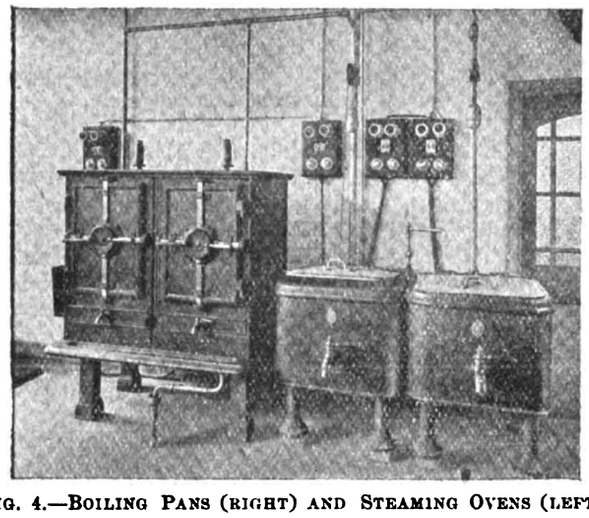

Fig. 4.—Boiling Pans (right) and Steaming Ovens (left).

The fish and stock-pot suite consists of two pans each, internally 18 in. × 14 in. × 6½ in. deep, loaded to 3 kw.

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each, for fish, &c., and one larger pan, 18 in. × 14 in. × 11½ in. deep, loaded to 5 KW., for soup, stock, &c. This suite is mounted at one end of the central range, and has the control gear mounted at the front between the two front legs of the stand. The overall dimensions are 5 ft. 3 in. long, 2 ft. 3½ in. deep, height to hob being 3 ft. 5½ in.

The boiling pans (two of which are shown in fig. 4) are three in number, two being of 15 gallons capacity and one of 25 gallons capacity, each pan being fitted with vapour standard and back balance weight and chain to the lid. The construction in each case comprises a cast-iron inner pan with a sheet metal outer case, with the space between the two packed with slag wool, each pan being mounted on four substantial cast-iron legs.

The 25-gallon pan is internally 21 in. × 20 in. × 17½ in. deep, the height being 36 in. to the hob and the back standard 4 ft. high from the top of the hob. This pan is fitted with two inner wire baskets, one being 9½ in. deep and the other 7½ in. deep, and the maximum loading is 8 KW.

Each of the 15-gallon pans is internally 21 in. wide, 20 in. broad, 11½ in. deep, loaded to 6 KW. maximum per pan, one basket being fitted, 7¼ in. deep. The height to the top of the hob is 32 in., and the back standard is 4 ft. high from the hob.

The battery of two steaming ovens (fig. 4) consists of two ovens, each internally 16¾ in. wide, 22¼ in. deep, and 24 in. high, each compartment being fitted with five wire baskets and lid, the loading being 5 KW. maximum. The overall sizes of the body are 3 ft. 10½ in. wide, 2 ft. 1 in. deep, and

FIG. 5.—HOT CLOSET AND CARVING TABLE.

4 ft. 10 in. high. The cistern for maintaining a constant level of water projects 7½ in. from the body, and is 16 in. long.

The hot closet and carving table (fig. 5) is overall 8 ft. × 2 ft. 6 in. deep × 2 ft. 10 in. high, sliding doors being fitted on both sides, and the top being fitted with one open-type Bain Marié 27 in. × 24 in. × 4½ in. deep, loaded to 3 KW. maximum, and two carving wells each 18 in. × 12 in., loaded to 500 watts each maximum. The hot closet is loaded to 6 KW., and the control gear being mounted at each end.

In addition, there is a porridge boiler similar in construction to the boiling pans referred to above, and several tea, coffee, and hot-water urns.

The hot-water system is neat and efficient; in an outhouse is installed a coke-fired boiler arranged with two heating systems, one for town water and the other for rain water which is collected off the roofs of the buildings. From this central heater hot water is fed to the various points where it is required in the kitchen. The system is very economical, the consumption of coke being quite small, and the heater requires very little attention. The two water systems are entirely separate, although heated by the same fire, and provision is made to fill the rain-water tank with town water, should it be necessary.

Electricity is supplied by the Shropshire, Worcestershire, and Staffordshire Electric Power Co., being brought in at 5,000 volts and stepped down by means of a 300-K.V.A. Westinghouse three-phase transformer to 110 volts, at which pressure it is used for heating, cooking, and lighting, the high-tension switch cubicles, &c., being supplied by the Power Co.

The low-tension switchboard was constructed by the Mudie Electric Co., Ltd., Birmingham, to Mr. Carrington's designs, and the wiring was carried out by Messrs. Ellis and Ward to his specifications. The wiring throughout is in lead-sheathed cable, which provides a very satisfactory continuous earth by means of the lead sheath. The lighting is semi-direct, the arrangement being found a very satisfactory and economical method of lighting. The heating is by means of "Carron" electric radiators throughout; the design of heater is of a robust type, and quite satisfactory in operation. There are 24 of these radiators, each loaded to 3 KW.

The furniture of the canteen was supplied by the King Fisher Co., of West Bromwich, while the sinks were supplied by the Staines Kitchen Equipment Co., of London.

Above the canteen, on the second floor, is a well-appointed house occupied by the canteen manager, which house was also furnished by the District Co. The sitting room is furnished in Jacobean oak throughout, the bedrooms in English oak, and the kitchen furniture is of the Welsh pattern. The house is lighted and heated electrically; the kitchen, however, is provided with an ordinary kitchen range with back boiler, which works in conjunction with the main boiler tanks, enabling them to provide hot water for the bath-room, lavatories, &c., when the main boiler is not in use.

RECONSTRUCTION: LIMITATION OF PROFITS, EFFICIENT DISTRIBUTION, &c.

BY G. H. HOOLE.

THERE has been much voicing of general opinion on this subject, but very few definite proposals as to how best to take advantage of the peculiarly favourable conditions which obtain at the moment; conditions such as never obtained before, nor are likely to occur again in the lifetime of the present generation. There is undoubtedly a better feeling between master and man; between "Capital" and "Labour." There is a greater appreciation by politicians of the real power of the working classes. Those in authority have found, much to their surprise, that the people are prepared to back them up in any drastic proposal, irrespective of the inconvenience caused, so long as the proposal is for the good of the whole, and as the need after the war will be equally as pressing, they will agree to a much less degree of inconvenience.

The workers are expecting a definite lead being given, definite steps being taken, which will ensure to them a greater security against poverty, on the one hand, and tyranny on the other.

Unfortunately, it is rare that direction to any big movement beneficial to the masses comes from the masses, but the reason for this can be accounted for by the fact that they—with all respect—have not the ability to give that "direction." They state, it is true, in general terms what they want, but it is purely generalisation; they cannot, unfortunately, furnish a plan of the route to be followed to attain their ends.

Certainly they have advanced, but the power to direct effectively takes years "to acquire"—and they were bad starters. And when, as the result of repetition of their wants, a solution is not forthcoming, they consider that they have been badly treated, and, as a result, frequently resort to force—to them the only alternative—but this procedure is changing. The responsibility, to a very large extent, rests on those who have the ability, and are in authority, to render the lives of the people more tolerable.

The proposals I would put forward as a basis for reconstruction come under the following headings:—

1. Relationship between Capital and Labour.
2. Relationship between the State and Capital and the State and Labour.
3. Distribution of commodities.

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Relationship between Master and Man, or Capital and Labour.—The Whitley Committee put forward certain proposals which, if acted upon, will certainly lead to a better understanding, and consequent smoother working; but the proposals are not bold enough.

Surely the Committee has misjudged the pulse of the people. It regards it as being weak instead of at full strength, the life blood pulsating through the body in a manner indicative of sound robust health. Has not the Committee been afraid that "Capital" could not stand too much of a shock and that "Labour," was not in a fit state to take strong nourishment? That is wrong. Capital is sane, strong, and vigorous: Labour in the same healthy condition, and they face each other, instead of being side by side. Each is prepared to do the right thing so long as it can be convinced that the right thing is that which is for the good of the people as a whole.

There are no real leaders of Capital who desire the slavery of their fellow men; nor are there any true leaders of Labour who desire to make bankrupt the capitalists. The position stated truly, and without heat, is: the capitalist does not wish to hoard, but naturally—I use the word in its human sense—wants a reasonable return for his capital outlay; whilst similarly the Labour man wants a greater return for his capital—*i.e.*, his labour.

The Whitley proposals of Councils, &c., should be the first stage, and as the outcome there should be:—

1. Better working conditions;
2. Greater output;
3. Shorter hours—

benefiting both parties and the nation as a whole. The masters would save in obvious ways—such as lighting, heating, power, waste of man-hours, &c.; whilst the man would benefit by having more recreation and better health; and it cannot but be agreed that the two sides of the account balance.

Having got over the first step, the next is that of limitation of profits, and this is a subject bristling with difficulties; but does not that fact make the subject more worthy of solution? Parliament should pass an Act limiting profits to, say, 7½ per cent. after making provision for the following:—

(1) Depreciations: the per cent. to be definitely laid down by a Committee for buildings for the different industries, different classes of machinery, &c.—*i.e.*, allow fair and reasonable depreciation allowances. Then (2) a sum of money should each year be placed to an "Industry Reserve Fund" to ensure that during lean years the capitalist gets his 7½ per cent. return and the workman his wages; (3) workmen's holiday pay: (4) workmen's sick pay; and (5) workmen's pension fund.

If, after these charges have been met, there is a profit of over 7½ per cent., that surplus should be expended in cheapening the article produced, to the consumer—*i.e.*, the general public should reap the benefit. The cost of goods would not reach anywhere near the figure we are now paying for them and, I believe, would not be much in excess of pre-war conditions—first, because of the greater output, and, second, because of the redistribution of the profits.

These proposals in no way cut out competition, but rather encourage it, inasmuch as the most progressive, up-to-date firms would yield the greater dividends, enabling them to offer the cheapest goods. The effect would be to shut down the smaller unprogressive firms—those where workshops are dens and where working conditions generally are bad. The firms who treat the industry on scientific lines, whose members—principals and staff—have one object in view: the maximum output at minimum cost consistent with the proposals made, are the firms who have the right to the front place in industry.

Greater output is certain to result, all workers in the firm having a real interest in the success of the firm. The making of goods in the firm's time and of the firm's material will be reduced to a minimum, each workman recognising his loyalty to his fellows and to the firm. This is only one of the minor savings, but it is mentioned as an illustration. This factor of greater output is one of the most important, and one which, to a great extent, rests with the worker, but he, of course, must have every mechanical and technical facility to that end.

How would these proposals affect our foreign trade? I venture to say very slightly, if at all, as the balance-sheet of the cost of the article may roughly be said to be as follows:—

Debit.	*Credit.*
Extra cost of improved conditions.	Increased production.
Extra cost:—	Increased saving of power and lighting.
Wages.	Saving of costs of strikes and disputes.
Holiday pay.	Reduction in dividend.
Sick pay.	
Pension fund.	

And the conditions obtaining in other countries should be borne in mind. Naturally, the old age pension would fall out automatically in a few years.

Distribution.—In this connection the most drastic methods should be employed, as the national waste in duplicate distribution is appalling and unworthy of a great nation. The case should be dealt with thoroughly from the railway down to the baker's cart.

Railways.—I am against nationalisation, as it is too clumsy and too expensive; but Parliament should pass an Act compelling railway companies to work definite areas for goods traffic. At the most there should not be more than one company for Scotland, one company for the North of England, one company for the Midlands, and one company for the South of England, with special arrangements for the long-distance lines.

The companies should be compelled to amalgamate to this end, *i.e.*, the saving of time, men and material. A big financial saving would result.

Provisioning of Areas.—As regards town and country distribution: in this connection, centres of distribution, *i.e.*, shops will be dealt with as well as the actual distribution.

England wants every available man now, so as to increase her wealth: every penny which is at present wasted should be saved. Dealing with a large town first: the organisation would be to divide the town into areas, say, of 10,000 people, and in each area arrangements should be made to ensure that there be no more than an *adequate* number of shops to meet the requirements of that area, *i.e.*, all food requirements, coal, and minor requirements such as boot repairs, &c. Is there any sense in five grocers' carts coming into one terrace to supply five different people? The shopping centre of the town would consist, then, of such shops as:—Jewellers, drapers, milliners, clothiers, haberdashery, fancy goods, &c., and other articles not of daily requirement. The saving in men, horses, time, and property would be enormous, especially when it is remembered that the distribution from the wholesalers would also be reduced. The area shops should be controlled by companies, if possible, made up of the present shopkeepers of the area—but if they cannot agree to form a company, then outsiders may step in.

Apart from the saving referred to, it would be a national asset to close many of the small shops, as they have a daily struggle to "make ends meet." Would the people agree to it? Have they agreed to rationing?—and the need is equally as urgent. It would not be nursing the people, but educating them. Care should, of course, be exercised that each area is amply supplied and the prices throughout the country systematised, which is a simple matter. Tea, flour, cocoa, coffee, milk, &c., at standard prices, but no rationing. In the country the same wastage occurs, and the same remedy should be applied. At present there are butchers' carts travelling miles to a village where there is already a shop; similarly half-a-dozen grocers' carts will come to a village which has a store and a railway station. There is also an important change to suggest—and that is, "No credit." During the last four years, many outstanding accounts have been cleared up owing to the high wages, and the time is opportune for the cancellation of the credit system in foodstuffs—a pernicious system.

Relationship Between State and Capital, and State and Labour.—It will be observed that provision has been made for the State to lay down what profits a firm should make and for a rational distribution scheme to be brought into force, and there only remains the question of the interworking between industries to prevent overlapping. For instance, one industry specialises, whilst there are many

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that may be termed bastard industries—*i.e.*, industries which touch the fringe of others, and produce a cheap and inferior article, to the detriment of the industry proper. Those places which are not proper to any particular industry should be closed, otherwise the nation is losing man-power, &c., and the State should step in and stop it. I do not, of course, refer to repair shops, but to "producers." The State should also receive from every firm the excess profits where the profit is over 7½ per cent. after the conditions previously mentioned have been met and the article has been reasonably cheapened, so as to form a fund for the opening up of new industries or for the assistance of decaying industries.

THE USE OF HIGH-PRESSURE AND HIGH-TEMPERATURE STEAM IN LARGE POWER STATIONS.

On Wednesday, November 27th, Mr. J. H. Shaw, A.M.I.E.E., read his paper (an abstract of which appeared in our issue of July 19th, 1918) at Birmingham before the South-Midland Centre of the I.E.E.

Mr. L. S. Carr, discussing the paper, said the question could not be considered from the point of view of thermal efficiency only, for it did not follow that the most highly efficient conditions would naturally be the best from a commercial point of view. With turbines a very high vacuum was required to obtain high efficiency, but this vacuum called for heavy capital expenditure for condensing plant, and, in inland stations, heavy costs for cooling towers and pumping, and in the same way they had to consider what very high pressures and temperature would entail in the way of capital costs and maintenance. At present there were very few data available regarding those—at any rate as to extra-high-pressure. They had had three years' experience with steam at a temperature in the neighbourhood of 700 deg. F., and had experienced no trouble whatever as regards the erosion effect on blading. Gunmetal fittings had to be replaced by steel or one of its alloys, but otherwise the results had been most satisfactory. Glasgow's new station was designed for 250 lb. per sq. in. and 250 deg. superheat, and boiler plant at a new station on the N.E. coast for a working pressure of 475 lb. per sq. in. and 700 deg. F. was now being installed, which was a big advance on anything attempted in this country before. He hoped the figures of capital, running and maintenance costs, and steam consumption would be published. He would like to see the term "pounds of coal per KW. generated" abolished; it was entirely misleading. When making a comparison between two districts it was obviously unfair to attempt to compare on such a basis a station using coal of 12 or 13,000 B.TH.U. with one using that of, say, 8,000 or 9,000. The latter, though it might be burning more lb. per KW., might be the more highly efficient. He thought that for machines of 15,000-KW. rating and upwards it would be found that the very high vacuum figure of 29.1 given by the author would be taken full advantage of, owing to the huge volume of steam to be dealt with, entailing unmechanically long blades at the low-pressure end; 28.8 was nearer the mark. An article appeared in the March number of the *General Electric Review* by Eskil Berg, of the turbine engineering department of the General Electric Co., of Schenectady, which he would advise anyone interested in the subject to read.* In it the benefits derived from high pressure and high superheat were very clearly shown by means of tables and diagrams.

Mr. H. Bentham asked the author if he had any actual operating figures, no matter how small, to compare with the tables. In Schedule V, columns 3 and 11, a saving of 8 per cent. in fuel consumption was shown by raising the steam-gauge pressure from 200 lb. with 200 deg. F. superheat, to 300 lb. with 300 deg. F. superheat. The hesitation of most engineers to adopt very high pressures and temperatures was on account of the added possibility of breakdown, which would not only wipe out possible economies, but might dislocate the running of the station. The higher temperatures would lead to serious expansion troubles, particularly in turbines of the reaction type which depended on fine clearances for their efficiency. Could the author say whether high pressure or temperature had anything to do with the recent breakdown of the two 35,000-KW. and one 25,000-KW. turbines in the States?† He had inspected the high-pressure and superheat B.T.H. and Babcock combination at Rugby after a long run, and apart from the scoring of the first row of nozzles, which received the high-pressure steam and, he believed, the first row of buckets, it was in excellent condition. That set, however, was small, and he was afraid expansion trouble would occur on sets of 5,000-KW. to 10,000-KW. capacity. He could hardly agree that the total works costs were not likely to be affected by the use of higher pressures and temperatures. There was no doubt that maintenance costs would wipe out fuel saving if one ventured to operate some existing plant at higher total temperatures than 600 deg. F. Additional expansion due to higher temperatures would undoubtedly set up further "racking" strains on the pipework. At one large power station they were discarding all welded steam piping on their main steam ranges, and substituting riveted pipes and flanges owing to serious troubles with the welded type at high temperatures.

Mr. R. A. Chattock criticised some of the figures given; such a valuable paper ought to represent accurately what was being attained in modern power stations rather than include figures, which the author himself described as being optimistic. The statement that cooling towers could not be expected to obtain a lower bottom temperature than 75 deg. F. was hardly correct. In Birmingham they were obtaining an average temperature throughout the year of 71 deg. F., and the vacuum corresponding to that was 28.3 in. Coal would not come down as low as 10s. per ton for a good many years; the average price when things became normal would be about 15s. per ton, and he thought the figures should have been worked out on that basis. He considered that a vacuum of 29 in. should be easily obtained with a circulating-water temperature of 60 deg. F. As an average figure, an overall efficiency of boiler-house plant of 77.5 per cent. was practically unobtainable. Whilst it was true that on individual boiler tests, including economisers, efficiencies of 80 per cent. to 85 per cent. could be obtained, the average efficiency of the whole of the boiler-house over a period of twelve months could not be expected to be higher than 70 per cent., and it was generally even lower than that. The coal per unit was stated in lb. throughout the paper; it was more useful to state it in B.TH.U. per unit. For comparison lb. of coal per unit was quite misleading. He was very glad that the author had referred to the importance of de-aerating the condensate and make-up feed water. With the very pure water that it was necessary to use in modern high-duty boilers, the liability to internal corrosion of pipes and economisers was very great, and it was of the utmost importance that the carbon dioxide or the oxygen contained in the water should be removed. The closed circuit system of handling the water should be adopted, and the temperature should be raised to at least 180 to 200 deg. F. Most firms building condensing apparatus were now looking into that question. The advisability of using high pressures and high temperatures was quite recognised amongst engineers. In Birmingham they were proposing to press the boilers up to 325 lb. per sq. in., and to superheat up to a total temperature of 700 deg. F.

Mr. J. G. Mackersie said it would be interesting to know how the author arrived at the figure of 8 per cent.; 1.538 lb. of coal per hour was an estimated figure for the standing losses of the power station under discussion with a working pressure of 200 lb. per sq. in. It was proposed to add 8 per cent. to that figure when the working pressure was 350 lb. per sq. in. He knew of no formula, empirical or otherwise, giving the proportion of standing losses on the increased pressure. The general opinion seemed to be that the boilers used in the new stations would be of the flash type, with no steam and water reserve. It appeared to him, looking at the matter from a station engineer's point of view, that that hand-to-mouth system of steam-raising would be dead against the continuity of supply.

Mr. R. J. Kaula said that the author was not very clear in his reasons for limiting the pressure to 400 lb. per sq. in. His remarks had been taken to mean that such a pressure could be adopted in existing stations provided suitable modifications were introduced. He did not think the author meant that, but in any case such modifications would be outside the range of practicable engineering. Increased pressure and temperature involved an increased risk of breakdowns, but without taking such risks there would be little progress. Raising the steam conditions meant increasing the turbine dimensions and cost in one direction and decreasing it in another, with the net result that apart from the question of materials there was not much to choose between the costs of the two designs. On the other hand, the two designs were essentially different, and if makers were to produce highly-efficient turbines for widely differing steam conditions, they would have to carry two sets of patterns for each standard output, which was a most serious handicap in the matter of cheap and rapid production. It would be an advantage if users could agree upon a standard steam pressure and temperature for new installations, such standard to be adhered to for a number of years.

Mr. F. Forrest said that one of the most serious considerations which arose when dealing with high pressures was the type of economiser to be used, and he thought the author had dismissed that important point with far too brief a reference. The pressure inside the economiser tubes was a pulsating one, which was greatly accentuated if reciprocating pumps were used, even though they were fitted with extra large air vessels, and the tubes were at the same time being subjected to external temperatures, probably as high as 500 or 600 deg. F. The physical properties of cast iron were such that at first sight one would condemn the use of this material for economisers. Future experience only would show whether cast-iron economiser tubes could be made as satisfactory at the higher pressures as they were

* Elec. Rev., July 26th, 1918.

† Elec. Rev., April 12th and October 4th and 25th, 1918.

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at the lower pressures. The steel-tube economiser suffered under the disadvantage that the metal rapidly corroded unless means were adopted for completely de-aerating the feed-water. There would be a decided difference of opinion as to which type to adopt, and boiler insurance companies, as well as engineers in charge would watch this matter very carefully.

Mr. J. P. KEMP asked the author whether the overall efficiency of the boiler-house plant, assumed to be 77.5 per cent., was seriously put forward as a practical figure. In an extensive experience of modern boiler-house control he had not known such a result, and he thought that an average of 67.5 per cent. would more closely represent the average efficiency obtained in quite well-managed boiler houses at the present day. When one considered that most boilers had of necessity to be blown down (a little) daily, and entirely let down and emptied occasionally, for a variety of reasons, 77.5 per cent. appeared to be far too optimistic for average conditions, which was the only fair criterion. The highest average result he had known was obtained in a power station in Brazil, where the average for one particular month was 72.0 per cent., but the conditions were extraordinary. He very much doubted whether the author's figure of 77.5 per cent. average efficiency was practicable.

Mr. W. N. Y. KING said that the scheme for high pressures was optimistic. From the profits shown there must be deducted various losses attendant on the use of the increased pressures. Auxiliary plant, which was as important as the main plant in large turbine lay-outs, would be considerably affected in design. With higher steam pressures auxiliary piping would be a source of greater care and loss of heat due to radiation, and was likely to involve more in upkeep of valves and lagging. The power required to drive the auxiliaries was estimated on too conservative a basis, even with highly efficient plant. It would have been more suitable had the power required been expressed in KW. instead of in B.H.P. in connection with technical electrical matters.

REVIEWS.

Power Plant: Installation, Upkeep, and Economical Installation. By ROLAND WOLLASTON. Pp. 117; 17 figs. 1918. Manchester: Sherratt & Hughes. Price 5s. net.

This little work is one that will be of great service to the owners, managers, and engineers for whom it is intended, and we venture to think that consultants and electrical engineers might often do worse than dip into it for hints and facts of value.

Men of all kinds are liable to idiosyncrasal obsessions on motive power which have no sound reasons behind them. A predilection for class in machines is like a fashion in ties and boots. The author before us possibly has such weaknesses himself, but, if so, he hides them well.

There can be rightly no fashion in motive power, for every situation has its own proper solution. Often the reasons for rival systems are so evenly balanced that two competent engineers may choose differently, but both will probably unite in rejecting all other systems but the two they have chosen. It is usually easy to decide that the choice must be either *a* or *b* if a man is an expert, but to non-experts it is difficult to decide between three or even four. Ordinarily there are seven systems to choose from, viz., steam, gas produced by the owner, gas from public supply, electricity from outside, electricity produced inside, by steam, by gas from outside, by gas produced inside.

To these seven may sometimes be added water power on the premises, or water power outside and brought into the premises electrically, also oil engines. Not all these systems are likely to be available at any one place.

Choice is usually to be based on cost. But cost, even when obviously low, cannot always rule. The lowest cost in every way may involve a capital expenditure beyond the owner's reach, and he may properly choose a method involving much more cost in the long run, because he has not capital to lay out. Thus it may be much cheaper to lay down plant and produce electricity on the premises than to pay the cost of a company's long mains, poor load factor, or profits on excess capital. But the external power station supplies from already sunk capital, and may help an owner to develop some new invention on some cheap site on which it would be folly to sink much capital in power plant.

Now the author is clear-sighted on these points, and sees in its proper perspective such a crazy procedure as putting in costly steam plant, with high economy engines, and extra boilers to generate steam for heating purposes. But it is not clear why we may expect soon to see almost all demands for power, light, and *heat* filled from big central stations. A central station as big as the moon could not distribute heat economically by way of electricity except for what may be termed drawing-room purposes, or purposes where the heat is kept in as in cooking or similar uses. But to warm a cotton factory which must be ventilated is quite a different problem, for a big stream of air is flowing to waste and removing the heat as fast as it is supplied, and there is precious little heat in the electricity produced by a pound of coal valued at 14,000 B.TH.U.—perhaps 896 units; in rare cases even 2,000 units, or less than a third of the very poorest steam boiler heating efficiency. In fact, generally, factory heating at any distance from where the fuel is burned is a problem that cannot be airily dismissed, though the conveyance of heat from power stations has not received the attention here which has been given to it already in America.

It is unfortunate that even engineers who ought to know better are often apparently blind to the difference between heat in quantity and temperature, and to the difference between maintaining the temperature of a closed and insulated space and that of a free and ventilated space.

What the author has to say on gas power may be commended, especially in the matter of bituminous fuel, but he is a little off the mark in asking for positive blast for all suction gas plants independent of engine suction, especially if by blast he means the usual steam-blown jet, for much of the value of suction plant is the freedom from the steam boiler. For small work at steady loads there is apt to be no serious rival to suction gas, and if a town supply is available for possible emergency starting, the suction plant is easily first, for the engine can be started on town gas and the producer drawn up to activity by the running engine with its load on until finally and soon the producer is fully on and the town gas fully off. A producer may be blown, of course by the engine it feeds if a fan blower be employed, but is it really worth while?

One item of prospective weight should be noted. It has always been the mere commercial man's boast that he was entitled to do as he liked, even to wasting hundreds of tons of coal per year in order to make a £5 note extra profit. There is a tendency to-day, when we have lost already so many of our rightful and proper liberties, to limit our "right" to waste coal. No longer are men to pitch a thousand tons of coal into the cooling tower because it pays them to do so, or they think it pays them, or they pretend it pays them, because they are too lazy to take better care of shareholders' or taxpayers' money. But coal is a national asset, and it seems as though it were going to be soon as criminal to waste coal because one has the cash to buy it as it ought to be to trade coal or anything else with the men who sank the *Lusitania*. Coal is already controlled after a fashion. True, it is not well controlled yet, but some day the control may be managed by engineers who really understand the art and science of fuel economy. Then what about wasting coal to suit Tom's, Dick's, or Harry's notion of heat utilisation?

In Part II economical operation is dealt with, and useful charts are given as an aid to the comprehension of what becomes of the heat value of the fuel.

Part III is given over to the chemistry of water treatment, coal, and flue gas, and an Appendix treats of weir measurement of feed and condensation water. Altogether a very useful little work.

Works Lighting. By DANIEL H. OGLEY, B.Eng. Pp. 134; + 66 figs. London: Iliffe & Sons, Ltd. Price 7s. 6d. net.

Nobody will deny that the gospel of good lighting has still far to be carried before the lot of the worker and possibilities of output, so far as natural and artificial lighting are concerned, attain the ideal. As a popular work "Works Lighting" should assist in this propaganda to a large extent, but as a technical work for the assistance of the practical man or the illuminating engineer, it leaves much to be desired, and emphasises the fact that British practice is far behind American practice. Works by American writers on this and allied subjects are far beyond their English contemporaries; demonstrating that illumination is with the former the subject of thorough research, while here we are contented to copy and adapt.

In the first chapter generalities are touched upon, matter from sundry bulletins and publications being rewritten and presented in a collective form. An oft-produced chart showing the similarity between distribution of accidents and periods of darkness is shown; we are of opinion that too much stress is laid upon this, so far as it affects illumination pure and simple, and those making use of it should bear in mind that the period of cold weather also synchronises with the natural light curve, and will have a considerable bearing upon the accidents occurring. The need of cleanliness of the lighting unit is particularly emphasised, and the importance of this from the economic point of view clearly demonstrated. The characteristics of good lighting are then briefly touched upon, the discussion being largely based upon the report of the Home Office Committee on "Lighting in Factories and Workshops."

"The Development of Gas Lighting" makes interesting reading, but does not appear to be of great service. Certain figures relating to light deterioration of gas mantles are quoted; these figures are laboratory results, and the author expresses the opinion that "no doubt a considerable improvement is to be obtained in practice"; this is very much open to question, for laboratory conditions are usually far superior to those found in practice.

The illustrations showing gas lighting installations are poor and serve to show the advantages of electricity. Although entitled "Modern Practice in Gas Lighting," the next chapter is of general application, except in so far as a certain portion relates to high-pressure gas lighting. The author shows a lack of knowledge of the properties of reflecting surfaces, and misunderstandings are likely to occur if the statements at the opening of the chapter are taken too literally.

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We are glad to see that stress is laid on the fact that the height of suspension of a lamp has no bearing on the resultant illumination provided a suitable reflector is employed, a fact which is often overlooked. "Progress of Electric Lighting" forms the subject next dealt with, but again this is largely a reprint from manufacturers' pamphlets, and could have been presented in a more convincing manner by the inclusion of original matter and experience.

The measurement of illumination is next treated upon, indirect lighting is introduced, and the main types of reflectors are mentioned. Under the heading "Modern Electric Lighting" much that has already been stated is presented in a different manner, and mercury vapour lamps are brought to one's notice.

Chapter VIII deals with oil lighting, and one is impressed with its capabilities for situations where independent units are required or where the installation of gas or electricity would occasion undue expense, but at the same time the necessity for expert or semi-expert attendance cannot be ignored, for the inconvenience of priming and details of construction consequent thereon are enough to frighten any but the stoutest hearts.

"Natural Lighting" forms the subject of the last few pages; again general considerations are given, but the chapter serves to draw the attention of those responsible to the careful study which is desirable if the best results are required. We congratulate the author upon the introduction of this aspect into the book, for far too little attention is paid to the positioning of windows in factories, relative to the operations or work to be performed; with modern machinery top lighting alone is not always sufficient, so that adequate side lighting must also be provided.

The work closes with the table of "Cosines cubed" and an exceptionally complete index. The illustrations are, on the whole, good, but the method of numbering them chapter by chapter is awkward and cumbersome when one desires to refer back. The general setting out of the book is satisfactory, but for the information contained therein, the price appears to be excessive. One would have expected something better from the author of "Incandescent Lamps and their Applications," for the impression left after a careful reading of its contents is but poor.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

"Refills."

In the Electrical Review of the present week, on p. 545, in the legal column, there is a paragraph headed "Electric Lamp Refills." This is liable to do us an injury in our business. We shall be glad if you will kindly draw attention to it in your next issue. It should have read "Electric Battery Refills."

We have no connection or anything in any way to do with either of the two firms mentioned.

The Renew Electric Lamp Co., Ltd.,
F. Harrison,
Director.

London, N.W., *December 7th*, 1918.

[We are pleased to insert our correspondent's disclaimer, though we think his fears are groundless; there have been several such actions in connection with pocket lamps lately, and no one would be likely to confuse them with his firm's products. Nor do we agree that the heading should have been "electric battery refills"; the articles concerned were not refills for electric batteries, but refills for pocket or portable electric lamps.—Eds. Elec. Rev.]

Super-stations and Aircraft.

Many are the lessons this war has taught us:—

At the commencement we were told that aeroplanes were of no value; but now we know that they have played a most conspicuous part in terminating it. We were pleased 4½ years ago that they could take a few cwt. 200 miles, now we know they can easily carry tons as far as Berlin. What will they not be able to accomplish in another 4½ years? The 16 (more or less) super power stations which we are to gratefully accept as the cure of our present wasteful methods, will necessarily be huge, prominent, and conspicuous. The next time an enemy wants revenge, he will bomb these places to scrap heaps the day *before* he declares war. What then could we do with all our machinery standing idle? Imagine the chaos!

The men who said 4½ years ago that concrete ships would be sailing before the war was over would have been told to go and "sleep it off"; but we know that concrete ships are now sailing.

Electrically-propelled ships were scoffed at, and as for battle cruisers with turbo-electric drive of 150,000 kw., "well, the man must have bats in his belfry"; but all the same this is practically an accomplished fact.

For large power supplies, I know that if I had even a 15,000-kw. turbo-alternator and its boiler plant equipped with automatic stokers, superheaters, and economisers (such as most ships have not) fitted into a concrete barge and anchored near a dock, I should feel relieved. Her propeller when she was anchored would create a current for the circulating water, and also move her, when wanted, to another part of the system when the load centre of gravity demanded it. This would be easier than the usual laborious method of wayleave chasing.

Ash disposal would be easier than at present, foundation, unsuitable site, and building troubles eliminated. Costly circulating pipe runs not needed. No special coal bunkers required, a telpherage coaling scheme such as ships use at sea would be feasible either from docks or collier power-barges; equipped at makers' works, and delivered under steam and ready to work, in standard sizes.

In America a 200-mile transmission is not considered a particularly long one, and I know not, therefore, why it should be any more difficult here to transmit electric power over the same distance, but an 80-mile radius from any of the following waterways would cover any part of England, Scotland, or Wales: Thames, Wash, Humber, Tees, Tyne, Tweed, Firth of Forth, Caledonian Canal, Mersey or Dee, Bristol Channel, and Southampton Water.

Two or more 100,000-kw. barges at each of these points would solve a good many "burning" and bombing questions. In the latter case, the ships would be fairly difficult to distinguish from ordinary ones, and also they might not be at the exact spot expected when the bombers arrived.

Think it out further—"It's no sae daft as it micht luik."

C. T. Allan.

Cardiff, *December 4th*, 1918.

"Fraternity"—or Tyranny?

With regard to the remarks of your correspondent "Plain Speaking," and others—considering the staff engineers have been for so many years without any organisation whatsoever, why (when the E.P.E.A. is being put on a sound basis) should we want to rush into the arms of the E.T.U.? I think if all staff engineers would join the E.P.E.A., and thereby help the men who have done, and are doing, so much spade work, we should soon get the improvements in our working conditions which we all desire, without the help of the E.T.U. or anyone else.

S. A. Woodward.

Gloucester, *December 9th*, 1918.

In your issue of December 6th, "Plain Speaking" comes much nearer the mark in advocating what is practically the solution of the whole problem, viz., "*a strong union*," but states that the methods of the E.T.U. in the past have not altogether been to the liking of himself and fellow members.

He complains that an application by the E.P.E.A. for better remuneration has been turned down by various employers. As for methods, I can give many instances of men who joined the E.T.U., who, after doing so, and participating in the various advances, &c., &c., conceded to them through the E.T.U., have at the invitation, or, shall we say, command of their "chief," joined the E.P.E.A., because the "boss" is a member, and who, I feel convinced, would at the word of command put on overalls and become "stokers." Yet they ask for "fraternity." Who has refused it? Certainly not the E.T.U., which is open to all electrical workers, chiefs, and otherwise. By all means let us fraternise, and the course for the members of the E.P.E.A. is obvious. Cohere, and tyranny will cease to exist. United we stand—divided we fall.

William F. Wood.

Stockton-on-Tees, *December 9th*, 1918.

Wages and Working Conditions in Electricity Works.

I am desired by the Marylebone branch of this union to state that they, in common with the members of other branches of the Enginemen's Union interested in the rate card award, are far from satisfied with the net result. Though the men were told time after time that everybody would get something, complaints are so numerous as to no advance in wages being granted that there is a suspicion that the mixed nature of the work incidental to electricity undertakings has precluded the possibility of grading the men; the men, therefore, feel justified in asking for the abolition of these hybrid grades; and to benefit the lower hybrid grade men the introduction of a flat-rate wage of 8½d. per hour, or its equivalent for men on the weekly wage books, for *all grades* of work now rated at 8½d. or less. Committees have sat month in and month out for nearly two years to thresh out these wage rates, hoping for some substantial improvement to accrue as a result, but as their hopes are not realised the reaction is all the more violent. For eleven months past branches have been in constant session to answer questions, to advise generally, to confer with the representatives of other unions, and it is not nice to know that the work will have to be started all over again. This time, however, the men will not be found easy to satisfy, as they want entirely open negotiations.

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As samples of the complaints coming in we may cite: Men are shifted from job to job, and are not paid the higher rates when shifted; men acting practically as higher-grade men—entered on wage books as lower-grade men in days gone by when grading didn't matter—now failing to obtain higher rates; coal trimmers doing ashing; the mains man doing meter fixing or meter reading or testing, or installation inspector's work; meter fixers' mates doing meter fixers' work; meter readers being made responsible for connecting and disconnecting at less than installation inspector's rates; day hands doing Sunday work are paid overtime, but shift hands doing Sunday work get no overtime; men completed a day's work and restarted same night without overtime pay; overtime payment for Sundays discontinued, and a bonus system introduced. All of these things seem to us to be needless complications. The men say they are determined to obtain a living wage without having overtime pay to make up for the shortage in other directions, and to obtain that living wage the branches will ask for an all-round advance of 4d. per hour, with an absolute minimum of 8½d. per hour, from which the 4d. shall be calculated. The members want the 47-hour week, which they are determined to press for. The delegates attending the conferences were asked to leave the 48- or 47- or 44-hour week in abeyance; but the engineering award becomes operative on January 1st; this award the members want applied to the electricity undertakings, together with the abolition of overtime; also they request the conversion of war wages and war bonuses into a permanent wage. The members further desire the abolition of piece rates and bonuses; also the minimum period of rest between any turn of duty shall be twelve hours (public breakdowns alone excepted); also the reinstatement of men returning from the Army or Navy to be carried through as expeditiously as possible, as it has been a great hardship for a man to do 1¼ man's work per day. Hardships have been borne cheerfully for the sake of the brothers at the Front, and what sacrifices have been made as a war departure cannot now be made a permanent institution.

John Vincent,
Secretary,
National Amalgamated Union of Enginemen, Firemen, &c., of Greater Britain.

Smooth versus Undercut Commutators.

The following remarks will give your readers a brief outline of my experience with commutator troubles.

I have invariably had trouble with commutators caused either by inexperienced attendants or gross carelessness of those in charge of motors.

The general electrician in the first place fixes his brush position exactly in the centre of the main poles, and on tracing the lead of the armature one finds it may be out of the neutral position on a small machine by about 1 in. This is a frequent mistake, and I have been caused endless trouble through it.

The next thing is that one finds the brush-holders not equally spaced; a simple method of spacing them is as follows:—

Take a piece of paper and cut it to the width of commutator, place the paper tightly round the commutator, then mark off one complete radius of the commutator and take the paper off again. Now divide the paper into so many equal parts according to the number of poles, if a 4-pole machine divide the paper into 4 equal parts, if 6-pole divide into six, and so on.

This I have found is the most efficient way of spacing the brushes; some people count the number of bars on the commutator, and divide the number by the number of poles, and set the brushes accordingly. This method is wrong in cases where the mica and commutator bars vary in thickness, thereby giving a variation in the distance between the brushes, although the amount may be small it is nevertheless a fact. Now with regard to undercut mica, may I say that on a certain plant abroad I had over 100 motors, and after rectifying faults as stated above, I resorted to cutting down the mica on all machines, and in every case except one the experiment proved a great success, and fully justified my anticipations.

I may say that I cut the mica down 1/16 in. and insulated each section with a coating of very thin shellac, and it proved a greater success than any paste or filling that is used on such occasions.

With regard to the machine that did not prove a success, but certainly not worse, I may say it was a 20-H.P. motor, and had a great number of sections on the commutator, and we also had trouble with the oil creeping on the shaft and commutator.

Trusting these few remarks may be helpful to your readers, although it seems like treading over old ground, I should like to read other opinions on this subject.

Thos. R. Yearsley.

Birkenhead, *December 2nd*, 1918.

Referring to the correspondence in your November 29th issue on undercut commutators, I should like to give my experience, in the hope of helping on the great work.

I may claim to have a wide experience of all types of motors, such as tramway, crane, lift, workshop, and central stations, &c., and I have found in all cases that undercutting is beneficial, provided the slots are not too deep, because this allows an accumulation of carbon and grease which tends to put a short on the segments.

My worst experience was in a gas-engine station, where the fumes from the exhaust pervaded the engine-room, and played havoc with the windings and segments; I say windings because repeatedly we found an accumulation of dust behind the lugs, which seemed to absorb the gases, and caused a low-resistance fault between windings, and as the distances between windings and segments are appreciably smaller, the short soon took up the path of least resistance, viz., segments. We tried covering the lugs with stout shellacked canvas, but the result was not much better, and I firmly believe, sir, that the secret of success lies with the designer, who *must* study the conditions under which the machine is to work, viz., gas-engine station, flour mill, carbon works, &c., if, initially, the machine costs more it would pay in the long run. I would write more, but I think enough space has been taken up. Wishing you every success.

W. Parker,
Charge Engineer, Portsmouth Corporation.

Portsmouth, *November 30th*, 1918.

LEGAL.

The Fleming Valve.—Petition for Prolongation of Patent.

In the Chancery Division, on December 4th, Mr. Justice Sargant commenced the hearing of a petition, in the matter of Fleming's patent No. 24,850, of 1904, for prolongation of the patent.

Mr. J. Hunter Gray, K.C., and Mr. R. Moritz appeared for the petitioners; Mr. H. A. Colefax, K.C., and Mr. J. Whitehead for the British Thomson-Houston Co., Ltd., and others; Mr. Courtney Terrell for the De Forest Co., and Mr. T. Terrell, K.C., Mr. D. M. Kerly, K.C., Mr. Austen Cartmell and Mr. J. Whitehead for the Crown.

Mr. Gray said the invention was an instrument for detecting oscillations produced by energy generated some distance away in the form of Hertzian waves. The invention related to certain new and useful devices for converting alternating electric currents, and especially high-frequency alternating electric currents, or electric oscillations into continuous electric currents for the purpose of making them detectable by and measurable with ordinary direct-current instruments. Having read the patentee's claims in his specification, Mr. Gray said that the six opponents to the petition of prolongation of the patent were the Automatic Telephone Co., Ltd.; the British Thomson-Houston Co.; Creed & Co., Ltd., the Indo-European Telegraph Co., Ltd., Siemens Bros. & Co., Ltd., and the Western Electric Co., Ltd. These opponents alleged that there was no subject matter in the patent in question; that the invention was not of sufficient merit; that the petitioners had been amply rewarded for any ingenuity of labour or money they might have expended in respect of the invention; that the petitioners had had ample time and opportunity of putting the alleged invention into practical use on a commercial scale, and if they had not been adequately remunerated that was due to the petitioner's want of diligence, and, further, that the alleged invention was not useful. By clause 7 of the particulars of objection they admitted none of the allegations of the petitioners, and they traversed certain of them. Counsel, proceeding, said the petitioners alleged that the Fleming valve enabled signals to be received with certainty at distances much greater than was possible with any previously known detector, and it was now, and had been, some years in universal use all over the world for long-distance signalling; the Fleming valve had proved a more reliable and sensitive detector of wireless signals than any other, and its sensitiveness, unlike that of most detectors, was not impaired temporarily by violent atmospherical discharges, and thus its introduction marked an epoch in the development of long-distance wireless telegraphy, as it had led to the practical elimination of atmospherics, the magnification of signals, and new methods for the production of continuous waves.

The first witness called was Mr. John St.V. Pletts, chief of the patent department of the Marconi Co. He said that the magnetic detector came in in 1902, and it very rapidly displaced the coherer, which was very easily affected either by atmospherics or by one's own transmitters in the same stations. The magnetic detector still remained on many ships to-day. His company put the Fleming valve in ships because it was a more sensitive receiver, and it probably would have displaced the magnetic more rapidly had it not been that it was frequently burnt out by the operators using the filament at too high a pressure. He did not think that grid Fleming valves were put on board ship before the war. He knew of no other invention in connection with wireless telegraphy other than the 7777 that was so important. Great strides had been made since the

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war in wireless methods and apparatus, and he did not think any of them would have been possible without the Fleming invention.

Cross-examined by Mr. Colefax, witness said that by Fleming valve he meant a valve which rectified by means of electrons. Before Fleming there had been no disclosure of the idea of using this valve, and that was an absolutely novel idea at the date of the patent.

(To be continued.)

Workmen's Compensation.

At the Bow County Court, on Friday, before his Honour Judge Graham, K.C., and a jury, Thomas Edward Knight, of 17, Cooper Street, Canning Town, sued the Charing Cross, West End, & City Electricity Supply Co., Ltd., to recover £300 damages for personal injuries, under the Employers' Liability Act, owing to an alleged defect in the plant.

Mr. Moyses appeared as counsel for the plaintiff, and Mr. Wickham, barrister, for the defence.

The plaintiff's case was that he was employed as a boiler scaler, and on June 20th, in the morning, asked for a brush and pail for his work. This was not forthcoming, so he went out on top of the boiler to fetch it. At that moment one of the tubes burst—they were water-tube boilers—in a boiler 50 or 60 ft. away, with the result that in trying to grope his way to safety in the blinding steam he fell off the boiler to the concrete floor below, a distance of 24 ft. He was very seriously injured, and had not recovered since. A juryman desired to know whether the insurers of the boiler had anything to do with defending the action, and whether the firm had had a number of similar accidents, but Judge Graham ruled that the questions were not permissible. The plaintiff said there were many men employed there who knew nothing at all about a boiler when they were engaged. He had no knowledge that three men and two mates were kept specially for the testing of these tubes. Had there been a guard on the boiler he could not have fallen off. He disagreed with counsel that he could not have been at his work to have been outside, as he had to go there to fetch his brush.

A mass of evidence was called for the defence to prove that every care that was humanly possible was taken to prevent such an accident, by testing, and the Board of Trade's most stringent regulations were fully carried out.

The jury gave a verdict for the plaintiff for £75 damages. Judgment was entered accordingly, with costs.

Electricity Supply in Cork.

In the King's Bench Division of the High Court of Ireland, before Mr. Justice Kenny, in the case of Meagher and Hayes *v.* the Cork Electric Tramways & Electric Lighting Co., Ltd., Mr. J. F. Burke applied, on behalf of the plaintiffs, for leave to deliver interrogatories to the defendants. Counsel explained that the action was brought to recover £101 8s. 5d., being the amount of overcharge paid by the plaintiffs, under protest and without notice, for a supply of electricity, contrary to the provisions of the Electric Lighting Act, 1882. The plaintiffs believed that electricity had been supplied to others in the same area on reduced and preferential terms, and they wished to administer interrogatories on this subject.

It was stated that the interrogatories had not been drafted, and Mr. Justice Kenny said the application could be renewed when that had been done.

Isaacs *v.* Hobhouse.

The hearing was concluded on December 5th in the Court of Appeal, consisting of Lords Justices Bankes, Warrington, and Scrutton, of the case of Isaacs *v.* Hobhouse, upon the application of the plaintiff, Mr. Godfrey Charles Isaacs, the managing director of the Marconi Wireless Telegraph Co., for a new trial of the action which was tried before Mr. Justice Darling and a special jury in July last.

Mr. Isaacs brought the action to recover from the defendant, Sir Charles H. E. Hobhouse damages for alleged libel concerned with the Marconi contracts for the construction of Imperial wireless telegraph stations.

The trial, which lasted eight days, resulted in a verdict and judgment for Sir Charles Hobhouse, and from this decision Mr. Isaacs now appealed, upon the grounds following: (1) Misdirection; (2) unsatisfactory conduct of the trial by Mr. Justice Darling; (3) wrongful exclusion and inclusion of evidence, and (4) surprise.

Mr. J. A. Hawke, K.C., Mr. Stuart Bevan, and Mr. Hildesley appeared in support of the appeal; and Mr. Douglas M. Hogg, K.C., and Mr. Eustace Hills for the respondent.

At the conclusion of the arguments of counsel for the appellant, and without calling upon counsel for the respondent, their lordships dismissed the appeal, with costs, holding that there had been no such misdirection by Mr. Justice Darling as would justify the Court in setting aside the verdict of the jury. They also held that the appeal failed upon the other grounds enumerated in the notice of appeal.

A stay of execution with the view to an appeal was refused.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Northrup-Ajax High-Frequency Induction Furnaces.

The Pyrolectric Instrument Co., 636-640, East State Street, Trenton, N.J., is now marketing the Northrup-Ajax high-frequency induction furnace, to which we drew attention some time ago, which is adapted in small units for laboratory use and scientific investigations. These furnaces present a radical departure from the usual furnace practice and embody the first employment of oscillatory current for the generation of heat. By reason of the possible induction without the interlinkage of an iron magnetic with an electrical circuit, currents can be set up in the containing crucible in the case of a non-conducting melt, or in the melt itself if this has sufficient conductance to permit the flow of currents. No iron is employed for the concentration of magnetic lines of force. The furnace is intended for single-phase operation, and the thermal efficiency is said to range from 40 to 60 per

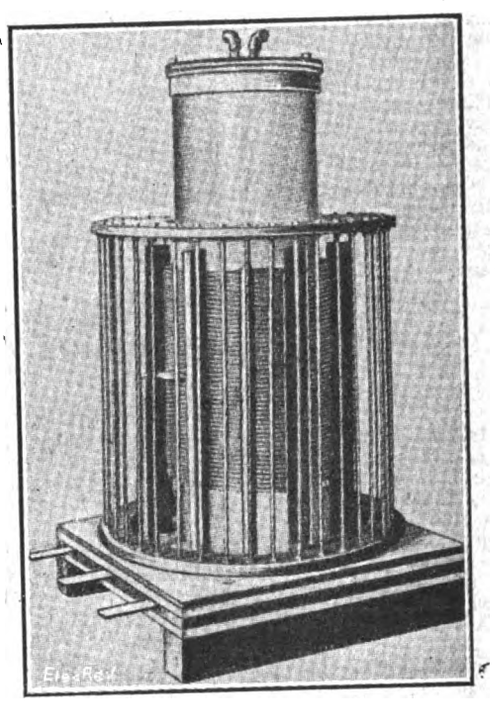

Fig. 1.—Northrup-Ajax High-frequency Induction Furnace of the Standard Vacuum Type.

cent. of the power input at the switch terminals. The complete equipment includes the following parts, some of which are omitted on the smaller size of furnace: Switchboard, series reactance with tap-off points, one shunt reactance, one transformer with windings for primary voltage of 110 or 220 volts, condenser units, condenser rack, mercury discharge gap with alcohol dropper and mercury adjuster, furnace, and a set of heavily insulated cables leading from the oscillatory system to the furnace. The furnaces may be used for the heat treatment of metals, for making special alloys, for melting glass and non-conducting materials, for producing temperatures above 1,400 deg. C. without the presence of carbon being essentially associated with the operation of the furnace, for producing higher temperatures under controllable conditions of vacuum or pressure and nature of atmosphere, or for other like uses. They are made in five sizes: 6-, 8-, 12-, 16-, and 20-kw. capacity.

A Combined Electric Heater and Cooker.—With reference to our notice of this device in these columns last week, we understand that the B.E. Co. (of London and Birmingham), Ltd., 410, Mansion House Chambers, Queen Victoria Street, London, E.C. 4, acts as London agents for this device, and carries stocks of all styles and voltages both at the London and Birmingham stores.

For Disabled Soldiers.—There has been issued by the Ministry of Pensions, Westminster House, Millbank, S.W. 1, a most useful series of little pamphlets in which full pension and other particulars are given in handy form. An illustrated one, written by Major R. Mitchell, C.B.E., on the advantages of training for a future career, contains the testimony of a number of disabled men who have been satisfactorily trained for successful work in electrical and other directions. "The Disabled Soldier's Handbook, 1918" (32 pages), given to every man on his discharge, is a useful guide to a host of matters.

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BRITISH-MADE A.C. METERS.

By H. COBDEN TURNER.

With the cessation of hostilities, we may expect a return of the competition between British and foreign meters, perhaps not in this country, but assuredly in the Colonies and Neutral Countries. The following results of tests and deductions therefrom may not, therefore, come amiss at this time.

It is probably not generally known that the British-made induction motor meters, as contrasted with the Continental meters—chiefly German and Swiss—fall into quite a different class, by reason of a fundamental difference of design—namely, the disposition of the series and potential coils.

A.C. meters of British origin have, with one exception, separate magnetic cores for the fluxes produced by the pressure coil and the series coil. This is not generally the case in meters manufactured on the Continent, where, with one exception, they possess only one core for both series and shunt fluxes. This core has three limbs—the outer two generally being wound with shunt coils and the middle one with a series coil. The fluxes are led through the disk by means of an iron keeper on the reverse side of the disk. Meters of the latter construction do not stand overloads well, and, in fact, are generally unsuitable for any condition other than the normal one for which they were calibrated.

Two typical forms are shown in attached sketches figs. 1 and 2. The obvious result is that home-made meters are, almost without exception, larger, and, consequently, heavier, than Continental meters, but, in electrical performance, the British method by far excels the other.

The following table shows the comparative results obtained on various well-known meters with variations of voltage. The first four are British and the last four Continental:—

With 50 % Increase of Pressure.

British.		*Continental.*	
A ...	− ½ %	W ...	− 16 %
B ...	− 3 %	X ...	− 16 %
C ...	− 3 %	Y ...	− 3 %
D ...	− 3 %	Z ...	− 30 %

With 50 % Decrease of Pressure.

A ...	− 0	W ...	− 3 %
B ...	+ 1 %	X ...	+ 3 %
C ...	+ 1 %	Y ...	+ 1 %
D ...	+ 3 %	Z ...	+ 20 %

− sign represents that the meter was running slow.
+ means fast.

Similarly with variations of frequency:—

With 40 % Increase of Frequency.

A ...	− 3 %	W ...	+ 1 %
B ...	− 1 %	X ...	+ 5 %
C ...	− 6 %	Y ...	− 2 %
D ...	− 5 %	Z ...	+ 8 %

With 40 % Decrease of Frequency.

A ...	+ ½ %	W ...	− 10 %
B ...	− 3 %	X ...	− 33 %
C ...	+ 1 %	Y ...	− 15 %
D ...	− 4 %	Z ...	− 47 %

With 40 % Increase of Frequency—P.F. 0·5.

A ...	+ 3 %	W ...	+ 8 %
B ...	+ 4 %	X ...	+ 21 %
C ...	+ 5·2 %	Y ...	− 3·0 %
D ...	− 5·8 %	Z ...	+ 15·7 %

With 40 % Decrease of Frequency—P.F. 0·5.

A ...	− 12 %	W ...	− 22 %
B ...	− 12 %	X ...	− 87·5 %
C ...	− 14 %	Y ...	− 26·6 %
D ...	− 25 %	Z ...	− 71·8 %

The figures are based on variations at half-load.

It might be opined that these variations are severe, but the purpose in this was to accentuate the errors, which will be proportional for small and more ordinary conditions of change. Also, small changes of wave form, such as are found to occur in ordinary practice, are quite comparable with large changes of frequency, seeing that they are caused by the presence of the higher harmonics.

Comparison of Construction.

Terminals.—In the terminals and connections from the terminals, and in the gauge of wire used for the various coils, it will always be found that the British-made meters are more liberal in section than the Continental.

Cases and Covers.—These on British meters are generally of pressed steel or cast-iron, giving a protection to the meter from external fields such as is not acquired by means of the jointed spelter or zinc covers used on the Continent.

Watt Consumption.—In this respect the two types are approximately equal, as the following figures will show:—

Shunt-coil Losses.

A	1·4 watts	W	2·4 watts
B	1·4 „	X	1·5 „
C	1·5 „	Y	1·2 „
D	2·5 „	Z	1·2 „

Torque.—As regards the torque developed, either type can, of course, be made to give practically any value of torque by increasing the number of turns on the series coil, increasing the air gap in the shunt magnetic system, placing the motor system a greater distance from the centre of the disk, &c.; but the limiting factor is the brake magnet, because it is an axiom of A.C.-meter design that the speed of the disk should not exceed 50 R.P.M.

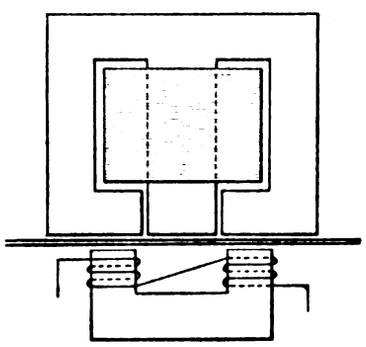

Fig. 1.—British Type.

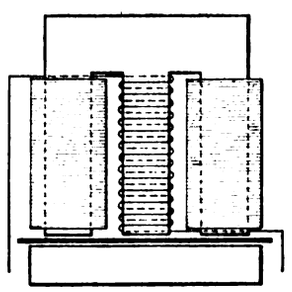

Fig. 2.—Continental Type.

In other particulars no sharp difference between the two makes can be defined. Prevention of shunt-running is obtained variously by provision of holes in the disk or by means of the attraction of the permanent magnet for a particle of iron inlet in the disk, or a piece of iron wire extended from the spindle. Similarly, better values of starting current and registration on low loads are obtained by causing the shunt leakage flux to be laterally unbalanced by a variety of means.

New Electrostatic Separator.—The principal feature of the Bibolini-Riboni separator is in the form given to the electrostatic field. This field is generated by a number of electrified cylindrical polar surfaces arranged in parallel groups, situated at different levels. Each one of these cylinders, considered together with the polar plane facing it, generates an element of the electrostatic working field, and is intended to operate on a portion of the triturated mineral (mixed with a number of other minerals and gangues) which is either passed across it by a conveyor band moved at a uniform speed and sliding on the induced polar surface, or is allowed to gravitate on to the plane polar surface, suitably inclined and prepared. The crushed ore is fed into the transporter (or on the plane polar surface) by as many feed buckets as there are electrifiers in a group on one level, and thus forms on the belt or on the pole which receives it as many bands of constant thickness and breadth as there are separating units. The action of each unit on this band of material is to project in a direction lateral to the axial plane of its own field, the granules forming the mineral mixture. During this operation separation is effected in that one or a number of qualities of the granular constituents of the mixture tend to keep in the central zone of feed, while the others are projected into the zones lateral to this central zone. The products thus separated are treated similarly in the other stages lower down, until separation is complete. To graduate the process the apparatus is provided with several devices which constitute special features of the method: *e.g.*, it is possible (1) to vary the geometric shape of each electrostatic field element by varying the curvature of the electrifying units and their position relative to the polar surface opposite; (2) to vary the conductivity of the plane pole; (3) to vary the period of electrification by varying the speed of the conveyors and the angle of the surface of descent of the granules.—*L'Industria.*

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BUSINESS NOTES.

The Christmas Holidays.—We shall be glad if our readers will take note that, owing to the Christmas Holidays, the Electrical Review for December 27th will have to be printed two days earlier than usual. All matter intended for that issue, whether editorial or advertisement, should be in our hands at the earliest possible moment. From a notice appearing elsewhere in our pages to-day, it will be observed that all new advertising copy and alterations to existing displayed advertisements must be received here not later than the morning of Friday next, December 20th. Official Notices and small prepaid advertisements can be received up to the following Tuesday morning.

Activity of Foreign Firms in Denmark.—H.M. Commercial Attaché at Copenhagen emphasises the importance of British firms preparing at once for the competition they will shortly encounter in Denmark. A number of Danish firms have inquired from him whether there would be any possibility of placing orders with British firms now for goods to be delivered after the conclusion of peace. They state that foreign firms are canvassing for orders to the detriment of British industries. The firms who have approached him have previously bought their requirements from British firms, and they are loath to pass their orders to other countries, should there be a reasonable chance of obtaining supplies from the United Kingdom within a reasonable period. He suggests that the question be considered whether British firms would not be well advised to book orders for delivery so soon as conditions permit. In the present circumstances, where neutral markets are bare of goods, merchants are anxious to place orders, even though they realise that considerable time may elapse before they can be executed. Some foreign houses appear readily to accept such orders, with the result that the merchants in many cases, having once placed orders in those countries to cover their requirements, these are lost—for the time being, at any rate—to the British market.—*Board of Trade Journal.*

Export Prohibitions.—A further list of relaxations in export prohibitions, announced by the Board of Trade to take effect as from to-day, appeared in the *Board of Trade Journal* for December 5th.

Indian Government Contracts.—The Report of the Public Works Department Reorganisation Committee in British India contains important material to United Kingdom firms which have been executing contracts for the Indian Government. It deals with the present system of purchasing stores through the India Office, and advocates that greater latitude shall be given to Public Works officials in obtaining material in India. The tendency will be more and more to cut away from the London connection, and to call for more and more tenders in India. If British manufacturers are to continue to retain the same proportion of these public orders as they have secured in the past, says the *Board of Trade Journal*, they will be obliged to open their own branches in India and operate them with a trained staff, and also—in the case of manufacturers of large plant—with a competent erecting staff.

The Report may be consulted by interested British firms at the Inquiry Room of the Department of Overseas Trade (Development and Intelligence).

Tasmanian Electrolytic Zinc.—At Risden, Tasmania, the Electrolytic Zinc Co. is producing 90 tons of high-grade zinc weekly.—*Times.*

The "Paragon" System in France.—Capt. Lucien Fialon, the representative for France and the French Colonies of the "Paragon" inventions of Mr. W. P. Durtnall, was awarded the Croix de Chevalier de la Legion d'Honneur on July 10th last. Capt. Fialon was one of the first Continental engineers to investigate the merits of Mr. Durtnall's system, and is about to apply the "Paragon" internal combustion cycle to large 7-ton commercial lorries, &c.

Reconstruction Problems.—Two more of the series of pamphlets on reconstruction problems have been published (2d. each) by the Ministry of Reconstruction. No. 6, entitled "Raw Materials and Employment," shows how the supply of raw materials is a fundamental point in the work of demobilisation, resettlement, and industrial revival. It covers briefly the bearing of the question on metal industries, textile industries, and the boot and shoe industry, timber, paper-making, &c. The importance of preventing a general scramble for available supplies has led the Government to the conclusion that there must be some measure of Government control or supervision, and the Departments that have been chosen to exercise this control and to arrange for distribution through trade organisations—Industrial Councils or Committees in each industry—are described. Pamphlet No. 7 is a "Guide to Work and Benefits for Soldiers and Civil War Workers." The part relating to the fighting forces, deals with such matters as gratuities for service, "how to get a job," out-of-work donation, a Bill to be introduced giving State assistance to apprentices whose training has been interfered with by the war, openings in the Civil Service, training, civil liabilities, and grants to one-man businesses which have been closed but not given up. The remainder of the pamphlet relates to munition and other war workers.

Australian Copper Wire Works.—It is reported from Newcastle, New South Wales, that an English company, with £5,000,000 capital, intends to establish works for smelting copper and the manufacture of copper wire.—*Times.*

Samples of Foreign-Made Goods.—The Exhibition of samples of foreign-made goods received from various parts of South and Central America, which was held in Birmingham from November 27th to 29th, has proved very successful. This Exhibition was organised by the Department of Overseas Trade with the co-operation of the Birmingham Chamber of Commerce. The number of firms, or representatives of firms, who inspected the samples during the period of the Exhibition was 925.

Many of the articles exhibited were new in design, and represented selling lines in the South American markets.

A similar Exhibition is being held in the Cutlers' Hall, Sheffield, closing to-morrow.—*Board of Trade Journal.*

Book Notices.—*Decimal Educator.* Vol. I, No. 2. December, 1918. Pp. 32. London: The Decimal Association. Price 1s.—It is a pleasure for us to welcome the second issue of such an excellent pamphlet, which is voicing a keen desire which has always been expressed for the general use of decimal currency and metric weights and measures. We cannot do better than hope that it may meet the same fate as its predecessor—a wholly satisfactory one. The current number maintains the same high standard as the previous one, and we note an improvement in that it is printed in larger type. It contains an account of the general meeting of the Association, and the new rules which were then adopted. The progress that has been made by the Royal Commission on Lord Southwark's Decimal Coinage Bill is also recorded, and articles appear on the following subjects:—"The Adoption of the Metric System," "The Teaching of Decimals," "British Trade After the War," "Measurements in Engineering Works," and other interesting matter. To those who contemplate possessing themselves of a copy we would recommend early application. Judging by the demands that, we understand, were made for the previous issue, the present one will be out of print as quickly as, if not quicker than, its predecessor.

Pitman's Mechanics' and Draughtsmen's Pocket Book. By W. E. Dommett. 1918. Pp. viii + 127. London: Sir Isaac Pitman and Sons, Ltd. Price 2s. 6d. net.—This pocket book has been drawn up with a view to the requirements of mechanics, foremen, draughtsmen, and similar grades who have to use tables and occasionally to employ the more general mathematical problems in the course of their work. The notes and diagrams are not intended to take the place of text-books, but they will be found of use together with the tables, particularly those at the latter end of the book, to act as a means for refreshing the memory when necessary.

A New Theory of the Steam Turbine. By H. M. Martin. Reprinted from *Engineering.* Pp. 22; 10 figs. London: *Engineering.* Price 2s. 6d. net.—The rapid development of the steam turbine has been largely attributable to the circumstance that, from the standpoint of thermodynamics, it is a much simpler form of prime mover than the reciprocator. With the steam turbine theoretical considerations are more directly applicable, and a fairly reliable estimate can be made of the probable performance of most types of turbine of which the drawings are available. Nevertheless, experience disclosed some remarkable anomalies, some of which have not, until recently, been elucidated. One of the most disconcerting was the well-established experimental result, that under certain conditions the weight of steam discharged from a nozzle was actually greater than what was physically possible according to the then accepted theory. The anomaly was attributed to a fundamental error in the accepted theory of the efflux of steam. That theory assumed that the expansion of wet steam normally proceeded under conditions of thermal equilibrium, although the falsity of that hypothesis was definitely proved as far back as 1880. The author of the articles before us gives what appear to be very strong reasons for believing that another great outstanding anomaly in steam turbine engineering is to be traced to the same error. Actual experience, in short, affords much weighty evidence in favour of the view that so far from the steam being in thermal equilibrium in the "saturated field" of the Mollier diagram, it never is in thermal equilibrium until the condenser is attained. The relation between volume and pressure during the expansion of wet steam is accordingly never the same as if thermal equilibrium were established. The author endeavours to show that if his interpretation of Wilson's results be accepted, both superheat and vacuum corrections can be rationalised, whilst the contrary view involves wide discrepancies between theory and practice.

"The Manufacture of Aluminium." By J. T. Pattison. 1918. Pp. viii + 104; 18 figs. London: E. & F. N. Spon, Ltd. Price 7s. 6d. net.

"The Craft of Thy Caduceus." By "Exact Thinker." London: 6, Walton Place, S.W. Price 5s.

War Risks: Cargo Insurance.—On December 9th the granting of fresh insurances on cargo against war risks by the War Risks Insurance Office was discontinued, except in special cases. It is the desire of the Government to restore as quickly as practicable the normal conditions of the insurance market.—*Board of Trade Journal.*

Trade Announcement.—I. A. Timmis & Son.—The Government having requisitioned their premises, the firm's temporary address is now 16, Eaton Square, Westminster, S.W.1. Telephone: Victoria 481.

Siemens in Australia.—A Melbourne newspaper stated, early in October, that branch offices of Siemens Brothers' Dynamo Works, Ltd., in Melbourne and Sydney had been reopened for trading. "By the action of the British Government, the German interest has been completely eliminated from this company, and the Australian Government has removed the embargo against its operating in the Commonwealth."

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Foreign Trade.—The November Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures :—

Imports.	November, 1918. £	Inc. or dec. £	11 months, 1918. Inc. or dec. £
Electrical goods ...	90,506	− 32,561	− 245,471
Machinery	1,026,811	− 2,699	+ 1,735,110
Exports.			
Electrical goods, &c. ...	144,313	− 64,904	− 856,799
Machinery	1,211,690	−290,785	− 3,318,340

"Z" Lamp Club.—A social and athletic club has been formed for the staff and workers of the "Z" Electric Lamp Manufacturing Co., Ltd., at Southfields, S.W. We have received a copy of the fixture card of the football section, which last week played a match, resulting in a draw, with the "Magnet" Football Club, as mentioned below.

Football Notes.—On Saturday last a football match, resulting in a draw (2—2), was played at Dulwich between the Magnet F.C. and the "Z" Electric Lamp Manufacturing Co. The "Magnets" were the first to score through a good shot by Terrett, but soon after Driver ran through, and scored for the "Z's," and a few minutes later registered his second goal with a fine shot; just before half-time, however, Dyke equalised for the "Magnets." The second half was very evenly contested, and there was no further addition to the score.

Liquidations.—English Electrical Co., Ltd.—This company is winding up voluntarily, with Mr. J. B. Brent, of 3, Abchurch Yard, E.C., as liquidator. Meeting of creditors December 16th.

Chester Engineering Co., Ltd.—Winding up voluntarily. Liquidator, Mr. S. Cole, of Sardinia House, Kingsway, W.C.

New Electrical Finance Company.—Mr. C. S. Colton, for many years export manager for the British Westinghouse Electric and Manufacturing Co., Ltd., has transferred his activities to a new field of enterprise, having recently taken up the position of managing director of the Aabada Trust, Ltd. This company, which was established in 1912, undertakes the finance and construction of public utility works, electrical apparatus, inventions and designs, and general engineering propositions. Mr. Colton has secured for his organisation an expert technical staff, comprising the well-known firm of Messrs. Alfred Dickinson & Co., as consulting engineers, and Mr. J. W. Towle, M.I.E.E., as chief of the company's engineering staff. Mr. Towle was formerly superintendent for the Metropolitan District Railway and the London Electric Railways, and chief engineer to Ebro Irrigation Power Co., of Barcelona. Amongst the new enterprises which Mr. Colton hopes to put on the market immediately is the Aabada dry battery.

German Share Quotations.—It is now possible to give a comparison of the quotations for the shares of a few of the leading German manufacturing companies, as represented by the situation at the end of July, 1914, the end of June, 1918, and in November, 1918. The final making-up prices on the Berlin Exchange before the war were settled on July 31st, 1914, and although the publication of quotations has been forbidden in the meantime, and no official transactions have been permitted, business was done in what is termed an "open market." The accompanying table shows the official prices on the Berlin Exchange on July 31st, 1914, whilst the figures for the two other dates are those which were either quoted in the open market or made up on the day in question :—

	Quotations on July 31st, 1914.	June 30th, 1918.	Nov. 7th, 1918.
Berlin-Hagen Accumulator Co.	252·00	410·00	247·50
A.E.G.	210·00	249·10	223·50
Bergmann Electricity Works...	90·00	216·50	173·00
Schuckert Co.	118·75	164·25	142·00
Siemens & Halske	192·00	239·10	211·00

The par value is 100 in each case. It will be observed that an extraordinarily large rise took place down to and including the period of the German offensive early this year, the figures on June 30th being the maximum attained during hostilities. Later on, however, the quotations crumbled away, and the prices given for November 7th are those which were made up on that day, for the last time prior to the revolution.

New Company in Spain.—Under the style of Auxiliar de Explotaciones Electricas, Compania Anonima, has been formed at Bilbao a company with a capital of 30,000 pesetas, for the manufacture, purchase, sale, and representation of all kinds of electrical machinery and accessories.

New Companies in France.—La Société le Materiel General Electrique is the name of a new company which has lately been formed in Paris (15, Rue des Petits Hotels), with a capital of £19,200, to carry on business as electrical engineers.

Under the ægis of a number of leading French motor-car manufacturers a company has lately been formed in Paris, with the title La Société Francaise des Appareils Delco, to acquire and exploit the exclusive manufacturing rights in the Delco (American) electric lighting and engine-starting sets in France and the French Colonies.

Catalogues Wanted.—The Cark and District Electric Supply Co., Ltd., of Flookborough, Cark-in-Cartmel, Lancs., desire to receive catalogues of wiring supplies, small country house plants, and electrical supplies generally.

Exports to China.—The *London Gazette* for December 10th contains a further list of persons and bodies in China to whom exports may be consigned.

New Swedish Electrode Company.—The Aktiebolag Elektrod is the title of a new undertaking which has lately been formed in Falun, with a maximum capital of £55,500, to manufacture electrodes in accordance with the patented process of C. W. Soderberg.

Australian Industrial Development.—A certain amount of industrial and manufacturing development in the Commonwealth was disclosed by the Commonwealth Treasurer in his Budget speech. At the beginning of 1916 the issue of capital by companies became subject to Treasury control under the war precautions regulations. Since that time the applications received number 4,347 and the capital authorised amounts to £50,585,000, of which £30,099,000 was capital permitted in relation to "manufacture and production." The detailed figures include manufacture of foodstuffs, £4,163,000; iron and steel works and smelting and treatment of metals, £4,156,000; gas and electric light, £1,781,000; engineering and metal working of all kinds, £1,560,000; rubber goods, £1,196,000; apparel and textile manufacture, £932,000; lime and cement production, £858,000; tanning, wool scouring, and spinning, £723,000; drugs and chemicals, £368,000; paint manufacture, £436,000. Under the heading of other manufacturing and producing industries capital to the amount of £3,288,000 was included.—*Melbourne Age*, October 3rd.

Australian Copper Industry.—According to a Melbourne newspaper just to hand, the outlook in regard to Australian copper industry was seriously regarded at the end of September. In view of the fact that the price of copper in America was £140 a ton, Mr. Blakeley (N.S.W.) asked the Acting Prime Minister in the House of Representatives to enter into negotiations with the Allies for the sale of the products of Australian copper mines after the expiry of the present contracts with Great Britain. The Acting Prime Minister said he would not like to promise that. The Government thought that in the past it had been acting in the best interests of the Allied Forces when it had sold to Great Britain the output of such minerals as lead, zinc, copper, and certain other metals. The Government had all the time been conscious that in certain cases the prices ruling in the open markets of the Allies had been higher than the contract prices, but it had been considered advisable to sell to Great Britain even at some slight disadvantage to Australian producers, rather than sell outside. He could name metals in regard to which the American prices were higher than the prices at which Australian metals had been sold to the British Government. The Americans dominated the copper position, but it was not so with other metals. The Prime Minister had recently had the greatest possible difficulty in securing a renewal of the contracts even for six months. He would communicate with Mr. Hughes, to see whether it was not possible to extend the contract or to obtain more favourable terms. Unless something were done, some of the mines would be affected at the end of October, and the Government would have to make some arrangements for financing them. If the Government was not able to extend the contracts on some decent, favourable terms, he realised that there would be a greater danger facing the great copper industry of Australia.

Ministry of Munitions Orders Revoked.—The Cranes Order, 1916, and the Motor Engines and Vehicles Order, 1917, have been revoked.

Relaxation of Priority for Government Work.—The Minister of Munitions hereby gives notice that all uncompleted contracts for the Admiralty, War Office and Ministry of Munitions which have been placed in Classes A or B, including the various grades thereof, P 1, P 2, P 3, P 4, P 5, P 6, under the Order as to Priority of March 8th, 1917, need no longer be given the priority attaching to them under the Order, except in cases where the contractor is notified in writing or by official notice in the Press that a particular classification is still required to be given to any particular contract.

Contractors must notify the ordering Departments of the Admiralty, War Office or Ministry of Munitions responsible for the contracts in question, of any modification of the original date of completion resulting from this relaxation of the Order as to Priority.

Mr. Barnes and Nationalisation.—In one of his recent speeches to Glasgow electors, Mr. Barnes said he looked forward, as the result of nationalising railways, to an immense stimulus to this country's industries, and along with it, he believed, they ought to develop the canal system to a much greater extent than hitherto. As soon as possible the national workshops should be led on to the making of rails, locomotives, and all that was necessary to run railways into undeveloped parts of the country, and thus bring produce into the market at a cheaper rate. The nationalisation of railways and canals would be one of the main things to put industry into a better position than ever. He also hoped that national factories would be retained as far as possible for productive work for peace as they had been used for war. They should be speedily turned to all sorts of things necessary for housing, for railways, and for the equipment generally of Government enterprise.

French Foreign Trade.—Last month, says the *Times*, M. Clémentel, French Minister of Commerce, laid before the Chamber a Bill dealing with the reorganisation of the nation's foreign trade. The number of commercial attachés abroad is to be increased.

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LIGHTING AND POWER NOTES.

Accrington.—Year's Working.—The income of the Corporation electricity department for the year ended March 31st, 1918, was £41,127, compared with £35,775 in the preceding year; the expenditure was £27,743, against £34,064. Capital charges absorbed £10,929, against £11,242, and the net profit for the year was £2,777. The undertaking is now indebted to the rate funds to the extent of £21,724. Units generated totalled 7,777,745, and 6,459,900 were sold, including public lighting, 19,689; private lighting, 370,794; tramways, 816,884; power, 4,539,217; and Haslingden bulk supply, 560,880. The supply to Haslingden was at ·74d. per unit, against 823,005 units at ·7d. in the previous year. The working cost per unit sold was 1·03d., against 1·14d., and the total cost, 1·44d., against 1·516d.; the average price obtained was 1·44d., against 1·1d. During the year the number of consumers decreased from 1,457 to 1,429.

Armagh.—Strike.—The supply of electricity was suspended last week, owing to a strike at the electricity works.

Belfast.—New Generating Station.—At a meeting of the Electricity Committee, last week, it was stated that plans for the new generating station were nearly completed, and the Committee expected to be in a position to invite tenders for the erection of the new buildings at an early date. With a view to laying out the distribution system to the best advantage, prospective customers have been asked to communicate with the electrical engineer, and the data so obtained would enable the substations to be placed in the best positions. The Corporation was under obligation to supply a further 20,000,000 units per annum, and it was expected that in two years' time the annual output would not be far short of 50,000,000 units. A breakdown of one of the turbines was reported, and an inquiry is being held into the matter.

Bexhill.—Price Revision.—The T.C. has abandoned the maximum demand system of charging for electricity and adopted a flat rate. For power the rate is to be 2d. per unit, and in all cases a special war charge of 25 per cent. is to be charged.

Blackburn.—Price Increase.—The charges for electricity for all purposes are to be increased by a further 15 per cent. from January 1st next.

Bolton.—New Mains.—The Corporation has received the sanction of the L.G.B. to borrow £1,500 for the laying of a main between Back-o'-th'-Bank generating station and the Duncan street sub-station.

Bury.—Year's Working.—For the year ending March 31st, 1918, the working of the Corporation electricity undertaking resulted in a net profit of £1,626, against £2,668 in the previous year, of which £626 was transferred to the reserve fund and £1,000 to the relief of rates. The revenue totalled £50,776, against £46,596, and the expenditure amounted to £33,674, against £29,447. The number of units sold during the year was 14,544,937, against 13,971,547, and included private lighting, 500,702, against 523,480; public lighting, 12,733, against 11,044; power and heating, 8,650,324, against 8,714,355; bulk supply, 3,667,603, against 3,054,194; and tramways, 1,712,752, against 1,665,652. The maximum load was 5,152 kw., against 5,027 kw., and the load factor, 32·4 per cent., against 31·7 per cent. The generating cost per unit was ·555d., against ·506d., and the total cost, ·810d.; the average selling price was ·837d. The cost of coal increased from ·281d. per unit to ·31d. During the year, £3,034 was expended on the Chamber Hall power station and £851 on new mains and transformers. Since the inauguration of the undertaking, £11,500 has been transferred to the borough fund. Owing to the fact that the largest generating set was out of use for four months, the fuel consumption per unit increased from 2·95 lb. to 3·11 lb.

Chertsey.—Price Increase.—The B. of T. has agreed to the application of the E.S. Co. to increase its charges from 7d. to 8d. per unit, from January 1st next.

Croydon.—Wages.—The Electricity Committee has received the award of the Committee on Production, affecting all employés at the electricity undertaking. The award takes effect from August 19th last, and provides for a 56-hour week, 14 days' holiday after one year's service, and fixes special rates for overtime and public holidays.

Dublin.—Loan Sanction.—The L.G.B. has sanctioned the borrowing by the Corporation of £60,000, to provide working capital for the electricity undertaking.

Electric Tanning.—Application has been made to the Corporation for a site at the North Wall (Quayside), for premises for the treatment of 4,000 hides per week, by Dr. Groth's electric tanning process.

Threatened Strike.—The Corporation having refused to ratify the report dealing with the agreement regarding the wages of the members of the Irish Association of Electrical Station Engineers employed by the electricity department, the men concerned intimated their intention to cease work on December 9th if the matter was not settled. However, a special meeting of the Corporation empowered the E.L. Committee to deal with the matter in accordance with the agreement, and the strike notices were suspended.

Eccles.—Price Increase.—The T.C. has increased the price of electricity, for all purposes, by a further 25 per cent., a total war advance of 75 per cent., from the end of the present quarter.

Halifax.—Proposed Loan.—The T.C. has applied to the L.G.B. for sanction to borrow £9,021, for the purchase of a boiler and economiser for the electricity works.

Harpenden.—Proposed E.L.—The Luton T.C. is considering the question of extending its electricity supply to Harpenden.

Harrogate.—Year's Working.—For the year ended March 25th, 1918, the income of the Corporation electricity department amounted to £21,530, and the working expenses to £12,625. Interest on loans absorbed £1,940 and debt redemption £1,948; £3,974 was transferred to the sinking fund and £856 to the reserve fund. Of the 2,264,362 units generated, 64,530 were used on the works, 498,555 were not accounted for, and 1,701,277 were sold, including supply by meter 1,498,028, supply by contract 161,885, and public lighting 41,364. The maximum demand was 920 kw.

Ireland.—Water Power.—The B. of T. has appointed the following gentlemen to be a Sub-Committee of the Water-Power Resources Committee to inquire into and report upon the subject, so far as it affects Ireland:—Sir J. P. Griffith (chairman), Dr. J. F. Cowley (vice-chairman), Mr. T. M. Batchen, Mr. G. Fletcher, Mr. L. J. Kettle, the Earl of Leitrim, and Mr. J. C. White. The secretary to the Sub-Committee is Prof. H. H. Jefcott.

Leigh.—Price Increase.—The Electricity Committee has given notice that the charges for electricity will, from January 1st, be advanced by 10 per cent., making an increase of 35 per cent. during the past two years.

Lighting Restrictions.—The B. of T. has announced that, subject to the rations of gas and electricity not being exceeded, from the 9th inst. and until further notice any number of lights may be used for shop-window lighting; the Advertisements Lights Order remains in force.

London.—Islington.—The B.C. Lighting Committee has reported that in 1917 the electrical engineer estimated the cost of a new turbine, boilers, and other plant at £53,000. Owing to the delay in securing sanction to the loan and in obtaining satisfactory tenders, the cost will now be £125,000.

Stepney.—The L.C.C. Finance Committee has recommended that the proposed loan of £12,000 by the B.C. for the provision of a temporary sub-station and mains be sanctioned.

Woolwich.—In recommending sanction to a loan of £15,000 by the B.C. for extensions at the electricity works, the L.C.C. Finance Committee reports that the original estimate for the extensions at the Globe Lane station was £77,000, while the expenditure up to date amounts to £132,871, and it is estimated that a further £9,885 will be required to complete the work. The B.C. states that during the past four years the plant has been dangerously overloaded, and many items not included in the original estimate have been installed to stabilise the supply. The financial results of the undertaking had been unfavourable up to recent years, but owing to the war-time demand for electricity, the accounts for 1917-18 show a net surplus of £5,701. In view of the cessation of hostilities, the Finance Committee recommends the B.C. to take a careful review of the position of the undertaking.

Loughborough.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to a loan of £5,000 for a new boiler at the electricity works, and £2,760 to cover excess expenditure on amounts already sanctioned.

Maidstone.—Price Increase.—The T.C. has decided to increase the price of electricity by a further 5 per cent. as from January 1st.

Rawdon.—Proposed Street Lighting.—The Electrical Distribution of Yorkshire and the U.D.C. are to confer upon the question of lighting the streets with electricity.

South Shields.—Proposed Extensions.—The Special Sub-Committee appointed to deal with the application to the director of E.P. Supply for certificates for further plant has recommended that application be made to the L.G.B. for sanction to a loan of £7,500 for a new boiler and accessories, or, if two boilers are required, for £12,000. A copy of the recommendation is to be sent to the Electric Services Committee, the Ministry of Munitions, and the Board of Trade, with a request for an opportunity for the Council to place its views before these departments before any further action is taken.

The Sub-Committee reported that, at a conference, the Director of E.P. Supply was informed that the Council declined to fall in with his suggestion to supplement its supply by taking energy from the County of Durham E.P.S. Co. As a result, the Director agreed to the Council obtaining one boiler and economiser, and promised to further consider the application for a second boiler. The condition that the Council should obtain energy from the company was withdrawn, but permission to install additional generating plant was refused.

At an interview with the representative of the Controller of Merchant Shipbuilding (Lord Pirrie), a deputation from the Council stated that it was at present in a position to supply the requirements of the shipyards and to fulfil obligations and meet the future increased demand if it was permitted to extend its generating plant. It was pointed out that the plant could be installed in the Council's station as quickly as plant for adapting the supply from the company could be obtained, and that there was no advantage to be gained on the ground of cost.

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Stirling.—Year's Working.—For the year ended May 15th, 1918, the gross profit of the Burgh Electricity Department was £2,582. The income amounted to £7,504, and the expenditure to £4,922. After paying interest on loans, £860, redemption of debt, £1,266, and other capital charges, the net surplus was £82; this was carried to the reserve fund, which now stands at £2,059; 461,816 units were generated, against 448,877, and 434,012, against 421,758, were sold. The maximum demand was 277 kw., against 252 kw.

Stoke-on-Trent.—Proposed Extensions.—The Electricity Committee has received letters from Sir John Snell and the Director of Electric Power Supply, stating that the scheme for plant extensions had been approved by the War Cabinet Electric Services Sub-Committee, and the engineer has been instructed to prepare a report as to suitable sites, &c., for the new generating station.

Warrington.—Supply to Tanneries.—The B. of T. has granted an order enabling the T.C. to supply electricity to the Orford Tanneries, which are in the area of the R.D.C.

West Bromwich.—Linking-up.—Arrangements have been made for the linking-up of the electricity undertakings of the Corporation and the Midland E.P. Co., so that the former can obtain energy from the company when it is unremunerative to run its own plant.

Wolverhampton.—Loan Sanction.—The L.G.B. has sanctioned the borrowing by the Corporation of £10,000 for contingencies in connection with extensions to the electricity undertaking, and £100 for the extension of electricity mains.

TRAMWAY AND RAILWAY NOTES.

Christmas Day Services.—It has been decided to suspend the tramway services at Manchester, Salford, Birmingham, and several other towns, on Christmas Day.

Doncaster.—New Cars.—The Tramways Committee has ordered ten new tramcars, on the understanding that if priority of manufacture cannot be obtained the order shall be cancelled.

Hull.—Temporary Employés.—At the last meeting of the Tramway Committee the manager reported that application for the release of men from the Forces had been made, but he found that the machinery for releasing them had not yet been set in operation. He proposed that, as they were released, they should resume the positions they had vacated. The women would be the first to go, and those who had the least length of service would be the first to leave. They would be followed by the senior women, and then by the temporary men, in the same order.

Electric Vehicle.—The T.C. has decided to purchase a 20-cwt. electric truck for the collection of street refuse.

London.—L.C.C.—It is stated in the daily Press that, in view of their exceptional work on Armistice Day, £5,000 has been distributed amongst the L.C.C. tramcar drivers and conductors.

Wages.—The Highways Committee has recommended that the application of the National Transport Workers' Federation for 5s. per week, which has been awarded by the Committee on Production, be granted to the tramway employés concerned; the cost is estimated at £110,000 per annum.

The Metropolitan Electric Tramway Co.'s male employés have also been granted the 5s. per week extra.

On Wednesday the daily Press announced that the National Transport Workers' Federation was making immediate application for a further increase of 10s. per week on the war wages of its members; an eight-hour day, a 5½-day week, time-and-a-half rates for overtime, and double pay on Sundays are also demanded.

L.U.T.—On Tuesday evening the L.U.T. tramway service was considerably disorganised through the breaking of a trolley wire at Kew Bridge. For some time the service was maintained over a single line on one section.

Collision.—An L.C.C. tramcar collided with another car that was standing at the Abbey Wood terminus on Sunday night, both cars being badly damaged. Three persons were injured, one badly.

Maidstone.—Proposed Extension.—The T.C. is considering the question of extending the tramways in the North and South King Street Wards; the proposed new line will be 1¼ miles in length.

Market Drayton.—Proposed Light Railway.—Plans for the construction of a light railway between Shrewsbury and Market Drayton have been deposited with the R.D.C.

Middlesbrough.—Proposed Extensions.—The Corporation has notified its intention of applying for powers to construct a tramway to the Stockton borough boundary; the Stockton T.C. has decided to oppose the application.

Railway Nationalisation.—Speaking at Dundee, on Wednesday last week, Mr. Churchill stated that it was part of the Government policy to nationalise the railways; that great step it had at last decided to take. It was decided not to nationalise shipping. We may add that the total capital-account expenditure of the 38 principal railways in the United Kingdom was £1,120,542,271, with net receipts of £46,376,941, for the year ending December 31st, 1916.

Railwaymen's Eight-hour Day.—An official announcement was issued on Saturday stating that the principle of an eight-hour day for all members of the wages staff of British railways, including Ireland, had been conceded by the Government as the result of a Conference at the B. of T. on Friday last, and is to come into operation on February 1st next. All existing conditions of service are to remain unaltered, pending the decision of a Committee of both sides, to be set up as soon as possible to review wages and other conditions of service of railwaymen in Great Britain. Mr. J. H. Thomas, general secretary of the National Union of Railwaymen, is reported to have said that "it must be clearly understood that the eight-hour principle is not established for the purpose of enabling overtime to be worked. It is to be a maximum working day." Other items in the after-war programme of the N.U.R. include the payment of the pre-war rate of wages, with the addition of the present war bonus of 30s. per week, plus 10s. per week; the payment of time-and-a-half rates for overtime and nightwork, and double pay for Sunday work; and 14 days' holiday each year, with full wages.

St. Helens.—Tramway Control.—The T.C. has decided to take over the undertaking of the New St. Helens and District Tramways Co. at the expiration of the lease in October, 1919, and a Committee has been formed for the working of the same.

Southend.—Coal.—The Corporation has obtained a supply of coal which will enable a full service of tramcars to be run.

Stockton.—Proposed Extensions.—The Corporation has decided to apply to Parliament in the ensuing session for powers to extend the tramways to Port Clarence.

Underground Railways.—Overcrowding.—There is no hope of relief from the nightly squash on the underground railways till more material and skilled labour are available. There are three main causes of the overcrowding, they are:—London is crowded more densely than ever before; thousands of unaccustomed travellers—chiefly war-work girls, visitors to London, and soldiers passing through; people have the habit of going home earlier. Mr. Blake, superintendent of the line, is reported to have stated that the company is running not a train less than in 1914. No fewer than 1,046 trains pass every day, either Eastward or Westward, through the tunnel at St. James's Park; 25 per cent. more trains, both on the tubes and the District and Circle systems, could be put on, that would make all the difference, but it cannot be done till rolling stock is available. The tubes are actually running 22 motor-coaches and 23 trailers more than at the beginning of the war. The aim of the organisers is to obtain enough additional rolling stock to turn every five-coach into a six-coach train; 7,000 soldiers arrive at Victoria every day on leave, and they mostly use the underground railways to reach the terminal stations.

York.—Fare Revision.—The Tramways Committee has increased all the tramway fares by ½d.; workmen's fares remain as before.

TELEGRAPH AND TELEPHONE NOTES.

Argentina.—The Argentine Government has issued a decree granting the Central and South American Telegraph Co. the right to lay, operate, and maintain lines and cables connecting the Argentine Republic with Montevideo, Uruguay. The Uruguayan Government has also issued a decree granting the Central and South American Telegraph Co. the right to lay, maintain, and operate lines of telegraph and cable to connect Uruguay with Argentina. The Central and South American Telegraph Co. has all of the material on hand at Buenos Aires for the connections between the cable landings and its offices at Buenos Aires and Montevideo. It has also under contract the necessary length of cable over 70 miles to make the submarine connections. It is expected that the work will be completed within nine months. On November 1st the President of Brazil signed a concession granting the Central and South American Telegraph Co. the right to establish cable communication between Rio de Janeiro and Cuba, touching at places in northern Brazil and possibly the West Indies. The company has already two cables connecting New York with Guantanamo, Cuba, thence to Colon, Panama.—*T. and T. Age.*

Australia.—A new regulation requires that all vessels of over 1,600 tons registered in Australia or trading on the coast (passenger or cargo) shall be installed with wireless equipment. The apparatus must be in charge of competent, certificated operators, and it must be capable of transmitting and receiving messages over a distance of at least 150 miles by day or night; it must also include emergency transmitting apparatus which can be operated independently of the power supply of the vessel, with a range of not less than 100 miles by day, and capable of working continuously for six hours. The Naval Board may exempt any vessel. Non-compliance with the regulations makes the master, owner' agents, and charterers of the vessel severally guilty of an offence. —*Age.*

The building which is to house the new City North Telephone Exchange was due for completion in October last. It will be the

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first automatic exchange in the Sydney City area, and its ultimate capacity will be 20,000 subscribers. The first instalment of apparatus will deal with 2,500 subscribers, 1,100 lines being connected, having 1,700 instruments in use. It is expected that the exchange will be in operation in 12 months' time. The total cost of the equipment will be £78,000.

China.—A contract has been signed between the Chinese Government and the Marconi Wireless Co., to supply three wireless stations, each of a capacity of 25 KW. This gains for the British Wireless Co. its first footing in China. Several wireless stations have been erected in the past by Germans, but these never were used commercially. The Marconi stations will be erected in widely separated parts of the Republic like Kashgar, Urumchi, and Lanchowfu for commercial purposes, with the aid of a smaller station at Sianfu, and will exceed in power and range any others in the Republic.—*The Times.*

Cook Islands.—A wireless station has been established at Rarotonga, and was opened for traffic on September 9th last. The provision of wireless telegraph facilities has been under discussion for some years, the residents urging that the absence of any means of communication with the outside world has been the cause of much loss in the fruit and export trade. In July, 1916, the fruit exporters agreed to pay a duty of 1d. a case on fruit, amounting to about £700 a year, to provide for the maintenance of a wireless plant, and this duty has apparently been collected ever since, though the plant has only now been brought into operation.—*Auckland Weekly News.*

United States.—Mr. Daniels, Secretary of the Navy, has declared that he is in favour of a Government monopoly of all wireless stations in the United States and its possessions. The hearing of the Bill to take over the stations was to begin before the House Merchant Marine Committee yesterday. The Navy approves the Bill, which is opposed by the American Marconi Co. backed by the British Marconi Co. The American company is anxious to retain two high-powered plants on the Atlantic coast, which are apparently part of a plan to create a wireless link between England, the United States, and the Orient.

Mr. Vail, acting adviser to the Postmaster-General in organising cable systems under Government control, in a tentative report declares that the American cable system must be organised and freed from the uncertainties of foreign control. There must be an American system placing the country in direct communication with every country with which America hopes to have important commercial relations, and that there is immediate necessity for a cable on the east coast of South America to give America and the River Plate countries direct communication.—*Financier.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—SYDNEY.—April 28th. City Council. Supply and erection of power house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.

Victorian Railways Department.—January 15th. Supply of battery cells. Particulars from Agent-General for Victoria, London, S.W.

Dublin.—December 23rd. Electric Supply Committee. 200 single-phase and 100 three-phase, A.C. meters. See "Official Notices" to-day.

Luton.—B.C. Electric lighting installation at Town Hall and Market Place. Borough Surveyor.

CLOSED.

Australia.—MALVERN.—Installation of an automatic switchboard equipment at the telephone exchange, and for the supply of apparatus and material in connection with Brighton Exchange, £44,998. Automatic Telephones (Australasia), Ltd.

P.M.G.'s Department, Victoria—
274 miles, twisted pair, o.s., 18 s.w.g., distributing wire, £5,690; 31 miles twisted pair, o.s., 16 s.w.g., distributing wire, £815; 41 miles, single twisted, R.I., 18 s.w.g. wire, £582; 67,050 copper jointing sleeves, £369.—Western Electric Co. (Aust.), Ltd.
25 tons, G.I., 15 lb. wire, £1,500.—R. Johnson, Clapham & Morris, Ltd.
5,000 dry cells, £1,187.—J. McIlwraith & Co., Pty., Ltd.
Electric vehicle, £675.—Australian General Electric Co.

Victorian Railways Department—
Incandescent electric carbon filament lamps (Dutch manufacture), 16 c.p., 220 v., 2s. 2d. each; 25 c.p., 220 v., 2s. 3d. each.—H. Rowe & Co.

P.M.G.'s Department, Western Australia—
10 miles, twisted pair, V.I.R. wire, £220.—B.I. & Helsby Cables, Ltd.

P.M.G.'s Department, N.S.W.—
100 relays, 500 ohms, 120 83½ ohms, 200 50 ohms, £207.—Automatic Telephones (Aust.), Ltd.

P.M.G.'s Department, Tasmania—
45 Chloride accumulators, with spare parts, £213.—W. G. Watson & Co., Ltd.

Victorian Railways Department—
Electric incandescent metallic filament lamps, 2s. 2d. each.—Australian General Electric Co., Ltd.; do., do., 2s. 6d. each.—Edison Swan Electric Co., Ltd.

—*Tenders.*

Spain.—The Sociedad Minera y Metalurgica de Penarroya has lately placed a contract with Messrs. Piccard-Pictet & Co., of Geneva, for four 5,500-H.P. Francis turbines, in connection with the extension of its hydro-electric generating station.

Stretford.—U.D.C.:—
H.T. switchgear, £2,099.—British Westinghouse Co.
L.T. switchgear, £2,482.—Bertram Thomas.

Wolverhampton.—T.C.:—
Five boiler feed regulators, £247.—Crosby, Ltd.
Brickwork for new boilers, £200.—Windsor & Co.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, December 13th. At 7.30 p.m. At 39, Victoria Street, S.W. Lecturette "Air Compressing," by H. P. Anderson. Adjourned annual general meeting.

Friday, December 20th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 7.30 p.m. Presidential address by Col. R. E. B. Crompton, C.B. "What war has done for Engineers and the part Engineers will have to play in Reconstruction."

(Midland Section).—Friday, December 20th. At 7.45 p.m. At the University, Birmingham. Paper on "The Manufacture of Cast-iron Pipes," by Mr. T. E. Dimbleby.

Electro-Harmonic Society.—Friday, December 13th. At 8 p.m. Smoking concert at the Holborn Restaurant (Venetian Chamber).

North of England Institute of Mining and Mechanical Engineers.—Saturday, December 14th, at the Wood Memorial Hall, Newcastle-on-Tyne. At 2 p.m. Paper on "The Training of Students in Coal Mining, with Special Reference to the Scheme of the Engineering Training Organisation," by Prof. F. W. Hardwick.

Manchester Association of Engineers.—Saturday, December 14th. At 6.30 p.m. At the Grand Hotel. Paper on "Wood Testing," by Mr. J. E. Hurst.

Birmingham and District Electric Club.—Saturday, December 14th. At the Swan Hotel. At 7 p.m. Annual general meeting.

Industrial Reconstruction Council.—Tuesday, December 17th. At 6 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "The Restriction of Output," to be opened by Mr. W. Hill.

Liverpool Engineering Society.—Wednesday, December 18th. At 8 p.m. At the Royal Institution. Paper on "The Growth and Arrangement of Industrial Boiler Plants," by Mr. H. S. Rowe.

Illuminating Engineering Society.—Thursday, December 19th. At 8 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. "Summary of Progress in Photometry, with Special Reference to War Problems."

Chemical Society.—Thursday, December 19th. At Burlington House, Piccadilly, W. At 8 p.m. Paper on "The Conception of the Chemical Element as Enlarged by the Study of Radio-active Change," by Prof. F. Soddy, F.R.S.

Belfast Association of Engineers.—Thursday, December 19th. At 7.45 p.m. At the Municipal Technical Institute. Paper on "Aeroplane Construction," by Capt. G. H. Creighton.

Institution of Electrical Engineers.—Thursday, December 19th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "Carbon Brushes: Considered in Relation to the Design and Operation of Electrical Machinery," by Mr. P. Hunter-Brown.

(Irish Centre).—Friday, December 13th. At the Royal College of Science, Dublin. At 7 p.m. Paper on "Heating," by Mr. S. L. R. Price.

(Scottish Centre).—Monday, December 16th. At 7.30 p.m. At 207, Bath Street, Glasgow. Address by the President, Mr. C. H. Wordingham, C.B.E.

(South Midland Centre).—Wednesday, December 18th. At the University, Birmingham. At 7 p.m. Paper on "Carbon Brushes," by Mr. P. Hunter-Brown.

NOTES.

L.C.C. Munition Works.—A report submitted to the L.C.C. Education Committee by the Education Officer with regard to the work done in London educational institutions during the past three and-a-half years in the manufacture of munitions and training of munition workers, states that in June, 1915, the Council agreed to place its resources at the disposal of the Ministry of Munitions and the Metropolitan Munitions Committee. Two lines of action were adopted—(1) the manufacture of such essential munitions as could be made with the staff and machines available in technical institutions, and (2) the training of workers for munition factories. In connection with the manufacture of munitions the main efforts of the organisation have been directed to the manufacture of precision gauges. About 83,000 gauges have been delivered and passed by the National Physical Laboratory; in addition, 65 orders for miscellaneous types of accessories have been completed.

With regard to the second item, over 12,000 students have been in training, of whom about 9,000 have completed their courses satisfactorily and been placed in employment.

The staff engaged on this work at December 1st, 1918, numbered in all 482 persons, 44 of whom belonged to technical institutions, 193 had been transferred from their normal posts in various kinds of schools, and 245 were temporary employés. Machinery and equipment to the amount of £17,000 has been purchased for manufacture, and remains the property of the Council. Certain funds will be available for the reconstitution and equipment of workshops in technical institutions from the manufacturing side. Suggestions have been invited from the various principals and heads of departments who have been engaged on munitions work, with a view to utilising to the best advantage the experience gained during the past three and-a-half years.

The total value of the work carried out for the manufacture of munitions and the training of munition workers has been of the order of £300,000.

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The I.M.E.A. and Plant Extensions.—With reference to the memorandum which was addressed to all members of Parliament by the Council of the Incorporated Municipal Electrical Association some weeks ago, suggesting that the Ministry of Munitions had not acted with freedom from partiality in the allocation of sanctions for the extension of generating plant, the following letter, dated December 4th, has been addressed to the Secretary of the Ministry of Munitions of War :—

Sir,—In reply to your letter of November 13th (received on November 15th), the Council of the I.M.E.A., at its meetings held on the 14th and 29th ult., had this matter under further consideration.

A letter dated November 12th has been received from the town clerk, Sheffield, containing the following statement :—

"The Committee desire me to state that the statements made by Mr. Fedden at your meeting of October 17th, to which you refer in your letter to the Ministry of Munitions of the 2nd inst., were made on his own responsibility, and without previous consultation with any members of the City Council, and the Committee, therefore, must disclaim responsibility therefor.

"If it should transpire that any inquiry is made into the allegations on which your Council's resolution is based, Mr. Fedden will be prepared to submit such facts as are within his knowledge, and the Corporation will also furnish any information they may possess."

I am desired to inform you that, having regard to the statements of the Corporation of Sheffield, the resolution of October 22nd is withdrawn, and regret is expressed that the same has been submitted.

A copy of this letter is being sent to everyone to whom the original resolution was communicated.

I am, Sir,

Yours obediently,

(Signed) C. McArthur Butler, *Secretary*.

National Electricity Supply.—In the course of his manifesto, issued last week, the Prime Minister said that one of the most important things the Government had in mind was the utilisation of our great mineral resources for the production of electrical power on a great scale. This would enable rural industries to be created, so that workmen could find remunerative employment under conditions where they could also have a bit of land for cultivation, and where they could bring up their children in the healthier atmosphere of the country. A great electrical power scheme would also assist in cheapening and increasing the efficiency of our town industries.

Australian Electric Supply Advisers.—A Melbourne newspaper, dated September 30th, contains the following paragraph :—"Regulations under the Local Government Act passed by the Executive Council yesterday provide that no person shall act as adviser to an electric supply undertaking unless in possession of a qualification certificate, which may be obtained on application to the local municipal clerk if sufficient evidence is furnished of the applicant's experience."

Electric Precipitation from Flue Gases.—An interesting application of this process was recently made in a copper refinery, according to the *Journal of Electricity*. In this particular installation a noteworthy fact is the size of the generating and transforming unit used, all the current being handled by a single generator and transformer. A duplicate set has been installed for emergency purposes. The tubes containing the high-tension electrodes and through which the flue gases pass are arranged in six groups. The electrodes are suspended at the top from a rack which provides ample insulation, and are connected with the high-tension direct-current line at the bottom. Disconnecting switches permit the current to be cut off from any group to permit inspection and repairs. The gases from the furnaces pass through pipes

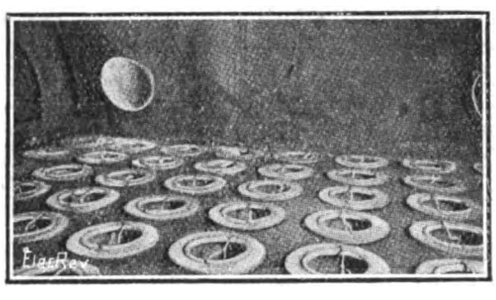

Fig. 1.—Interior of Treater, showing Electrodes suspended in Treater Tubes.

13 ft. in diameter, a "Y" with valves being provided so that the gases can be made to go either through the treater or directly to the stack, as desired. It is stated that tests showed that over 90 per cent. of the flue dust can be removed, and that the value of the copper, zinc, and other metals recovered will within a short time pay for the treating equipment. It is calculated that at full load 0·5 ampere, high-tension, direct-current is needed.

Two 40-K.V.A., 60-cycle, single-phase Westinghouse generators operating at 1,800 R.P.M. are arranged to deliver voltage ranging from 150 to 250 volts. A direct-current power line supplies excitation current. A 50-H.P., 230-volt, direct-current motor drives each generator. The transformers are of 40-K.V.A. capacity, 200 volts low-tension and 100,000 volts high-tension. Additional taps are provided from which voltages of 50, 62½, 75, and 87½ per cent. of the maximum voltage can be obtained, the full capacity of the transformer being available on each tap. The Westinghouse switchboard consists of two panels, one for each generating and transforming set. Each panel carries from top to bottom a circuit-breaker on the line between the generator and transformer, an alternating-current ammeter and voltmeter, a switch to reverse the polarity of the high-voltage direct-current, motor field and line switches, a generator field rheostat, a five-point switch for making connections with the five high-tension taps of the transformer, and the motor starting-rheostat. The voltage of the high-tension direct-current must be varied according to the condition of the flue gases being treated. The transformer taps provide the large steps for this variation and the voltage adjustment of the generator the small steps. In addition a bank of adjustable resistances is connected in series with the low-voltage alternating current, which acts as a ballast and permits of further adjustment of the voltage.

Fatality.—A Leeds boy, aged 10, named David Swift, was killed at the Victoria Council School, on the evening of December 5th. Unasked, he and a friend had been assisting the caretaker in getting some coke into the cellar, and Swift climbed on to the top of the pile and seized hold of the live part of an electric switch, at the same time having hold of an iron pipe near by, which completed the circuit. Another boy ran and turned off another switch, and Swift dropped to the ground dead. At the inquest it was stated that the switch was in proper working order ; but it was strongly recommended that in future the switch-boxes should be kept locked up. A verdict of "Accidental death" was returned.

American Railway Electrification.—The Association of Railway Electrical Engineers was convened for its tenth annual Convention, at Chicago, on October 29th. In the technical programme, the first report presented was that of the Committee on Data and Information, whose function has been to compile statistical data showing the extent to which various kinds of electrical equipment has been adopted by the railroads of the United States and Canada, thereby indicating the general tendencies towards the unification of practice which, in a general way, is the aim of the Association. Accompanying the Committee's report was a detailed tabulation of the various kinds of electrical equipment used at the present time on each of the 66 roads from which reports were received. In addition a tabulation was submitted to show the progress of electric car-lighting and other equipment of the railroads of the country as a whole.

Inquiries.—We are asked whether there is such a thing as an "electric navvy" on the market—apparently an excavator. Such machines have been used abroad, and possibly in this country ; perhaps some of our readers can help us to a reply.

Lantern Slides.—Manufacturing and other firms who have lantern slides showing electrical machinery, oil engines, and other such apparatus are invited to communicate with us, with a view to the utilisation of the slides in a military school of instruction for soldiers about to return to civil life.

Ferro-Concrete Posts.—The Société Mixedstone, of Geneva, erects concrete posts for telegraph and power-transmission lines after the manner of brick pillars. The concrete bricks are supplied ready-made in a thickness of 20 cm. to 30 cm. (9 in. or more) ; each brick is a frame, rectangular or of other shape ; the internal hollow is charged with the cement, in which the iron rods are embedded. Four such bricks are arranged in each layer to make up a four-sided pillar which is built up in sections hollow inside. A telegraph post of this kind, of bricks 25 cm. thick, 25 cm. × 25 cm. at the base, and 20 cm. × 20 cm. in the upper sections, armed with four iron rods, 12 mm. in thickness, one in each brick, was tested last May (*Schweizerische Bauzeitung*, August 24th) by Prof. A. Paris, of Lausanne, in presence of Federal authorities. The post had a height of 6 m. above ground, 1·5 m. being in the earth ; microscopic fissures were noticed during the load test, when the deflection near the top amounted to 76 mm. ; rupture followed 10 minutes after the deflection had risen to 146 mm., the lateral load being 211 kg. per sq. cm., which corresponded to three times the specified strength of 70·5 kg. per sq. cm. Another post for high-tension lines, 8·95 m. high, built up of four columns with 4 × 2 = 8 reinforcement rods, stood a lateral load of 1,600 kg., when the foundation gave way ; the maximum deflection recorded was 50·5 mm. The test proved that these brick-concrete pillars were not inferior to monolithic concrete structures.

What Mr. Hodge Advocates.—In a recent speech, Mr. John Hodge, Minister of Pensions, said that they had got to lay the foundation of a new England. He wanted an eight-hour day for every trade by Act of Parliament, so that the mean employer would not have the opportunity of undercutting the good employer. There could be no mistake as to the fact that there was a section of the community upon whom compulsion must be enforced. There should be minimum wages, minimum hours, and the very best possible conditions of work. National workshops ought to be started for the benefit of the partially-disabled men. The Government ought to schedule all the right jobs in the country suitable particularly for men who had lost an arm or were otherwise impaired. Either that or full pensions should be provided.

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Institution and Lecture Notes.—Röntgen Society.—A meeting of the Society was held on Tuesday, last week, at King's College Hospital, Denmark Hill, S.E. Visitors met in the board room at 7.30 p.m, where light refreshments were served, after which there was an inspection of the electrical generating plant. Mr. E. W. Johnston, chief engineer, conducted visitors round the station and explained the details of the plant, including the Siemens automatic telephone exchange which controls over 100 instruments in use. From the generating station current is distributed throughout the hospital, and is utilised for power, lighting, sterilising apparatus in the theatres, &c. The station contains three Diesel engines running on tar oil and direct coupled to E.C.C. direct-current generators running at 200 R.P.M., 110 volts, two sets being rated at 100 KW. and the third at 50 KW. There is also a small battery. The maximum load on the station is about 100 KW., the power load amounting to about 50 KW., which is made up of motors of various sizes driving refrigerators, pumps, lifts, ventilating fans, &c. The evening load on an average reaches about 66 KW. The X-Ray Department was the next visited; in the photographic room there was an exhibition of prints and a portable outfit. Capt. Reed, R.A.M.C., T., gave a practical demonstration of localisation of foreign bodies by means of the Baese localising unit, which apparatus is extremely simple in construction and operation. A foreign body can be localised by means of this unit in about 30 sec. In the radiographic room under Sister Pape various apparatus was inspected, including a large-coil outfit, kidney-examination table with compressor, a McKenzie-Davidson localiser, and a single-impulse apparatus in action. The Sweet method of localising foreign bodies in the orbit and eyeball and the card-index system of filing records were also explained. The dark rooms were next visited, where the reducing lantern and methods of developing were explained. In the consulting room stereoscopic negatives in a Wheatstone stereoscope, a Pèrie stereoscope, and a 50 radiogram in a cabinet were to be seen. Here, also, the storage and examination of negatives is carried out. Next the radio-therapeutic department, under Mr. A. O. Forder, was visited, where a small operating room, diathermy apparatus, both high-frequency and pantostat, together with X-ray treatment cubicles and ultra-violet light apparatus was viewed. Capt. Clayton showed visitors over the electro-therapeutic department, and explained the various forms of treatment used.

Institution of Electrical Engineers (North-Western Centre).—Mr. C. H. Wordingham, C.B.E. (President of the Institution), delivered his address before a meeting of this Centre at Manchester, on Tuesday, December 10th. It dealt with the organisation and work of the Institution, being similar to addresses delivered at other Centres.

Liverpool Engineering Society.—On December 4th, Mr. R. W. Allen, C.B.E., read a paper on "The Air Supply to Boiler Rooms," embodying the results of four years' experiments on the design of intakes, gratings, fans, and fan casings. The data show that very considerable improvements can be effected by having due regard to the behaviour of fluids in motion, and by so shaping the parts in contact with the current of air that eddies may be avoided and stream-line flow obtained.

Electrical Power Engineers' Association.—The Southern Division of the E.P.E.A. has arranged for a smoking concert to be held in Anderton's Hotel, Fleet Street, at 6.30 p.m., on Thursday, the 19th inst. A good programme has been arranged. Tickets may be obtained from the secretaries of Sections, from the organiser, Mr. E. N. Christmas, 55, Calabria Road, N. 5, or at "Anderton's" on the evening of the concert.

At the monthly meeting of the Western Section, Southern Division, E.P.E.A., the following resolution was unanimously agreed to :—

"That the members of the Western Section, Southern Division, Electrical Power Engineers' Association, are of opinion that it is unfortunate that any recommendation for a nominee for the post of general secretary should have been made by the National Executive Council, as their action may have a quite unfair and unwarranted influence; and they feel that due consideration has not been given to the qualifications which such a position demands. They desire that, so far as is practicable, each member shall be acquainted with the real situation and the vital importance of the appointment before a final decision is arrived at. Further, they take exception to the inadequate salary offered, and suggest that the whole matter be reviewed before nominations are considered. In the opinion of members of the Western Section, it is essential that the future policy of the Association should first be definitely formulated, as the qualifications necessary in a secretary are inevitably linked thereto. They consider that the post should be thrown widely open to competition."

At a meeting of the ABERDEEN ROTARY CLUB on Thursday, last week, Mr. J. A. Bell, the city electrical engineer, read a paper on "Aberdeen Electricity Supply," in which he stated that the power load at Aberdeen had increased by 99 per cent. during the past four years; the electricity department now supplied 50 per cent. of the power used for industrial purposes within its area.

On November 29th, at the Heriot Watt College, Edinburgh, Mr. A. Thomson read a paper on "The Running and Maintenance of a D.C. Concentric System," before the Lothians Branch of the Association of Mining Electrical Engineers.

Demobilisation and Resettlement: City of London Advisory Committee.—The attention of employers and workpeople is drawn to the activities of the Local Advisory Committee recently set up by the Minister of Labour in connection with the City of London Employment Exchange, 9, New Bridge Street, E.C. 4. In addition to assisting the Exchange in its extensive work of supplying suitable men and women for clerical and professional occupations in the City, the primary functions of the Committee relate to the employment of men now being discharged from H.M. Forces (including questions as to the wages which ought to be paid to disabled men), and also to the arrangements for dealing with reconstruction problems from the labour point of view. The Minister has been fortunate in securing Sir T. Vansittart Bowater, Bart., as chairman of this Committee, together with many prominent citizens—representative of employers and labour organisations—who are intimately acquainted with trade conditions in this area. The Committee has already held several meetings, and there seems every prospect that it will be able to render valuable assistance to the Government in achieving the important objects for which it has been established.

Demobilisation Advisory Committee.—The Minister of Munitions has appointed the following to be an Advisory Committee of Employers to advise upon the Demobilisation Board of the Ministry of Munitions, the Chairman of which is Sir James Stevenson, Bart. :—

Sir Vincent Caillard.	Sir Glynn West.
Sir Allan Smith.	Mr. Henry Summers.
Sir Herbert Rowell.	Mr. E. J. Brown.
Sir Wilfrid Stokes.	Mr. J. Main.
Mr. George Sutton.	Sir Harris Spencer, K.B.E.
Mr. H. C. B. Underdown.	Mr. H. B. Renwick.
Mr. W. L. Hichens.	Mr. R. G. Perry, C.B.E.

Unemployment Pay.—It was announced on Wednesday that the Government had decided to increase the rate of out-of-work donation to men by 5s. per week, making it 29s.; to women by 5s. per week, making it 25s.; to boys and girls between 15 and 18, 2s. 6d. per week, making their amounts 14s. 6d. and 12s. 6d. respectively. The new scale is payable as from yesterday, December 12th.

Appointments Vacant.—Outside assistant to take charge of meter, motor, and installation departments for the Leigh (Lancs.) Corporation electricity works; rolling stock and overhead equipment engineer (£450) for the Belfast Corporation tramways: chief electrical engineer (£350) for the Colne Corporation electricity works; shift engineer (£120) for the Llandudno U.D.C. electricity works. See our advertisement pages to-day.

Applications for the Chair of Physics and the Chair of Chemistry at the University of Birmingham, the former held by the late Prof. J. H. Poynting, F.R.S., and the latter vacant by the resignation of Prof. P. F. Frankland, F.R.S., have to be received by the secretary by February 8th, 1919 (the stipend in each case is £1,000 per annum).

Volunteer Notes.—ROYAL ENGINEERS (VOLS.), LONDON ARMY TROOPS COMPANIES.—Headquarters: Balderton Street, Oxford Street, W. 1.

Regimental Orders No. 50, by Lieut.-Colonel C. B. Clay, V.D., Commanding. Monday, December 16th, to Saturday, December 21st.—Drills as usual.

C. HIGGINS, *Capt.* R.E., *Adjutant.*

The Eight-Hour Day.—According to the *Manchester Daily Dispatch*, Mr. J. Rowan, general secretary of the Electrical Trades Union, in a special circular, says :—"We have been in direct negotiations for a shorter working week since 1913. The negotiations were suspended in 1914 on account of the war, and reintroduced two months ago. It must be borne in mind, however, that the desire for a 48 hours' week has been in the minds of the trade for at least 40 years. American organised labour, as one of their conditions for giving their support to the United States entering the war, laid it down that a 48 hours' week would be established in the United States at the end of the war. German workmen, when forming a new Government, also laid it down that one of the points must be a 48 hours' week. French labour has made similar proposals. From this, it will be seen, the movement is world-wide."

The following reasons are given for the demand for a 44-hour working week for Manchester Corporation employés :—

1. The Government's strong recommendation for easing the strenuous hours of labour.
2. A reported decision by Government inquiry of a higher standard of health prevailing as a direct result of breakfasting before work.
3. The expressed desire of municipal workers to attend evening technical classes, in order to qualify for a higher standard of efficiency in productive capacity, this being inconsistent and inopportune with early rising.
4. To afford a strong opportunity of absorbing surplus labour of discharged soldiers (who deserve the highest consideration) now returning to civil life.
5. To carry out in actual fact the strong recommendations as advised by our Premier at the Hippodrome on the occasion of the presentation of the Freedom of the Borough, September 12th, 1918.

Drake & Gorham, Ltd.—Mr. and Mrs. Bernard Drake entertained the heads of departments of the London offices of Messrs. Drake & Gorham, Ltd., at luncheon on Thursday, December 5th. Mr. Drake expressed his appreciation of the way in which the staff had worked during the war, and alluded to the various war contracts which the firm had carried out to the satisfaction of the departments concerned. These included equipments for the manufacture of explosives, poison gases, anti-submarine apparatus, and power and lighting plants for camps, aerodromes, and other military establishments. From the firm 123 had gone into khaki, two had been killed, and several wounded. He had seen it stated that every man in the fighting line required the work of nine others to keep him there. He thought those who were concerned in what might be termed the drudgery of war production had in many respects a more trying time. Mr. R. Wilson Smith proposed a vote of thanks to the chairman, who, he said, had worked as hard as anybody during the war, and to Mrs. Drake for the personal interest she had always displayed towards individual members of the staff.

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Accident.—James Johnston, assistant in the employment of the Electric Lighting Co., Newcastle, Co. Down, had a miraculous escape from being mangled in the machinery on Friday evening last week. The boy was assisting in starting the engine by pulling on the belt when the engine suddenly back-fired. Johnston failed to release his hold, and he was drawn under the fly-wheel, and so tightly wedged in that it necessitated the dismantling of the engine before he could be extricated. Johnston's wounds were slight, but he is still suffering from shock.

Light-Weight Motors.—We understand that the Royal Aircraft Factory has succeeded in evolving a motor of 500-watts capacity, which weighs only 12 lb.

Educational.—Northampton Polytechnic Institute.—The prize distribution took place on Saturday last, when the Principal, Dr. R. Mullineux Walmsley, read his report on the past year's work. He stated that, as regarded the Engineering Day College, the manufacture of high-class munitions upon a commercial scale commenced on July 1st, 1915, was continued uninterruptedly during the whole session, and until last week. During its existence this workshop has produced 14,720 high-precision gauges, many of them accurate to two ten-thousandths of an inch, and 43,511 gun parts for Woolwich Arsenal, a record which is believed to be in excess of the record of any similar educational workshop in the metropolis. In the Technical Optics Department the work of training women students in full-time classes in lens and prism grinding was vigorously carried on throughout the whole year, with the result that an almost continuous stream of women-workers in the industry was available for the development and extension of existing optical workshops, not only in England, but also in Scotland and Ireland. During the session nine complete courses for training suitable men as electrical sub-station attendants were held, and the whole of the men trained were placed out. This brought the total number of such courses held, since they were started in June, 1916, to 20. The Roll of Honour showed a total of 2,052 individuals who had joined the Colours, including 65 members of the staff, 712 members and students and 1,275 students. In addition, there were a number of V.A.D.'s serving in military hospitals abroad and at home. Ninety have given their lives in the service of their country, and 190 have been wounded in that service. The Roll of Distinction contains 42 names. The equipment and staff of the Polytechnic have been at the disposal of the Government for experimental and scientific work intended to aid the prosecution of the war, and, as the equipment of the laboratories is very complete, a considerable amount of excellent work has been done.

University of London, University College.—Arrangements have now been completed in the Faculty of Engineering to enable students, whose courses have been interrupted by war service, to resume them as nearly as possible at the point at which they left off, by rejoining at the beginning of the second term, January 13th, 1919; and to enable students who were unable to begin their engineering studies last October, owing to war conditions, to begin them by entering next term, January 13th, 1919. For both classes of students additional work will be provided during parts of the Easter and Long Vacations, so as to enable them to get in a full session's work between January and August, 1919.

NATIONAL ELECTRICITY SUPPLY.

The Incorporated Municipal Electrical Association has been considering the report of the Committee appointed by the Board of Trade on the subject of Electric Power Supply, and at a general meeting of the members at Birmingham, on November 29th, adopted a report addressed to the Rt. Hon. Sir Albert H. Stanley, M.P., President of the Board of Trade. An abstract of the report is given below:—

After giving a summary of the chief recommendations contained in the report of the Board of Trade Committee, the report proceeds:—We observe with satisfaction that the report recommends that in the national interest generating stations and main transmission lines ought, as a general rule, to be publicly owned, and submit that the District Electricity Boards should in all cases be so constituted as to be wholly independent of the influence or control of commercially-owned electrical enterprises. To secure this object, it is strongly urged that the Boards should consist of representatives of local authorities and large consumers, to the exclusion of companies generating or distributing electricity.

The suggested methods of electing the Boards are open to criticism in detail; in the constitution of the Boards a combination of all the public interests concerned would lead to efficient and economical administration. Those representatives who are at present primarily responsible for the administration of the existing publicly-owned undertakings, such as chairmen and deputy-chairmen of municipal committees, would be suitable to form the nucleus of the new Boards, in view of their special local knowledge, and this course would ensure a continued expansion of the business on lines suited to the needs of their local areas. Members of the Board should be elected for a period of six years.

Clause 30 appears to suggest that three of the five Commissioners should give their whole time to the service at a salary not less than £3,000 a year, and that the other two may be remunerated in some other way, and be allowed to engage in other work. If this interpretation of the Committee's intention is correct, we emphatically protest against the proposal, as we believe it essential that all the Commissioners should be whole-time officers, and have no other interests whatever than the special duties which it is proposed to confer upon them.

Ample evidence is available, to demonstrate the fact that a well-situated power station, equipped with large modern units of generating plant, is able to afford a supply of electricity at the station bus-bars at a lower price than a number of separate stations of a total equivalent capacity. The question of a cheap supply of electricity is not, however, solely dependent upon cheap generation. In certain cases the capital costs and operating expenses incidental to a long transmission line may counter-balance the advantage derived from the concentration of large plants. But in most industrial districts these large stations will be connected together by means of a common network, which should result in a considerable saving in capital expenditure on spare plant. They are also thereby enabled to operate at a higher load factor, and to obtain the great advantage of still lower working costs which result from a diversity of demands.

A mistaken impression undoubtedly exists that the report recommends the establishment of 16 large power stations for the supply of the whole of the electrical requirements of the country. The number 16 refers not to power stations, but to the number of districts into which the country would be divided for administrative purposes. It may be possible to have an area too large for efficient administration and control. Attention is drawn to the great amount of work already done in several parts of the country towards the delimitation of suitable areas. Full opportunity should be afforded the several local undertakings to make representations to the Electricity Commissioners on this point.

We agree with the findings of the Committee in regard to the transfer of all generating stations and main transmission lines to the Board, subject to the reservations herein stated. Such a procedure we consider absolutely essential in all cases where energy is to be transmitted from one area to another by means of an interconnected network, or where extensions of plant are carried out for the common use of the authorities constituting the Board. We are of opinion that to allow any existing undertaker to retain the ownership of a power station within any given district, whilst the remaining power stations are transferred to the Board, would introduce serious complications in actual practice, as well as financial chaos, and is therefore quite impracticable. When local undertakings are transferred to a District Board, provision must be made to transfer all the rights and obligations under existing contracts. The provisions made for excepting certain undertakings from transfer to the District Boards cover all the cases likely to arise in practice.

The report nowhere countenances the view held in some quarters that all existing power stations are to be shut down, and new super-power stations erected forthwith. The first duty of the District Boards will be to consider which stations, or portions of stations, should for the time being be employed; then to consider on which of the existing sites extensions can be economically carried out, and if and when these provisions are found inadequate to deal with the requirements of the area, the question of new sites, with large modern plants, would then be considered. Under this procedure some stations will be shut down, others will be continued, and a few will be extended.

The report clearly contemplates—and, in our opinion, rightly so—that with the exceptions already referred to, all extensions should be financed by the new District Boards. A consideration of this point will inevitably lead to the conclusion that all generating stations should be transferred to the new Boards.

Paragraph 56 (c) of the report contains a most important provision, namely, that it should be obligatory for the District Boards to supply a local undertaking, whose generating plant has been taken over, at least as cheaply as the latter could produce it themselves. We are of opinion that this safeguard should go a long way to facilitate the shutting-down of uneconomical plants.

We favour direct control and operation by the several District Electricity Boards in their respective areas.

We are in general agreement with the recommendation that existing authorised undertakers should retain their distributing rights.

We are strongly of opinion that the terms set out in paragraph 56 (b) of the report, upon which the several undertakings should be transferred to the District Boards, are inequitable and inadequate, and are not such as could be accepted by local authorities. Where the District Board is formed to take over the undertakings of local authorities only, the basis of outstanding debt might not be inappropriate. We are of opinion that all sums—to whatever fund they may be allocated—other than statutory sinking funds, should be retained by the individual undertakings.

The case of those authorities who have placed sums from revenue account to capital account, or who, whilst maintaining their undertakings in a high state of efficiency out of revenue, have written down their capital at a rate in excess of statutory requirement, should receive special consideration.

The difficulty is greatly accentuated in the case of the companies, or where both local authority and company under-

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takings have to be acquired by a District Board. Obviously, equality of treatment is essential, and in such cases it may be found necessary to apply Section 2 of the Electric Lighting Act, 1888.

The transfer of local authority undertakings to the new District Boards should not be viewed in the light of a public purchase, but more on the lines of the setting up of a partnership.

In Clause 70 it is suggested that provision should be made whereby the District Board *may* provide compensation for displaced engineers and officials in case of hardship. We do not consider these provisions are adequate. In all cases where a power station or distributing system is transferred, thereby involving a loss to or diminution in the position of officials, a definite obligation should be placed upon the District Board to provide compensation on a fair and reasonable scale, which scale should be set out in any Bill that may be promoted to carry into effect the recommendations of the report.

With regard to the use of overhead lines, wayleaves, rating, water rights, and liability for nuisance, amendments to the existing law in these directions are considerably overdue, and it will be difficult, if not impossible, to develop a national scheme until largely extended powers are granted in these directions.

We entirely support the findings of the Committee that the present position is unsatisfactory, contrary to the national interests, wasteful of fuel resources, and deprives industry of the advantages which would result from a well-devised system of generation and transmission. In most districts the position of undertakings in regard to the provision of extensions to meet future requirements is of the most pressing importance. In order that steps may be taken at the earliest possible date to proceed with developments on sound lines, we are of opinion that the Commissioners should at once be appointed to assist in the preparation of the legislation necessary to give effect to the recommendations contained in the Board of Trade Committee's report.

Regarding the enhanced cost of materials resulting from the war, we heartily support the recommendation that assistance, both financial and otherwise, should be given by the Government in order to ensure the early carrying out of extensions without unduly burdening the industry with high charges for interest and amortisation. The suggestion that the sinking fund should be suspended, and interest paid out of capital during the constructional period, should receive support.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Central Station and Tramway Officials.—Mr. H. W. FIDDAMENT, of the Manchester Corporation tramways department, and previously with Messrs. Dick, Kerr & Co., has been appointed car shed superintendent to the Exeter Corporation Tramways at a salary of £239 per annum.

Birkenhead Electricity Committee has appointed Mr. W. C. GALLOWAY, of the borough treasurer's department, chief clerk in the electrical engineer's department at £200 per annum, plus war bonus.

General.—Coun. J. THOMPSON has been appointed chairman of the Wolverhampton Electricity Committee.

Roll of Honour.—Lieutenant C. F. BARROW, R.E., who has been awarded the Military Cross, was employed in the Bolton Corporation electricity works.

Sapper S. H. BURROWS, who has died of wounds, was an apprentice with Messrs. Electromotors, Ltd., Manchester.

Private L. WHEELER, M.T., A.S.C., who has died of illness in Mesopotamia, was an apprentice with a Bedford firm of electrical engineers.

Captain T. HOLDER, London Scottish, who has died in hospital at Banbury, was previously engaged with a London electrical engineering firm. He was in the Mons retreat, and was given his commission on the field.

Mr. S. S. BARBER, one of the prisoners of war released from Ruhleben, is an electrical engineer, and he was formerly on the staff of Messrs. Siemens Bros., of London. At the outbreak of war he held an appointment in Germany.

Mr. E. N. PINK, who has arrived at his home at Winchester, after being a prisoner of war at the Ruhleben camp, Germany, for four years, was previously an electrical engineer at Berlin.

Corporal G. CRANFIELD, M.T., A.S.C., who has died from the effects of a chill, was an electrical marine engineer, formerly with Messrs. Cammell, Laird & Co., Ltd., of Birkenhead.

Obituary.—MR. A. A. MILLS.—The death occurred recently of Mr. Alfred A. Mills, aged 58 years, who was for a long period on the staff at the Limehouse generating station of the Stepney Municipal Electricity Works.

Will.—Mr. JAMES ARTHUR FRY, who left £500,000, "so far as can be at present ascertained," was a director of the Bristol Wagon and Carriage Works, Co., Ltd.

NEW COMPANIES REGISTERED.

Explosives Trades, Ltd.—This new company has been registered at Somerset House by Ashurst, Morris, Crisp & Co., Solicitors, 17, Throgmorton Avenue, E.C., with a nominal capital of £18,000,000 in £1 shares (6,500,000 6 per cent. cum. pref., 8,000,000 ord., 1,500,000 def., and 2,000,000 to be issued with such rights as the directors may think fit, subject to the rights of the cum. pref. shareholders). The objects are: To carry on the business of manufacturers and producers of explosives of all kinds, chemicals, artificial manures, dyes, &c., and to enter into an agreement with the Lords Commissioners of H.M. Treasury and the Rt. Hon. Sir Albert Stanley. The Articles of Association contain provisions (in the usual form approved by the Board of Trade) for excluding foreign control. The filed documents do not give a list of amalgamating firms, but a circular recently sent out by Nobel's Explosives, Ltd., states that the boards of some 20 well-known companies have approved the scheme. The directors are to number not less than five nor more than 21. No enemy may be a director or alternate director, and at least three-fourths of the directors must always be British subjects resident in the United Kingdom. The qualification of a director is ordinary and/or deferred shares of the nominal value of £2,000. Remuneration, £1,000 per annum for the chairman, £750 for the deputy-chairman (if any), and £500 each for the others. No notice of situation of registered office was filed with the original papers. The registration fees paid to the Government in connection with the above registration amount to over £45,000.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Hong-Kong Tramway Co., Ltd.—Satisfaction to the extent of £300 on May 14th, 1918, of mortgage by way of trust deed, dated July 1st, 1903, securing £195,000. (Notice filed November 27th, 1918.)

Power Plant Co., Ltd.—Satisfaction in full on October 8th, 1917, of debentures dated 1906-13, securing £5,000, £2,000, and £5,000.

James Keith & Blackman Co., Ltd.—Satisfaction in full on November 11th, 1918, of first and second debentures, dated 1902-14, securing £800.

Holloway Electric Supply Co., Ltd.—Mortgage and land registry charge on freehold property at Islington, dated November 9th, 1918, to secure £1,600. Holders: Mrs. A. C. Mackower and E. Wheldon.

Remco Carbon Co., Ltd.—Particulars of £2,500 debentures created October 7th, 1918, filed, the whole amount being issued on November 29th, 1918. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

Fuller Accumulator Co., Ltd.

Mr. G. Fuller, M.I.E.E., presiding at annual meeting on December 3rd, said that they were still unable to give a detailed statement of their finances owing to long negotiations that had been going on under the Excess Profits Acts. In the meantime they felt justified in recommending dividends of 10 per cent. on the preference and 15 per cent. on the ordinary shares. The turnover for the past three years had been approximately: 1916, £50,000; 1917, £150,000; 1918, £280,000. As to reserves, they had written £18,000 off patents, approximately £16,000 off buildings, machinery and plant, and after setting aside an ample sum for excess profits and munitions levy, they were carrying forward a substantial amount. Generally speaking, the profits had increased in a similar rate to the turnover. The buildings and plant had been greatly extended, and with a view to the future development of the company they had purchased considerable additional land adjoining the works. Their site was one of the finest for electrical works, with ample provision for future extensions. They commenced the new year with the greatest hopefulness. The directors were optimistic men of business, full of enterprise, and alive to all the great possibilities. The prospects of electrical requirements in the future were so great as to be almost overwhelming. At the close of the financial year the orders on the books were over £110,000. Accumulators would be more and more necessary in the future development of the electrical trade. They were really a key industry, and the company's field of enterprise was world-wide. Another important development in their business was the manufacture of electrical miners' lamps using their block cell. They had orders on the books for many thousands of these lamps. They anticipated being very busy in the near future in supplying the greater part of the requirements of the mining industry. The chairman referred in some detail to the social side of the business, and the arrangements that were made to improve the conditions of the workpeople.

In the course of a reply to questions, the chairman said that they were not dividing the profits up to the hilt; they could have doubled the dividend on the ordinary shares quite easily, but deemed it more prudent to keep as large a sum as possible in hand in view of the expansion of the business. The question of additional capital would have to be considered shortly, and the shareholders would have the first opportunity of subscribing.

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Tata Hydro-Electric Supply Co.

The ninth ordinary general meeting of the shareholders was held on October 24th at Bombay, Sir D. J. Tata, Kt., chairman of the board of directors, presiding. The report for the year ended June 30th, 1918, showed that the company's total income was Rs.32,28,162; deducting total expenditure of Rs.13,49,384 and Rs.4,00,000 set apart for depreciation, the balance was Rs.14,78,777. Adding Rs.75,340 brought forward from last account, and Rs.6,91,484 which stood in last account for premium on shares, and which has now been transferred to profit and loss account, the total disposable profits amounted to Rs.22,45,602. Deducting Rs.8,01,247 paid in May last by way of ad. interim dividend and two sums of Rs.3,98,155 and Rs.49,362 respectively, representing part of guarantors' commission and balance of brokers' commission, and also Rs.80,613 carried to reserve fund, the balance available for distribution was Rs.9,16,235. Payment was recommended of the final dividend for the year at 7 per cent., less income tax, on preference shares, and at 8 per cent. on ordinary shares, old and new, with due regard to the amount paid up per share. That would absorb Rs.8,35,067, leaving Rs.81,167 to be carried to the next account. The present B.H.P. of motors in service is 45,000, exclusive of 5,500 H.P. supplied to consumers other than factories. The plant at the power house has on the whole given satisfaction; improvement in the generators has been undertaken with good results. Lightning storms have this year given rise to more frequent interruptions to service, and special steps are being taken to further strengthen the lines. The fourth synchronous condenser has been erected and put into service, and all the plant has continued to give satisfactory service. No trouble has been experienced with the underground cable system. Forty-one consumers are now receiving power. Difficulties in getting the necessary equipment consequent on the continuation of the war have prevented completing the installation of equipments for power already contracted for. The operation of the hydraulic lakes and canals system has been taken over by the operating staff. During last season good progress was made with Shirawta dam. The chairman in his speech said that the number of consumers had again increased from 38 to 41; the increase would have been still greater but for the war, which had delayed the supply of mill motors and cables. They had been rather severely and unexpectedly handicapped by the extraordinary paucity of the rainfall. The minimum rainfall for the last 50 years for which they had records was 93 inches. For the year under review it had only reached 88 inches. With the various steps taken, and some luck in the unseasonable rains, they would probably tide over what appeared to be a rather difficult situation. They had to congratulate themselves on the growing popularity of electricity as a motive power in that city. They had already a large night load; the public and the Government had been rendered a great service by the conservation of coal; the energy supplied by them during the last year would have required 100,000 tons of coal to produce it and 6,000 wagons to bring that amount of coal into Bombay. Their income was increasing, and he felt confident of the future.

India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.—The report for the year ended September 30th, 1918, states that after making provision for doubtful debts and war contingencies reserve, which includes excess profits duty and munitions Exchequer payments, the net profit is £143,589, plus £59,866 brought forward. The preference dividend absorbed £12,500; interim dividend on the ordinary shares £12,500; put to reserve £50,000. A final dividend of 15s. per share, free of income tax, making 10 per cent. for the year, is recommended, requiring £37,000, and leaves £90,955 to be carried forward. Mr. G. W. Smith, extraordinary director, who had been manager of the Persan factory for 44 years, died in February last. Mr. Stuart A. Russell, the works manager at Silvertown, has been elected an extraordinary director. Meeting, December 19th.

Barbados Electric Supply Corporation, Ltd.—Trading profit for the year ended June, 1918, £3,197, against £2,970 and £2,693 for the two preceding years. Repairs and renewals, £484, consist chiefly of replacing poles, which work is now practically completed. Consumers increased from 1,403 to 1,541, and 25-c.p. (equiv.) connections from 19,562 to 22,208. Considering the continued difficulty of obtaining materials the progress is satisfactory. £1,270 was expended on further house connections and additions to mains. Owing to legal difficulties in connection with the collateral security proposed to be issued on the renewal of the loan of £10,000, an arrangement has been made with the subscribers to that loan under which they have taken up £110 of 5½ per cent. debentures in respect of each £100 subscribed.

Castner-Kellner Alkali Co., Ltd.—Net profit £261,339, plus £45,078 brought forward. £60,000 is put to depreciation, a final dividend of 11 per cent. is to be paid, making 20 per cent. for the year, and £48,819 is to be carried forward.

Parsons Marine Steam Turbine Patents, Ltd.—Dividend for 1917-18 25 per cent., the same as for each of the two previous years.

Amazon Telegraph Co., Ltd.—Mr. C. W. Parish, speaking at the annual meeting on November 26th, said that the difficulties prevailing in the Amazon had necessitated the sending of a large number of telegrams. Their traffic receipts had amounted to £59,158, as compared with £51,166 for the previous year, an increase of £7,992, or over 15 per cent. The Brazilian Government subsidy and interest were both slightly higher, and the gross revenue amounted to £80,455, against £72,144, an increase of £8,311. Whilst most of the expenditure items showed a slight increase, the cost of maintaining cables had amounted to only £12,476, or £2,409 less than for the previous year. The total working expenses were £31,598, or under 40 per cent. of the gross revenue. The net revenue was £48,857, as against £40,605, an increase of £8,252, or over 20 per cent. After placing £17,000 to the general reserve account, increasing it to £65,000, they recommended a dividend of 4½ per cent., less income tax, leaving £6,842 to be carried forward. With regard to prospects, traffic receipts up to date were about the same as for the corresponding period of last year. It was impossible to foretell what conditions were likely to prevail in the rubber market during the remainder of the year, but it was the general opinion that when peace was settled and normal shipping facilities were available, there would be a great demand for rubber; if so, it would bring additional revenue to the company. They might safely face the remainder of the year with equanimity. The expectation of a further expansion in the service of local deferred messages had been justified, as 107,262 more local deferred words had been sent during the year, an increase of 133 per cent., and the receipts from that class of traffic were £5,459 more than in the previous year. Mr. F. E. Nosworthy (the managing director) said that their system now comprised 2,480 nautical miles of cables, with 19 stations. During the last two years there had only been six interruptions to through communication, totalling 17 days.

Cape Electric Tramways, Ltd.—Mr. L. Breitmeyer, presiding at the annual meeting on November 27th, said that the recovery in the traffic receipts had steadily continued, and was the most satisfactory feature of the undertaking. During the year the passengers carried on the Cape Town and Port Elizabeth systems were 26,444,465, earning £264,138, an increase of 2,692,449 passengers and £33,032. The nearest approach to these figures was in the year 1903-04. The working expenses were higher than in the preceding year, but the ratio of expenses to receipts at 61.16 per cent. compared with 60.91 per cent. in the preceding year. The profits earned were better by £8,420. Most of their fares were fixed either by Acts of Parliament or by agreements, and the power of revision was considerably restricted, but they had put increases into force where they were free to do so, though those alterations were only introduced toward the end of the financial year. South Africa, from the business and agricultural points of view, had been passing through a period of unprecedented prosperity. New industries had been started. Work was in full swing, and at high pressure everywhere.

Norwegian Marconi Company.—It is announced from Christiania that the "Norsk Marconi Kompagni" has been floated, with a capital of 900,000 kroner, which will engage in the construction and sale of apparatus for wireless telegraphy and telephony. The Marconi Wireless Telegraph Co., London, is to receive 300 shares in return for the exclusive right granted to the Norwegian company to construct and sell apparatus in accordance with the patent of the English company. As the Belgian "Société Anonyme Internationale de Télégraphie Sans Fil," which is closely connected with the English company, had previously received the sole right for the sale and erection of wireless installations on board Scandinavian merchant ships, the Norwegian company has concluded an agreement with the Belgian company, according to which the former obtains the right of having the monopoly of supplying all Norwegian merchant ships, which will be built in Norway, with Marconi wireless installations. —*Financier.*

Fraser & Chalmers, Ltd.—In their report to June 30th the directors refer to the sale of the Erith works and the engineering business to the General Electric Co., Ltd. The price agreed, which included a substantial sum for goodwill, in addition to the book value of buildings, plant, machinery, and stocks, has been received in cash since the close of the accounts. The assets of the business in South Africa have also been sold. The profit, after providing for depreciation, and after making provision for excess profits duty, was £33,295, as compared with £36,174 for the previous year. Negotiations are proceeding with regard to the sale of the assets of the remaining branches of the company in Canada, Australia, and Singapore. In view of the comprehensive realisations which have been lately effected, the directors will ascertain the views of the shareholders at the coming meeting with regard to liquidation.

Companies Struck Off the Register.—The following companies have been struck off the Register, and are accordingly dissolved:—

Anglo-Foreign Engineering Offices, Ltd.
Harold Wood Electrical & Engineering Supplies Co., Ltd.
Stansfield Engineering Co., Ltd.

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Power Gas Corporation, Ltd.—Satisfactory results for the year. An agreement has been entered into for the purchase of Messrs. Lymn & Rambush, thus securing a new type of gas-producer plant. Profit £26,899, plus £10,525 brought forward. Dividend 6 per cent., less tax; £5,350 to reserve, and £16,797 carried forward.

Western Telegraph Co., Ltd.—First quarterly interim dividend 3s. per share, free of income tax, being 6 per cent. per annum.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—Final dividend of 3 per cent. on the 6 per cent. cum. pref. shares.

Globe Telegraph & Trust Co., Ltd.—Quarterly dividend 2s. per share on ordinary shares.

Shawinigan Water & Power Co.—Dividend of 1¾ per cent., less tax, for the quarter.

STOCKS AND SHARES.

TUESDAY EVENING.

THE main interest of the week is that centred upon Home Railway stocks. In this market, the recent speech of Mr. Winston Churchill at Dundee, at which he said that nationalisation forms part of the Government programme, has awakened interest in a lively degree, and has had the effect of putting up prices smartly. Optimism is rife with regard to the prices which holders of the stocks are likely to receive under a nationalisation scheme. Some quotations have gone up 4 or 5 points. Others advanced more slowly. Amongst the latter may be classed Districts and Metropolitans, with gains of ½ and 2 respectively. The Income Bonds of the Underground Electric Railways, after touching 92½, went back to 91½, showing a rise of 2. Upon what basis the Government is likely to found its scheme for taking over the securities is, of course, entirely unknown. Ingenious calculations are made to show that the basis is likely to be one which will give proprietors considerably more money than their stocks are valued at in the market to-day.

Manifestly, Home Railway dividend-paying securities will have to be treated in a class different from that which governs the non-dividend payers, and on any probable ground, so far as can be seen at present, Metropolitan Consolidated stands fairly high. In regard to Districts, the fact of the stock having received no dividend for 36 years is accounted as a point in its favour. What is likely to happen to the Debentures, Guaranteed and Preference issues few people care to hazard a guess. It is, however, interesting to notice that City & South London 4 per cent. debenture stock can be bought at 70, giving a return on the money of 5¾ per cent. In the preference list, District 4½ per cent. is on offer at 71¾, the return in this case being 6⅜ per cent., while London Electric 4 per cent. preference is offering at 65, affording a return of 6¼ per cent. on the money. A small amount of District 3 per cent. rent charge can be obtained at 54, the yield in this case coming to £5 13s. 3d. per cent. None of these stocks are, of course, available for strict trusts, and consequently they show higher yields than can be obtained from investment securities falling within the trustee boundary.

Accompanying the rise in prices has come a considerable volume of business, so that the market presents an aspect of greater activity than has characterised it throughout the present year. The introduction of an eight-hours day is held to be of no particular account in reckoning up the chances of valuation under a nationalisation scheme, and it is considered that it will pay the companies to declare as much dividend as they possibly can in respect of the current six months, since thereby they may be improving their chances of obtaining a good price for the stocks when the blessed word "nationalisation" is translated into practical politics.

Elsewhere in the Stock Exchange markets there is a fair amount of activity amongst industrials. British Aluminiums have been prominent with a rise to 37s. Dealings have now started in the new shares of Callender's Cable, and the ordinary are quoted at £7¼ for the £5 ordinary shares, while the preference stand about ⅛ above the paid-up value of £3. Allotments of the new Siemens shares have appeared within the past few days, and the market price is 5¾ middle, comparing with 6¼ for the senior issue. Babcock & Wilcox have fallen ¼. The Fraser & Chalmers report had little influence upon the price of the shares, which remained at 31s. 6d. Indeed, some disappointment is expressed at the lack of information with regard to the assets of the company in Singapore, Canada, and Australia, although those in the Union of South Africa duly figure in the balance-sheet. Analysis of the latter is held to show that the current quotation represents a fair value for the shares, but having regard to the other assets already mentioned, the optimists look for an ultimate price several shillings higher than that now prevailing.

Electricity supply shares are mostly quiet. The advanced levels are well maintained, but pending further developments there is not much going on at present. Brompton ordinary and Chelseas are both ¼ up, while Kensingtons show a rise of 7s. 6d., advancing to 5⅛. South Metropolitan second preference at 18s. are a shilling to the good.

Beyond a further sagging in the price of Anglo-American Telegraph deferred to 23⅛, and another 1/16 improvement in United River Plate Telephones, the list of cable issues exhibits no changes. India-Rubber shares have risen 5s. to 17¾ in spite of the slight falling-off in profits as disclosed by the report just out. The dividend on the ordinary shares is again 10 per cent., free of tax. The directors raise the carry-forward by some £30,000 to £90,000, and the balance-sheet shows the company to be in an excellent position.

The colonial and foreign traction group is disposed to ease off, except as regards debenture stocks of the best companies. Amongst the latter, Madras 5 per cent. debenture stock has risen 3 to 85, and Melbourne consolidated debenture stock at 86 is 1 up. On the other hand, British Columbia Electric debenture moved back a point, and Brazilian Tractions are 1½ lower, while the Anglo-Argentine Tramways group is inclined to give way a trifle after its recent display of strength. Pernambuco Trams are fairly active about 8s. 3d., but business in the preference has dwindled, and the price is now 16s. 9d. An inquiry for Isle of Thanet 5 per cent. preference, no dividend on which has been paid since December, 1913, showed a pronounced scarcity of shares, while it is not easy to buy the ordinary at anything like their normal quotation of half-a-crown. London & Suburban ordinary at 3s. 6d., and the preference at 8s. 6d. are more easily dealt in. British Electric Traction remains firm at 47½, and the 6 per cent. preference at 78½. The Rubber market shows very little change on the week, and business in base-metal shares is meagre.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Dec. 10, 1918.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	9	10	7½	+ ¼	£6 18 0
Charing Cross Ordinary	5	4	3⅜	—	5 14 4
do. do. do. 4½ Pref.	4½	4½	3⅜	—	6 13 4
Chelsea	3	5	4	+ ¼	6 5 0
City of London	8	8	13½	—	6 0 9
do. do. 6 per cent. Pref.	6	6	10⅜	—	5 18 5
County of London	7	7	11⅝	—	6 5 7
do. do. 6 per cent. Pref.	6	6	10⅜	—	5 18 5
Kensington Ordinary	6	7	5⅞	+ ⅜	5 19 ⅜
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	4	—	6 5 0
Metropolitan	3	4	3½	—	6 3 1
do. 4½ per cent. Pref.	4½	4½	3½	—	6 18 6
St. James' and Pall Mall	8	9	7⅛	—	6 6 4
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	7⅛	—	6 6 4
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	*6	6	99	—	6 1 0
do. Def.	1½	1½	23⅛	— ⅛	6 9 6
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	15⅝	—	*5 1 7
Eastern Tel. Ord.	8	8	159½	—	*5 0 5
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 5
do. do. Pref.	6	6	10½	—	5 14 3
Great Northern Tel.	24	22	83	—	6 13 5
Indo-European	13	13	58½	—	5 11 0
Marconi	15	20	4⅜	—	4 6 7
Oriental Telephone Ord.	10	10	8½	—	2 17 2
United R. Plate Tel.	8	8	7⅝	+ 1/16	*5 8 3
West India and Panama	6d.	1/3	1⅛	—	*8 12 6
Western Telegraph	8	8	16½	—	*4 15 7
HOME RAILS.					
Central London Ord. Assented	4	4	65½	—	6 2 2
Metropolitan		1	31	+ 2	3 4 6
do. District	Nil	Nil	26	+ ½	Nil
Underground Electric Ordinary	Nil	Nil	8⅜	— ⅛	Nil
do. do. "A"	Nil	Nil	9/-	—	Nil
do. do. Income	6	4	91½	+2	*4 7 5
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅜	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	4⅛	+	—
do. do. 2nd Pref.	5½	—	3⅛	—	—
do. do. 5 Deb.	5	5	75½	—1	6 12 5
Brazil Tractions	—	—	56	— 1½	—
Bombay Electric Pref.	6	6	10⅜	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	67½	—	7 11 5
do. do. Preferred	Nil	Nil	52⅜	—	Nil
do. do. Deferred	Nil	Nil	47½	—	Nil
do. do. Deb.	4½	4½	62	—1	6 17 8
Mexico Trams 5 per cent. Bonds	Nil	Nil	67	—	Nil
do. 6 per cent. Bonds	Nil	Nil	55	—	Nil
Mexican Light Common	Nil	Nil	40	—	Nil
do. Pref.	Nil	Nil	50	—	Nil
do. 1st Bonds	Nil	Nil	71	—1	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	37⅞	— ¼	4 0 0
British Aluminium Ord.	10	10	37/-	+ 2/-	5 8 1
British Insulated Ord.	20	20	2½	—	4 9 0
British Westinghouse Pref.	7½	7½	2⅝	— ⅛	5 14 1
Callenders	20	25	9⅝	—	6 9 10
do. 5 Pref.	5	5	5⅛	—	—
Castner-Kellner	22	20	3⅝	—	5 10 4
Edison-Swan, "A"	—	—	⅝	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	10	1¼	—	8 0 0
Gen. Elec. Pref.	6	6	10⅜	—	6 2 4
do. Ord.	10	10	17½	—	*5 12 8
Henley	25	25	2¼	—	5 11 ¼
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17¾	+ ¼	*5 12 8
Telegraph Con.	20	20	48	— ½	*5 0 0

*Dividends paid free of Income Tax.

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ELECTRIC SPOT WELDING.*

By G. A. HUGHES and R. H. POOL.

To decide whether it is better to rivet or to spot-weld an article one must take into consideration the use of the article, and not base the decision on the cost of obtaining a desired strength. In light work spot welding can successfully replace riveting in 90 per cent. of the cases. There are numerous conditions where it is impossible to use rivets because the stock will not permit the punching of the hole, or because the rivet head is objectionable. Special spot-welding machines can be made to take care of the difficult shapes, and thus reduce the cost of an article in the saving of the rivets and dies, maintenance of dies, and labour in laying out and punching the stock. An ideal condition for spot welding is where a smooth surface is desired and the material does not permit the countersinking of the rivet heads. The thickness of material that can be successfully welded will depend entirely upon its size and shape, together with the rating of the welding machine. The writers have seen two pieces of ½-in. (1·27-cm.) material—a total thickness of 1 in. (2·54 cm.)—welded on a 30-kw. machine.

The data are intended to give an idea of (1) power consumption, (2) strength of the weld, and (3) speed at which welds can be made. All the tests on which the data are based were made on 30-kw., 220-volt, 60-cycle, hand-operated machines made by the Federal Welding and Machine Co., of Warren, Ohio. Fig. 1 shows its standard 449-B machine. The machines were in service for two hours before the tests were made. This was to allow for the heating of the machines. Each machine had an auto-transformer in the primary circuit of the welding transformer to control the welding current. Taps were provided on the auto-transformer to adjust the primary voltage in eight steps from 65 per cent. to full-line voltage.

In making the test recorded in Table I, three plates of soft steel $\frac{3}{16}$ in. (4·8 mm.) thick were used, making a total thickness of $\frac{9}{16}$ in. (13·2 mm.). The first three welds were made with the auto-transformer on tap 5. The time of welding varied from 42 to 44 seconds and the power demanded from 17 kw. to 18·4 kw. The fourth and fifth welds were made with the auto-transformer on tap 7. The time of welding was 30 to 31 seconds and the power demanded 24 kw. to 25·6 kw. All of the welds were satisfactory. (Note the power factor.) An attempt was made to weld on tap 8, but this was unsuccessful, as the material next to the copper contacts would become hotter than the centre plate and would be forced out from under the contacts, and thus burn the material at the point of welding.

An attempt was made to determine the proper pressure for the contacts while welding, since the presence of the scale and rust caused considerable arcing and burning of the material under the contacts, forcing the molten metal out, and thus leaving a bad weld, although it would have the appearance of a perfect one. Upon cutting into the weld, however, it would have the appearance of a honeycomb. To avoid this trouble it was decided first to burn the rust and scale off. This was accomplished by forcing the welding contacts firmly on the material and then turning the power on the welder for a moment. This method removed the scale and assured a good contact between the welding points and the material. Then the power was turned on and the material brought up to a welding heat without arcing. This saved the cleaning of the stock and added about 50 per cent. to the life of the welding points.

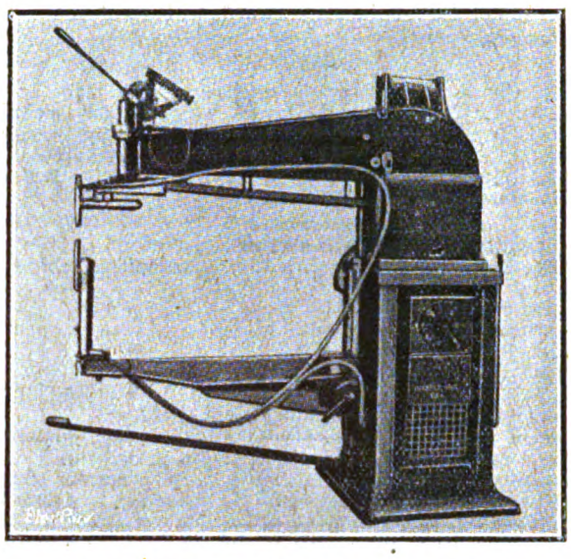

Fig. 1.—Standard Spot-welding Machine.

To determine the kilowatt-hours consumed in a day's run, an integrating watt-hour meter was installed. Some conclusions made from these readings are:—

1,480 welds of two pieces No. 18 gauge sheet steel.
1,050 welds of four pieces No. 16 gauge and one piece $\frac{3}{16}$-in. plate.

2,530 welds total in 10 hours. Energy consumed, 42 kw.-hours.

680 welds of two pieces No. 18 gauge sheet steel.
1,350 welds of four pieces No. 16 gauge and one piece $\frac{3}{16}$-in. plate.
545 welds of one piece of No. 18 gauge and one piece of $\frac{1}{8}$-in. mild steel.

2,575 welds total in 10 hours. Energy consumed, 35 kw.-hours.

In making the tests indicated by Table III it was impossible to obtain two results alike, owing to the different chemical analysis of the steel.

TABLE I.—Data Obtained Using Three $\frac{3}{16}$-in. Plates.

Volts.	Amp.	kw.	p.f.	Size of spot. In.	Tap of auto-transformer.	Time, seconds.	Condition of materials.
232	186	17·6	0·41	$\frac{7}{16}$	5	44	Free from rust
232	176	18·4	0·45	$\frac{7}{16}$	5	42	
232	180	18·1	0·43	$\frac{7}{16}$	5	44	
230	256	25·6	0·43	$\frac{7}{16}$	7	30	
230	248	24·0	0·42	$\frac{7}{16}$	7	31	

TABLE II.—Data Obtained Using Two $\frac{9}{32}$-in. Plates.

Volts.	Amp.	kw.	p.f.	Time in seconds.	Tap of auto-trans-former.	Condition of material.
218	208	26·4	0·57	24	7	
218	224	26·0	0·53	22	7	
218	244	26·4	0·53	24	7	Scale
218	228	26·8	0·54	22	7	and rust
218	216	26·0	0·55	22	7	were
218	224	26·4	0·54	26	7	present.
218	220	25·5	0·53	25	7	
218	224	28·0	0·57	22	7	

TABLE III.—Data with Different Material.

Volts.	Amp.	kw.	p.f.	Time, seconds.	Tap of auto-trans-former.	Size of spot, in.	Material used.
220	244	24	0·54	15	7	$\frac{3}{16}$	Two $\frac{3}{16}$-in. mild steel plates
220	260	20	0·35	20	7	$\frac{3}{16}$	Two $\frac{3}{16}$-in. "Vasco" non-shrinkable steel plates.

TABLE IV.—Comparison of Spot-Welded and Riveted Joints.

Test No.	Size of spot, in.	Condition of sheets, and contacts.	Maximum load, lb.	Nature of failure.	No. of spots.
1	$\frac{3}{16}$	Free from scale. Contacts good.	4,460	Welds pulled out	1
2	$\frac{3}{16}$	Free from scale. Contacts good.	7,250	Welds pulled out	2
3	$\frac{3}{16}$	Free from scale. Contacts good.	10,920	Welds pulled out	3
4	$\frac{3}{16}$	Scale on sheets. Contacts poor.	4,400	Welds sheared	2
5	$\frac{3}{16}$	Rust and scale. Contacts good.	8,100	Welds sheared	3
6	Two ½-in. rivets, holes drilled and rivets inserted with care.		4,700	Rivets sheared	—
7	Two ½-in. rivets, holes drilled and rivets inserted with care.		5,200	Rivets sheared	—

All tests were on No. 14 gauge sheets, steel 3 in. wide, single lap-joint, single-shear.

TABLE V.—Tension Tests on Spot-Welded Joints.

Test No.	1	2	3	4	5	6	7	8
Maximum load, lb.	3,700	3,740	6,470	6,195	4,980	4,980	7,830	7,790
Nature of failure	Weld pulled out	Weld pulled out	Weld pulled out	Weld pulled out	Weld pulled out	Weld pulled out	Plate failed	Plate failed
No. of spots	1	1	1	1	2	2	2	2
Kind of joint	Lap Single shear	Lap Single shear	Butt Double shear	Butt Double shear	Lap Single shear	Lap Single shear	Butt Double shear	Butt Double shear

Material tested.—No. 16 gauge sheets, 3 in. wide; welds, ⅜ in. spots.

Forcing the Yield of Oil Wells by Electricity.—The yield of an oil-well may be diminished, and in some cases stopped, by the cooling of the rock-beds due to ingress of air. The crude oil is thereby thickened, and its flow through the crevices and porous channels in the beds is checked or wholly arrested. The remedies commonly used are hot water, steam, or hot air. These, however, are effective for only moderate depths. The recently devised method of applying an electric current to the warming of the oil avoids this difficulty, and moreover offers special advantages. The oil is heated without loss, and, much gas being generated, a pressure is set up which in some cases has forced the oil to the surface in bore-holes of great depth. The system is as effective in wells a thousand metres deep as in those of little depth. The military commands have used the system of electrical heating to restore to working order temporarily abandoned mines in Galicia and Roumania.—*Chemiker und Techniker Zeitung.*

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ELECTRICITY SUPPLY PROGRESS IN WAR TIME.

In our issue of November 22nd (p. 487), we gave a schedule of electricity supply undertakings which had carried out extensions during the war, stating the amount of plant installed or ordered for that purpose. To supplement this schedule, we have obtained particulars of the extensions from the engineers responsible for them, and give them in brief below. As the data have not all come to hand as yet, we are unable to adopt a systematic classification, and therefore they will be inserted as circumstances permit. We trust that these particulars, with the comments of the engineers attached, will be of interest to our readers.

BRADFORD.

Not only have considerable extensions been made to the plant of the City of Bradford (Mr. T. Roles, city electrical engineer and manager) during the period of the war, but further important extensions are at present in progress. The principal items of extensions which have already been carried out are roughly as follows:—

One 5,000-KW. turbo-generator.
Three 1,500-KW. rotary converters.
Three boilers, complete with fans, economisers, chimneys, &c.
Three cooling stacks.
Suction ash-handling plant.
Coal conveyor.
Switchgear.
Storage battery, having an output of 5,000 amps. for one hour, and building to accommodate battery.

One of the 1,000-KW. low-speed sets is being removed to make room for a 12,000-KW. turbo-generator, which is in course of construction, while another turbo-generator of similar size is on order, and to provide room for this two further 1,000-KW. sets will have to be removed. The capacity of the generating plant, 16,800 KW. in 1914, will thus be raised to 44,250 KW.

BURY.

The County Borough Council of Bury contemplated considerable extensions at the time when war was declared, but at the request of the Government these were held up. A 3,000-KW. turbo-alternator ordered at the beginning of 1914 was installed, and at a later date, with the sanction of the Ministry of Munitions, a 45,000-lb. boiler was added to the plant. The rated output has thus been increased from 5,700 to 8,700 KW.

During the past four years the electricity department has had to refuse new business to the extent of some 4,000 H.P. through inability to carry out extensions; these applications have not been from industries established specially for war purposes, but from others normally engaged on export or the home trade.

The output has been well maintained, mainly through the extra demand of munition makers coinciding with a falling-off in the requirements of other trades, such as textiles and paper-making; no doubt this process will now be repeated in the reverse direction.

The borough electrical engineer and manager, Mr. S. J. Watson, thinks it was a mistake to restrict extensions of modern works, particularly from the fuel point of view. A number of power users in his area who wanted to use the public supply, but whose demand could not be met, have temporarily brought into use second-hand prime movers or old plant requiring much more fuel per unit than a power station, and they will certainly have to wait 18 months or two years before an increased public supply can be provided. In some cases this will retard the establishment of useful industries. He considers that the prospects for an increased use of electrical power in Bury are distinctly good, and everything possible should now be done to ensure that these demands can be met. As a system of priorities will probably be continued for some time to come, and industrial development is now of first importance, and cannot properly be dealt with without an ample supply of cheap power, extensions of power stations should be facilitated by the highest priority certificates.

MAIDSTONE.

In the very early days of the war the Borough of Maidstone (Mr. E. E. Hoadley, engineer and manager) put in a 1,250-KW. Ljungström turbine, with a 1,000-KW. rotary converter; this was partly to replace some small 150-KW. Peache-Parker and Westinghouse sets, of which originally five were installed. On the outbreak of war, three of these were taken for purposes of wireless telegraphy, one to go somewhere in the Egyptian desert, and the other two to the Isle of Ascension. Since then the borough has got rid of the other two—one to an aeroplane factory and the second to a colliery—and is now erecting a second Ljungström set, but of 1,750 KW. capacity, giving a three-phase supply at 6,600 volts, with the necessary E.H.T. switchgear and transformers. An E.H.T. cable is being laid to a sub-station equipped with a 1,000-KW. rotary converter and the necessary transformers.

In the boiler-house a 30,000-lb. Thompson water-tube boiler is being installed, fitted with Class "A" travelling grate stokers, by the Underfeed Stoker Co., which are capable of burning either anthracite or coke breeze. A complete mechanical coal handling plant, consisting of elevators and conveyors, has been installed by Messrs. Ed. Bennis & Co., Ltd., and the Council has also purchased a 3½-ton electric coal wagon for carting coal, an air compressor for cleaning electrical machinery, and a 100-KW. balancer. All this plant has been installed to meet the additional demand which has been experienced, chiefly from large extensions to the power supply; most of the new connections have been used for the production of munitions, some of which have been of the very highest importance. The plant capacity before the war was 2,075 KW., and is now over 4,300 KW.

The borough is in an exceptionally fortunate position, as the whole of the load that has been obtained will simply switch over at once to peace-time productions, which were the staple output of the factories before they were put on to war work, and the authorities look forward to very large developments in electricity supply in Maidstone and its immediate neighbourhood in the near future.

RUNCORN AND WIDNES.

The Mersey Power Co., Ltd., had a small station at the beginning of the war, of a total capacity of 3,000 KW., with 1,500 KW. spare; this has been running on a 17 per cent. load factor for the last two and a half years. Recently the company has put in a new 3,000-KW. set, which is now on load, but which took 18 months to get. The total plant capacity has therefore been raised from 4,500 to 7,500 KW. The company is now designing and obtaining quotations for a 100,000-KW. station on the shores of the Ship Canal, beginning operations with two 12,000-KW. units.

SLOUGH AND DATCHET.

The Slough and Datchet Electric Supply Co., Ltd. (Mr. A. E. Farrow, general manager) has in hand a scheme for which the plant has not yet been received (although certificates have been granted, and it is hoped to have the plant in running order by next March); the company intends to install a 1,000-KW. Ljungström turbine in its works at Slough, and to generate there all electricity, both for itself and for the Windsor Electrical Installation Co. At the present moment it is laying a trunk main between Slough and the Windsor works; also it is putting down rotary converters at Slough for converting A.C. to D.C., and utilising the existing dynamos at Windsor, driving the latter with three-phase motors. Eighty per cent. of the load is for power purposes. The original capacity of the plant was 695 KW., and the extensions will bring it up to 2,030 KW.

SHEFFIELD.

At the outbreak of war the electricity supply department (Mr. S. E. Fedden, general manager) was installing an 8,500-KW. turbo-alternator at Neepsend. Orders were placed for a similar set and the corresponding boilers, and in 1915 a 2,000-KW. set and a 9,000-KW. set were commandeered, boilers were ordered, and the extension of the building was pushed forward night and day. Still the demand increased, and at the beginning of 1916 additional plant was ordered, being brought up to 68,225 KW. in 1917, as compared with the total rated capacity of the city electrical undertaking of 23,225 KW. in 1914—a total increase in three years of no less than 45,000 KW. During the same period the mains were greatly extended, 91 miles of cable being laid, new sub-stations were built and equipped, and new switchgear and other apparatus was installed at the power station and many of the existing sub-stations. During part of the time the whole of the generating plant was working continuously on overload. In addition to the above, a new power station is now being erected to accommodate plant of a total capacity of 28,000 KW., and an additional extension of 50,000 KW. has been authorised, which will bring the total rated output up to 146,225 KW.

WATFORD.

The staple trades at Watford, namely, printing and brewing, were badly hit by the war, and the growth and turnover of other industries to munition making has not done much more than counterbalance the loss sustained by the undertaking through the restrictions imposed upon these trades. Good steady progress has been made, in spite of difficulties, and various new businesses have been supplied from the Council's mains, such as printing for a Government department, the manufacture of saccharine and medicinal chemicals, and the driving of one of the largest magneto factories in the country. These will no doubt remain on the mains, but purely munition works, such as filling factories, &c., will probably disappear. In one respect the conditions are favourable, inasmuch as the bulk of the munition work has been a change-over to war work, and therefore the change to peace conditions should be easily accomplished.

The prospects are very good, seeing that the district generally is very healthy, and there is plenty of land suitable for factory sites, with corresponding residential sites, within the electricity supply area, which is served by two railway lines, with a third extending into it shortly. The works of the Urban District Council (Mr. A. W. Barham, chief engineer) are being modernised to meet present conditions, and

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a 1,250-kw. Ljungström turbine (at 0.8 power factor) is being installed to cope with the additional loads. This will bring up the total rated output of the plant from 2,500 to 3,750 kw.

TONBRIDGE.

The output for private supply has been much reduced owing to Government regulations, and practically no new business has been done. There has been a considerable increase, however, due to supplies to munition factories in the district, and new mains to the value of £5,000 have been laid. New generating plant of 570 kw. has been sanctioned, and part of this has been installed. The new plant consists of a 170-kw. Willans-Crompton Diesel set and a 400-kw. Willans-G.E.C. turbine set, raising the plant capacity from 370 to 940 kw. Bennis mechanical stokers have been fitted to the existing boilers. The Urban District Council (Mr. M. P. Plunkett, electrical engineer) has under consideration a scheme for utilising the water power at the Town Mills, which property it has recently acquired.

MANCHESTER.

Just before the outbreak of war the rated capacity of the generating plant of the Manchester Corporation (Mr. S. L. Pearce, engineer and manager) amounted to 76,000 kw., the first 15,000-kw. turbo-alternator (a Howden (Zoelly)-Siemens set running at 1,000 r.p.m., with surface condensing plant of 24,000 sq. ft. by Richardsons, Westgarth & Co., Ltd.) having been started up in June, 1914. It was originally contemplated that at this stage in the development of the Manchester electricity system—the Barton site having been acquired—no further plant would be installed at Stuart Street. But it was not then possible to proceed with the Barton project, and, in view of the most urgent demands for power arising from the war, extensions were carried out at the Stuart Street station.

During 1915 and 1916 two 6,000-kw. turbo-alternators running at 3,000 r.p.m. were put down, the first a Westinghouse-Siemens combination, and the second a Westinghouse-Westinghouse. The jet condensing plant was supplied by Mirlees, Watson & Co., Ltd. These two 6,000-kw. sets took the place of two of the original six 1,500-kw. engine sets. All of the latter have now been removed.

In the early part of the present year the installation of a second 15,000-kw. turbo-alternator was completed. This comprises a Richardsons, Westgarth turbine coupled to a Westinghouse alternator running at 1,500 r.p.m., with surface condensing plant of 30,000 sq. ft. by the first-named firm. This new unit replaced one of the two 3,750-kw. Wallsend-Slipway-Electrical Co. engine sets. There is further on order for delivery by the end of this year a 20,000-kw. turbo-alternator set running at 1,500 r.p.m., also of Richardsons, Westgarth, and Westinghouse construction, coupled to a Richardsons surface condensing plant of 40,000 sq. ft. cooling surface. The alternators of both sets are capable of easily maintaining a continuous output of 20,000 kw. and 25,000 kw. respectively.

By the end of the present year therefore the total capacity of the plant installed at Stuart Street will be 100,250 kw.

A clean sweep is being made of the original 24 10,000-lb. boilers in No. 1 boiler-house. Between 1909 and 1915 two Babcock & Wilcox 30,000-lb. land type boilers and six 45,000-lb. marine type boilers were added. During 1916 and 1917 four Babcock & Wilcox 60,000-lb. marine type boilers were installed.

There are under construction two boilers of a similar type, but of even larger capacity than the foregoing. They are expected to be capable of giving easily and continuously 100,000 lb. of steam per hour when burning coal having a calorific value of 11,000 b.th.u. Two additional units of this size are on order for completion during 1919.

At the Bloom Street station in 1914 a traction battery of 4,000 ampere-hours capacity—3-hour rating—by the Chloride Electrical Storage Co., Ltd., and in 1917 a 10,000/12,000-kw. Westinghouse-Westinghouse turbo-alternator running at 1,500 r.p.m., with surface condensing plant by the same company, were installed. The latter has superseded one of the four original 1,800-kw. Musgrave-Westinghouse engine sets.

CLYDE VALLEY.

The Clyde Valley Electrical Power Co. (Mr. R. Robertson, commercial manager) is in course of increasing its capacity from 55,000 kw. in 1914 to 75,000 kw. The following are particulars of the generating plant installed or under construction since August, 1914, at the company's generating stations:—

Two 5,000-kw. Westinghouse turbo-alternators, 11,000 volts, three-phase, 25 cycles, now in operation.

One 15,000-kw. ditto ditto, expected to be in operation in March, 1919.

One 15,000-kw. ditto ditto, under construction.

HACKNEY.

The Metropolitan Borough of Hackney (Mr. L. L. Robinson, M.Inst.C.E., borough electrical engineer) has increased its generating plant from 4,800 kw. in 1914 to 13,400 kw. in 1918. Part of the new plant is now being installed. Messrs. Babcock & Wilcox, Ltd., are supplying two boiler units, each comprising land type boiler, integral superheater, chain-grate stokers, Green economiser and induced-draught plant, and Weir turbine feed pump. The boilers are rated at 33,000 lb. per hour, and have a heating surface of 8,283 sq. ft. (+ 1,980 sq. ft. superheater), working at a pressure of 225 lb. per sq. inch, and a final temperature of 600 deg. F. Messrs. C. A. Parsons & Co., Ltd., are providing a turbo-alternator of the pure reaction type, with a normal output of 6,000 kw. at 0.8 power factor, running at 3,000 r.p.m. The condenser, of 9,500 sq. ft. cooling surface, will give a vacuum of 28.4 in. with barometer 30 in. at 6,000 kw., with 8,000 gallons per minute at 70 deg. F. cooling water. The air pumps are of the Edwards type, and the circulating pumps are Rees Roturbo. The guarantee is 11.9 lb. steam per kw.-hour at full load. Messrs. Ferranti, Ltd., are installing a panel for the 6,000-kw. generator.

(To be continued.)

THE SUPPLY OF SINGLE-PHASE POWER FROM THREE-PHASE SYSTEMS.

By PROF. MILES WALKER, D.Sc., M.I.E.E.

(Abstract of paper read before the Institution of Electrical Engineers.)

A very large proportion of the electrical power stations of the world generate alternating current in three phases; there are, however, some purposes for which single-phase current is to be preferred, as, for instance, in high-voltage alternating-current traction systems. Another purpose for which single-phase power is required at the present time is the operation of electric furnaces. There can be no doubt that, putting aside all considerations of convenience of electric supply and looking at the objects to be attained merely from the metallurgical point of view, the single-phase furnace has much to recommend it. Nevertheless, on account of the great objections raised by the suppliers of electric power to the unbalancing effect of a single-phase load upon their three-phase systems, the polyphase furnace is in much more extensive use in this country than the single-phase furnace.

In view of the very extensive use that will be made of electric furnaces for steel manufacture in the future, it is important to see what can be done to minimise the objection of the suppliers of electric power to a single-phase load.

The main objections to the single-phase generator are the following: The cost for a given output is higher than for a three-phase generator; for instance, the cost of a 25-cycle single-phase generator of 5,000-kw. capacity, running at 1,500 r.p.m., would be about 30 per cent. higher than that of a three-phase generator of the same characteristics. This is partly because the single-phase output from a given frame is less than the three-phase output, and partly because a single-phase generator must be provided with a very heavy and well-constructed amortisseur on the field magnet, the cost of which is a considerable item. Secondly, the efficiency of a single-phase generator is considerably lower (from 1½ to 2 per cent.) than that of a three-phase generator of the same rating. This is caused partly by the higher iron losses due to the single-phase armature reaction, and partly by the loss in the amortisseur and the metal surrounding it.

Where the load is divided between a number of locomotives or a number of furnaces which are not started simultaneously, it is possible to divide the whole into two parts, putting one part on to one phase of a two-phase generator and the other part on to the other phase. It may be that such an arrangement gives a balance of load that is good enough for practical purposes; and if the generator is constructed with an amortisseur so as to take a single-phase load without injury, this arrangement is perfectly satisfactory. Similarly, three independent loads can be taken from a three-phase system.

An appendix gives the graphic construction for finding the voltage change in each phase when a single-phase load is thrown on one phase of a three-phase generator, and it is established that if the single-phase load (even of low power factor) does not exceed 20 per cent. of the normal three-phase load the disturbance to the voltage is inconsiderable. An instance of this kind is found at Bradford, where single-phase furnaces of 400-kw. capacity are thrown on and off three-phase mains without causing a noticeable unbalancing of the voltages.

In some cases where power companies have refused to connect a single-phase load on to their systems, motor-generators have been installed. With a synchronous motor driving the single-phase generator, the set may be used for improving the power factor of the system by over-exciting the synchronous motor. For general convenience of operation this method is entirely satisfactory; the consumer has complete control over his own voltage; the power factor on the three-phase side can be adjusted at will; and the maximum demand can be kept within bounds, notwithstanding the heavy currents that may be drawn from the single-phase generator at times of short circuit. The main drawbacks to this plant are the high first cost and the poor efficiency. Owing to the low efficiency of the single-phase generator, especially when built with heavy armature conductors for large currents, the efficiency of the whole set is usually very poor. A 500-k.v.a. set has an efficiency of about 85 per cent.

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In order to secure a higher efficiency than can be obtained from a motor-generator, and a better specific use of the material employed, a number of different types of balancers have been proposed for balancing a three-phase system that would otherwise be thrown out of balance by a heavy single-phase load. These may consist either of stationary apparatus, such as choke coils or condensers, or of running machines, which may be either synchronous or asynchronous.

The generating plant in a three-phase power station might conceivably be so large and its impedance so low that quite a large single-phase load might be thrown on one phase, and yet the voltage might remain practically undisturbed; so that from *the consumer's point of view* the system might be considered in balance. It is necessary to distinguish between unbalanced currents and unbalanced voltages; and in considering voltages and currents, their phases and wave-forms are important as well as their virtual values.

If a symmetrical generating system has impedances of finite value, any departure from the conditions of balance in the currents causes a want of balance in the voltages. On the other hand, if the impedances in the generator and line are unsymmetrical, the voltage at the consumer's terminals will be unbalanced even when he draws currents that are balanced in ampliture and phase. If the voltages at the terminals of consumer S are unbalanced (owing, let us say, to an unsymmetrical load drawn by consumer U), a load of symmetrical polyphase machinery having small impedance, when put in circuit by consumer S, will have the effect of bringing the voltages more nearly into balance. This is due to the fact that the line supplies unbalanced currents to S's symmetrical apparatus, so that even if the effect were almost to balance the voltages S can justly complain that his load is unbalanced. He would, in fact, have unequal heating in his windings, owing to the unsymmetrical loading of U's apparatus. Meanwhile, the central-station engineer might be congratulating himself on the fact that his voltages and currents were very nearly balanced. If, therefore, we wish to make a complete statement of the want of balance on any system, we must be precise as to the part of the system under consideration, stating whether the voltages are unbalanced as to amplitude or phase, and whether the currents are unbalanced as to amplitude or phase. This is all on the assumption that the voltages and currents are of pure sine wave-form; if not, there are very many more ways in which the system and parts of the system may be unbalanced.

As Steinmetz has pointed out, there is another test of the balance of the loads. If the sum of the three alternating components of the power is zero, the load is balanced in the sense that the power flows from the generator in an even stream; but if the sum is not zero there is a fluctuating flow of power from the generator.

But it may happen that the amplitude and phase of three alternating power components are such that the three vectors representing them would form the sides of a triangle with the arrow-heads (showing the sense of the vectors) following one another consecutively. In this case the alternating components of the power balance one another, although it may be that neither the currents nor the voltages are balanced.

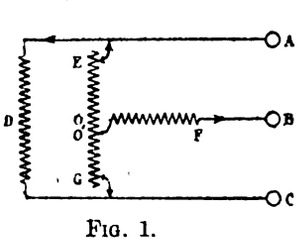

Fig. 1.

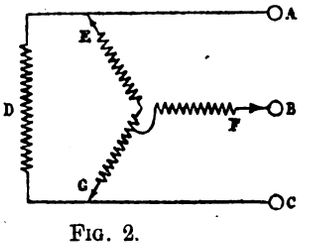

Fig. 2.

Where a polyphase load has been unbalanced by the addition of a single-phase load, it may be balanced by the addition of a wattless load taken by a choke coil or a condenser.

If we apply this method to the balancing of a three-phase circuit which is carrying a single-phase load, it will be found that for some loads the addition of the choke coil gives a true balance; but that for other loads the balance (while it is such as to bring to zero the resultant alternating components of power) is not such as to comply with conditions of balance of voltages and currents.

The addition to the system of the choking coil in question, while it brings about a balance, increases the wattless load on the system. Now that condensers of large capacity can be manufactured at fairly reasonable prices, it would be possible to use a condenser instead of a choke coil, with the effect of improving the power factor at the same time as balancing the load. Such an arrangement, however, has the drawback (apart from its first cost) of requiring to be switched in and out with the furnace load.

A running machine such as a synchronous motor or asynchronous motor is able to take energy from the circuit at one part of a cycle, store it as kinetic energy, and return it to the circuit at another part of the cycle. In this way it is able to neutralise the alternating component of the power. Any symmetrical three-phase motor or generator running on the system and having an armature of low impedance will help to balance the voltages on a system when the voltages are unbalanced, by taking unbalanced currents from the line.

If the armature impedance is not negligibly small, it is possible to obtain balance by connecting some kind of boosting appliance in series with the balancer to compensate for the impedance drop in the armature. In this way a comparatively small balancer can be compelled to take an unsymmetrical load sufficient to balance perfectly the voltage of the system. The main distinction between different kinds of balancers lies in the kind of boosting appliance employed.

The balancer may be either synchronous or asynchronous. A synchronous balancer can be used to correct the power factor of the system, whereas an asynchronous machine usually throws a lagging wattless load on the system.

(*a*) *Unsymmetrical Numbers of Turns on Balancer Winding.*—Fig. 1 shows a single-phase load D supplied from a three-phase supply, the terminals of which are A, B, and C. A balancer is shown with its windings E, F, G connected so as to balance the load. The windings E and G together may form one of the phases of a two-phase generator, F forming the other phase. In this case the number of turns in F is

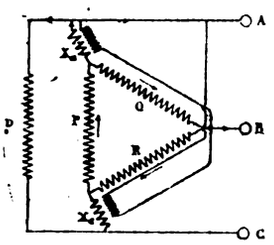

Fig. 3.

arranged so as to give a symmetrical three-phase voltage at the terminals. Or, if preferred, the winding E, F, and G may be wound as an ordinary three-phase generator (fig. 2). In either case tappings are brought out from E G near the star point so that the inner end of F may be connected in an unsymmetrical manner. Tappings may also be brought out near the outer ends of E and G.

The drawback to the use of these unsymmetrical connections is that at no load they cause as much out-of-balance as they cure when the load is on.

(*b*) *Boosting Transformers in Series with Balancer Windings.*—It is possible to compensate for the inductive drop in the balancer windings by injecting electromotive forces of the right amount and phase, by means of transformers, in series with the balancer windings. In 1915 experiments were made to see how far a synchronous motor could be made to operate as a balancer by means of injected E.M.F's. The connections are shown in fig. 3. It was found that a rotary converter could be made to balance the currents to within 6 per cent. of the mean current; this was good enough for practical purposes. The rotary converter, in addition to balancing the load, provided all the wattless current for the single-phase load, the current from the alternating-current generator being drawn at unity power factor.

It was found that if the single-phase load was thrown off with the boosting transformer still in action, the rotary converter took from the alternating-current generator an unbalanced load of a magnitude comparable with the single-phase load thrown off. In fact, for every change of the single-phase load it was necessary to alter the taps of the boosting transformer, and for different power factors of the single-phase load it was necessary to take different combinations of phases in order to supply a boosting voltage in the right phase.

It was thought by the author that it should be possible to combine in one machine the balancing and power-factor-correcting functions of the synchronous motor with the functions of a step-down transformer and boosting transformer. This combination has been made in the balancer described in the paper.

This rotating balancing transformer absorbs the balanced three-phase power in one winding, and supplies a single-phase load from an independent winding. A balancer of this kind is of special interest in connection with single-phase electric furnaces.

The main advantages claimed for the single-phase furnace are as follows: In the first place, only two electrodes are required instead of three; and as these can be brought into the furnace at two diametrically opposite points the liability of the arc to cause a short-circuit through the hot semi-conducting lining is very much reduced. This enables the voltage between the terminals to be raised to a value almost double that which is practicable for a polyphase furnace. The increase in the voltage leads to a corresponding reduction in current for the same power input; the smaller current leads to economy in conducting cables and contacts, and enables a much smaller electrode to be used than is possible in the polyphase furnace. As the electrode losses are dependent upon the surface of carbon exposed and also upon the amount of air-leakage through the furnace, the reduction in the number and size of the electrodes and in the number and size of leakage holes results in a great saving in electrode consumption. In the second place, the single-phase furnace has an exterior shape which approaches a spherical form;

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the radiation losses are thus reduced to the smallest possible for a given content.

When the purpose is to supply a single-phase current to an electric furnace, the source of supply being an ordinary three-phase system, there is an advantage in using a special kind of balancer which shall fulfil the functions of (1) voltage transformer, (2) balancer, (3) reactance, and (4) power-factor corrector. These functions can, of course, be performed by a motor-generator set designed with suitable characteristics; but the first cost of a motor-generator set is higher than that of a balancer of the same output, and the efficiency is lower. More clearly to understand the functions of such a balancer, something should be said of the advantages (from the user's point of view) of working a single-phase furnace with an inductance in circuit sufficient to make the current lag by 45 deg. behind the voltage.

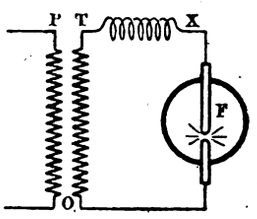

Fig. 4.

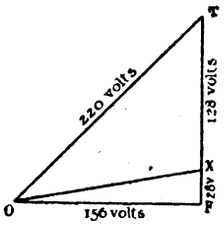

Fig. 5.

Consider the circuit shown in fig. 4 where O P is the primary winding of a transformer, O T its secondary winding, T X a choking coil, and F a single-phase furnace. In the vector diagram, fig. 5, let O T represent the voltage generated by the secondary, X T the reactive drop in the choke coil (with which may be included any reactive drop in the transformer); F X the reactive drop in the furnace, and O F the resistance drop in the furnace and the rest of the circuit. If this diagram represents the full-load working conditions, then the full-load current is lagging 45 deg. behind the voltage, and is represented to some scale by the line O F. When the inductance and resistance are adjusted to give these conditions on full load, and the inductance is maintained constant, the voltage O T being constant, the input to the furnace cannot exceed the full-load value however the resistance of the circuit may be varied. In fact, if we change the resistance of the furnace from infinity to zero, the current will increase from 0 to 1.41 times full-load current, and the power at various values of the current will be given by the curve in fig. 6. The full-load value of the current gives the highest point of the curve. Any reduction of the resistance of the furnace beyond this point causes a decrease in the input, although the current is slightly increased. If the furnace is short-circuited, the input falls to zero and the current cannot exceed 1.41 times full-load current.

These conditions give stability in operation, and are of great importance in preserving the lining of the furnace. No really refractory substances can be obtained for the lining of electric furnaces. The best commercial substances, such as dolomite, magnesite, or silica brick, have melting-points not very far above the temperature at which it is desired

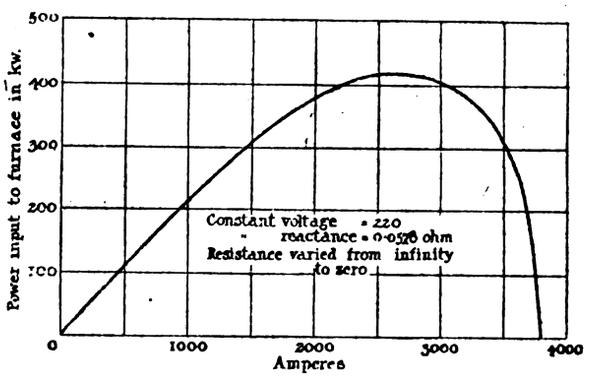

Fig. 6.

to work the furnace. If by any unfortunate chance part of the lining reaches a temperature above its melting-point, it begins to blend with the contents of the furnace, causing trouble with the pouring and heavy expense in re-lining. Now the maintaining of the furnace at its proper temperature depends upon the maintaining of the balance between the electrical input and the energy absorbed and radiated. If the characteristics of the circuit are such that an increase in the current is accompanied by an increase in the electrical input, the greatest care must be exercised, when the furnace is at full load, to keep the current near its full-load value; and this is difficult by reason of the unstable nature of the arc. Automatic regulators are often installed to keep the current within bounds, but even these are not found to be sufficient during the first twenty minutes after the furnace has been started up from the cold; and in some three-phase furnaces, where no great amount of inductance is connected in circuit, it is necessary to have three operators (one at the regulating wheel of each carbon), with their eyes fixed on the ammeter, to screw up and down the carbons every few seconds in order to keep the currents approximately balanced. After the furnace has been heated fairly well, the lengths of its arcs are greater, and the regulating can then be handed over to a regulator of the Thury type.

Where sufficient inductance is put in series with the furnace, the circuit becomes automatically stable and no such regulators are required. The ideal condition for steady running is attained when the inductive drop at full load is equal to the resistance drop, as shown in fig. 6. In some cases, the transformers that supply the furnace are built in such a way as to have their magnetic leakage great enough to give the required inductive drop. In designing transformers for this purpose, care must be taken to see that the cross-section of any iron added to the leakage paths is sufficiently great to give a fairly straight-line law for the increase of the leakage flux with the current, right up to the point 1.41 times full-load current; otherwise it may be found that when the furnace is short-circuited the current taken is much more than 1.41 times full-load current, and trouble may arise with the power company supplying the three-phase power. A case came to the notice of the author in which failure to provide a sufficient cross-section for the reactive iron resulted in undue disturbances to the power system and great loss of furnace linings.

(To be concluded.)

Discussion.

Dr. S. P. Smith congratulated the author on the excellence of his paper, and hoped the balancer which he had developed would meet with all success. He mentioned that the author had recently presented a thesis on the same subject which had gained him his science doctorship (Lond.). The study of vectors was full of interest, not only so, but as the paper under discussion had proved, quite correct solutions could be arrived at therefrom. After referring to one or two problems of load balancing, he said that he had noted that when several arcs were thrown on to a three-phase system the ammeter needle gave several violent swings; by the system described in the paper such disturbances could be entirely eliminated. He thought that electric furnaces, especially small ones, should render good service to electrical firms. Such firms usually had considerable amounts of scrap steel turnings, &c., which could very easily be reclaimed by the use of a single-phase furnace in the same way that cast-iron scrap was dealt with.

Mr. G. W. Partridge asked the author if it were possible to reverse the process described, could a three-phase supply be obtained from a single-phase system? If so a supply of single-phase could be taken for heating, lighting, and small furnaces from a large three-phase network, which arrangement might be desirable under certain circumstances. He thought that single-phase current would come to be used for most furnace work, especially for small furnaces. He also referred to a large-capacity induction type furnace to which reference had recently been made and to the importance of single-phase current, and the converting of the same from three-phase for railway work.

Mr. Bibby criticised the advantages that were claimed for the single-phase furnace; there was nothing in such a type of furnace that was not also practicable with the three-phase type. He said that a short fat arc was preferable to a long high-voltage arc, and he did not think the use of single-phase current would bring about a reduction in copper in the conductors, because with three-phase there were two arcs in series. He also criticised the shape of the furnace; the reason why a spherical furnace was adopted when single-phase current was used was so as to get the best advantages of the latter. Such a shape of furnace was not the best for steel making. Two operations had to be performed by an electric furnace, first the metal had to be melted, and then the steel had to be manufactured. A single-arc furnace would perform the first operation satisfactorily, but it was of not much use for the second operation.

Mr. Etchells said that certain statements made, both by previous speakers and also in the paper, needed explanation. There was nothing to recommend the single-phase furnace, whereas the three-phase type of furnace both melted the metal and also gave the necessary chemical treatment after melting. The furnace had a definite function to perform, and it should be thoroughly understood what that function was. He referred to the necessity of keeping the voltage between the electrodes low and the power factor as high as possible. With a 4-electrode, 3-K.V.A. furnace the maximum kick recorded was 1,200 KW.; the power factor was 0.9, and it was therefore not necessary, he submitted, to install rotary machinery in order to arrive at the same results. Besides, steel makers had a great dislike for rotating machinery, and it should not be introduced if it could be done without. The spherical form of furnace was not good; it was desirable that the bath should be shallow compared to its diameter, and that condition did not obtain with the spherical shape. He wondered whether trouble with high-frequency harmonics would be encountered with the system described, and would the author say whether the phase balancing depended upon a current lag of 45 deg.

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at full load, as stated on p. 15 of his paper, or not. Apart from the criticisms that he had offered, the paper contained much valuable and interesting information, and the author was to be congratulated.

Mr. Morday did not think such a machine as had been described would be found necessary; there were other means of arriving at the same ends. He asked whether the author was justified in using vectors as he had done; as soon as distortion entered the problem vectors should not be used; under such conditions the results arrived at from the study of vectors could not be relied upon at all.

Major A. M. Taylor called attention to a paper recently read by Mr. F. J. Moffett before the Staffordshire Iron and Steel Institute, in which the author very impartially considered several types of furnace, and his remarks upon the importance of sealing up the furnace to render it airtight; the heat lost through the electrodes and the water-cooled glands seemed to him (Major Taylor) to bear quite materially upon the question of single-phase *versus* three-phase furnaces. Referring to the tests of the balancer devised by Prof. Walker, he said it would appear that the power factor of the secondary circuit, external to the machine, was as high as 0.96. From that it was deduced that there was no external reactance, and that the whole of the reactance giving the curve shown in fig. 6 was contained in the secondary winding of the machine. He wondered whether the above large reactance was inseparable from the characteristics of the machine as, in certain circumstances, that might prove to be a disadvantage. He noted that the power factor of the primary circuit was about 0.91 at full load; the large secondary inductance was not, therefore, entirely neutralised. That was disappointing if it represented the limit to which the power factor improvement could be carried. It was worth noting that Mr. Moffett, in his paper, gave 0.85 to 0.95 as the power factor obtaining with arc furnaces, whereas Prof. Walker gave only 0.7 power factor. He hoped the meeting would bear with him in alluding to an invention of his own, and he would point out that, if an arc furnace could be got to work with 75 periods—and he understood that there were hundreds working in America at 60 periods—then his static frequency changer would be eminently suitable for working off systems which worked at 25 periods. The frequency changer had the following characteristics: No rotating parts; high efficiency—estimated at 95 per cent. for 500 kw.; unity power factor on the secondary side allowing enormous currents at low voltages to be supplied with a minimum amount of copper in the leads; giving a curve like fig. 6, so much commended by the author; perfect balance on all three phases, whatever the load. He believed that the poor power factor on the primary side could be rectified at a cost of about £1 per kw. by Kapp or other phase advancers. He had been working lately on a proposal which, if it fulfilled expectations, would enable a single-phase current of any periodicity whatever to be given from the secondary at unity power at a very low capital cost with high efficiency, with a perfect balance on the primary loads, with high power factor in the primary, and absolutely without any moving parts. Assuming that the inherent reactance of Prof. Walker's balancer could be kept low, it seemed to him that a very great field was opened for such a machine, quite apart from furnace work, and he wished it every success. He did not consider that the experiment quoted on page 18 proved that the balancer could deal with, say, a motor load of a poor power factor (such as 0.7) and yet give unity power factor in the primary, together with a balanced load. Perhaps Prof. Walker would reply to that point, and also say how the capital cost of the balancer compared with the cost of a single-phase generator at the generating station.

Mr. Sayers doubted whether such a machine as described by the author would be found efficient in practice, his objections being based on the fact that the machine was a rotating one.

Mr. Coats disagreed with the author's claims that superior regulation could be obtained with single-phase furnaces. To-day three-phase furnaces were automatically controlled, both as regards dip and current; the statements made by the author in this respect were not at all correct. The additional expense of rotating machinery would be a further disadvantage of the author's scheme.

Mr. Gifford stated that all the original Hercult furnaces were of the single-phase type, and the original furnace was still in active service in France. A departure from single-phase had been made in this country on account of the cost of motor converters. In his opinion, all furnaces up to 5 tons capacity should be single-phase, and those above, three-phase; the power factor also had an important bearing on the problem. A great disadvantage of rotating machinery was its high cost. The risk of breakdown should not be forgotten; spare parts were difficult to obtain at short notice, such parts were not usually carried on hand, and they introduced higher costs.

Mr. Mercer said that when he joined the Ministry of Munitions in connection with electric furnace work he made the discovery that the best results were claimed for every type of furnace; each maker claimed that his own particular make was the best. There were many good furnaces in this country doing good work; he gave instances where 70 tons had been produced by one furnace with a consumption of 220 units per ton, and another case of 180 tons per month with a consumption of 1,035 units per ton. On the face of it these results seemed good, but accurate and fair comparisons could only be arrived at after careful consideration. One had to consider what the furnace was actually doing, whether it was merely melting metal, or melting and refining. He said that the smallest furnace in this country had a capacity of ¼ ton; he had personally inspected practically every electric furnace at work in this country, and he thought on the whole the 3-ton furnace gave the best results. A great deal of trouble had been experienced with the bottom electrode and the water connection; much astonishment would be expressed were the actual number of breakdowns known that had been caused through the failure of water connections. With regard to electrode consumption, he saw no reason why all furnaces should not have a good record to show in that respect.

The Author, in reply, said that it had been assumed that the single-phase furnace could only have one electrode at the top. That was not the case, and there was no reason at all why such furnaces should not have any number of top electrodes in parallel. By such an arrangement all the electrodes would be at the same voltage, and there would, therefore, be no fear of short circuits between them. A single-phase furnace was primarily intended for melting purposes and not for refining. One had to know precisely under what conditions the furnace was to work and what it actually had to do before its advantages and disadvantages could be properly discussed.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

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19,340. Time-lag devices for electric automatic switches. F. C. Fuke and New Switchgear Construction Co. November 25th.

19,372. Method of magnifying telegraph signals by means of three electrode vacuum devices. N. P. Hinton & E. H. Shaughnessy. November 25th.

19,374. Electric lamps. E. F. Heath. November 25th.

19,388. Accumulator plates. C. P. Elieson. November 25th.

19,399. Electric incandescent lamps. H. Ozaki. November 25th.

19,404. Electrical contact makers. J. L. Scott. November 25th.

19,422. Operating and tripping mechanism of oil-break electrical switches. R. T. Norton. November 26th.

19,460. Filaments of highly-refractory metal. Westinghouse Lamp Co. November 26th. (U.S.A., December 19th, 1917.)

19,465. Means for generating high-frequency electric currents. I. Shoenberg. November 26th.

19,468. Means for supporting shade of electric incandescent lamp. L. G. Flory. November 26th.

19,491. Sound transmitting instruments. A. Marr. November 26th.

19,492. Telephonic head-piece receivers. A. Marr. November 26th.

19,494. Protective devices for alternating-current systems. A. E. McColl. November 27th.

19,569. Electric couplings. C. W. Saunders. November 27th.

19,595. Filaments. Westinghouse Lamp Co. November 27th. (U.S.A., December 19th, 1917.)

19,630. Sparking plugs for internal-combustion engines. C. K. Shepherd. November 28th.

19,649. Means for controlling speed of air-driven dynamos. G. H. Trotter. November 28th.

19,650. Means for regulating speed of air-driven dynamos. G. H. Trotter. November 28th.

19,664. Electroplating internal-combustion engine cylinders, &c. Q. Marino & A. Ness. November 28th.

19,675. Current regulators for alternating-current electric circuits. W. Langdon-Davies & A. Soames. November 28th.

19,728. Electrical transmission of synchronous movements. R. Van Couwenberghe. November 29th. (France, February 24th, 1916.)

19,756. Electrodes of electric furnaces. Soc. Electro-Metallurgique Francaise. November 29th. (France, December 3rd, 1917.)

19,759. Protective devices for alternating electric current distribution systems. British Thomson-Houston Co. & E. B. Wedmore. November 29th.

19,777. Automatic quick-silver switches for electric flat irons. Avanti Dansk Elektro-Mekanisk Fabrik & N. F. Nielson. November 29th.

19,785. Apparatus for transforming electrical energy. J. E. Calverley and W. E. Highfield. November 29th.

19,792. Shock-absorber and protector for electric lamps. J. W. Graham. November 30th.

19,814. Visual and audible electric indicators. J. G. Rose. November 30th.

19,818. Method of electrically welding iron, steel, brass, &c., studs to iron, steel, &c. A. E. Franking. November 30th.

19,831. Starting resistances for electric motors. T. A. D. Lawton. November 30th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

14,197. "Electrical starting apparatus for internal-combustion engines." Bijur Motor Lighting Co. November 24th, 1915. (110,356.)

14,582. "Thermo regulators and alarms." British Thomson-Houston Co. (General Electric Co., U.S.A.) October 9th, 1917. (120,412.)

16,103. "Insulator and binder for telegraph, telephone, electric, and other wires." A. Spencer. November 5th, 1917. (120,418.)

16,122. "Constitution of the magnetic circuit in electric ignition apparatus for internal-combustion engines." Akt. Ges. Brown, Boveri et Cie. January 12th, 1917. (112,926.)

16,202. "Electric switches." A. Holt. November 6th, 1917. (120,433.)

16,229. "Electric heating and cooking apparatus" W. H. Bennett. November 7th, 1917. (120,426.)

16,266. "Magneto-electric machines." British Thomson-Houston Co., A. P. Young & A. G. Salisbury. November 7th, 1917. (120,431.)

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CHRISTMAS—AT PEACE.

BEFORE our next issue makes its appearance the Christmas Festival of nineteen-eighteen will have been celebrated. Five years have passed away since this world was privileged to spend its Yuletide amid circumstances suggesting that there was Peace on Earth. Even then the nations, save ourselves and our trans-Atlantic cousins, were armed to the teeth. And now, after the agony and loss of long years of war, we are—if not actually at Peace again, approaching it.

Each Christmas during the war has revived in our ears the message of that company of angels of nigh two thousand years ago. At times it seemed as though the echo of that message was the marching of new armies and the thundering of thousands of guns. Could it be that these were the means of bringing in those peaceful days of which the angels sang? So has it proved to be, and now the carols of a new Christmas sound sweeter far than those of Christmases long since enjoyed—for by reason of these latter years of suffering, distress, and gnawing anxiety, we have been brought out of the period of darkness and death, with victory so definite for the cause of Righteousness, that we are nearer to the era of International Amity than for generations past. We have been fighting to bring to an end all war between the nations, and we have arrived at a stage where the skilful negotiations of Peace plenipotentiaries will reveal and test the sincerity of such a determination, and will, to a large extent, decide whether, or how far, it lies within human power to ensure the attainment of so great an end. In God's name we hope such an issue may be found possible as will save our children from the works of those who delight in insensate destruction, but, high as our hopes may rise, how blind we should be if we ignored the signs that there has been no magic change wrought in the heart of humankind. If the crushing out of the spirit of proud and barbarous militarism meant the uprooting of all human hate we might indulge in optimistic visions of millennial days, but do the evidences of the moment within this and other lands not shake our confidence and counsel walking warily? We have won what we fought for internationally, and in celebrating that grand result this Christmas time, what we need more than we ever did before is an imparting of the true Christmas spirit in the relations between man and man within the nation. We have all borne sacrifices for a Common Cause against a foe without; now we must all bear sacrifices, practise self-abnegation, join interests harmoniously, for the Common Good within.

A hundred thousand men are travelling homeward by various routes to settle down to peaceful avocations. Round many a fireside, as unrationed flames leap upward, there will swell again the happy laughter of the re-united circle, checked betimes by sacred memory and by rising tear. "Over there" millions of men still stand at the post of duty, but neither for them nor for theirs at home will the hardness or the uncertainty be the same as at other war-time Christmases. Over here, for the first holiday season for a long time past the war-works may stand idle, for munition workers' holidays, it is announced, are permissible everywhere. There is anxiety in many minds, it is true, because the end of the war brings expectation of unemployment, but a generous State in recognition of their war-time service has provided for unemployment insurance

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giving them time to transfer or to look around. Probably some of the great factories which are changing over to Peace production will not be so silent as is imagined, owing to the holiday week being availed of to get ready for altered operations. The hospitals at home and abroad are still occupied by sick and wounded men who cannot get back to the family circle, and there are amongst us many thousands of Colonials and Americans for all of whom, no doubt, we shall have a place in our hearts.

For all of us, however, it will be the Christmas of the Armistice preceding the Great Peace; and the freedom from strain, the opportunity for rest, the occasion for fraternising, should afford such a season as has never in living memory been spent.

Immense—almost overwhelming—are the tasks that lie awaiting us in the days that follow. Let this respite be so employed as to prepare us the better for those responsibilities, and for their fulfilment in the spirit which marks the season of the coming of the greatest message that was ever brought to our Humanity.

The I.M.E.A.'s Proceedings.

Whilst going to press last week, we received a copy of the Report on National Electricity Supply which was adopted at the general meeting of the Incorporated Municipal Electrical Association last month, and an abstract of the Report appeared in our last issue. It will have been noticed that it consists mainly of qualified endorsements of the conclusions arrived at by the Committee of the Board of Trade, mingled with explanatory comments, which seem somewhat superfluous; of what use, for instance, is it to inform the Committee that the 16 districts are not 16 power stations? Or to explain to the Committee that its report does not contemplate the shutting-down of all existing power stations? When all such redundancies are cleared away, together with the expressions of approbation, there is very little left in the way of criticism or suggested amendment. Perhaps the most notable proposition is that which demands the complete exclusion of the representatives of companies from the District Boards—a remarkable proposal, which seems to have been prompted by the memorandum of some of the North-Eastern Municipalities, upon which we recently commented. Seeing that the companies, which conduct one-third of the industry of electricity supply, are endowed with statutory powers to carry on their business, and are, therefore, recognised by Parliament as public service corporations, it is difficult to understand why they should thus be deprived of a voice in the control of the industry, while large consumers are to be admitted to representation on the District Boards. Is it fully realised that the companies' undertakings are owned by shareholders, who are in some cases very numerous, and have risked their own capital in the business, while the ratepayers and large consumers who are to be put in authority over them have not done so? We do not see how this demand can be reconciled with the principles of British justice. Most of the other suggestions are echoes of the I.M.E.A. meeting of June last, and therefore lack novelty. While we regard the Report of the Association as, on the whole, a weak production, reflecting little credit on its authors, we are glad to see that, at any rate, with the exception above noted, it is not contaminated with the reactionary spirit which pervaded the memorandum of the N.E. Counties; on the contrary, it cordially recognises the merits of the proposals contained in the Board of Trade Report, and endorses the broad principles upon which it was based.

We have so often commended the Council of the I.M.E.A. in the past for wise and well-balanced judgment that we may justly claim the right to criticise its errors, and it is with regret that we must thus characterise its recent actions in connection with the granting of sanctions for extensions—first, in bringing a comprehensive charge against the Ministry of Munitions without due deliberation—a charge which was distributed broadcast to all members of Parliament, and, secondly, when withdrawing the charge, in shabbily throwing the onus of its action upon one of its own members. The Council has given an exhibition of impulsiveness and instability which is not a pleasing spectacle, and will certainly not add to its prestige.

Trade Union Autocracy.

The decision of the controllers of the Union of Licensed Vehicle Workers to withdraw all public road vehicles from service in London after 4 o'clock on Christmas Day will be received with dismay by the many holiday-makers who rely upon such conveyances for the means of visiting their friends on this great national festival—the first "Peace Christmas" for five long years. We do not grudge the workers their share of the holiday, if they prefer to seek their own pleasure rather than to remain on duty and thus to minister to the happiness of hundreds of thousands of their fellows. Those who will suffer most will obviously be the less well-to-do, but all classes will share more or less in the inconvenience that will be inflicted on the public by the action of the Union autocrats. In point of fact, of course, the workers themselves are not responsible for the high-handed action of their leaders; arrangements had already been made for voluntary service on Christmas Day, which would have provided acceptable compensation for those who chose to remain on duty, whilst enabling others to participate in the celebration of the festival. The withdrawal of the services, therefore, is not necessary to this end; apparently it is merely a demonstration of the autocratic powers of the Union leaders. But Nemesis awaits the Union which arouses the wrath of the public; that great silent body may accept the situation with indulgent good humour—but when it is stirred to action, no Union can prevail against it; public opinion is a certain winner, as some of our quondam strike leaders have learnt from bitter experience.

The Times, commenting on this subject, recalls the downfall of Mr. Burns under such circumstances, and remarks that "many other leaders—or misleaders—have had a similar experience; and many more will learn the lesson in their time. There are signs that sundry Unions, intoxicated by facile successes, are being led on to dangerous experiments in high-handed action against the public. An instance was reported yesterday. The secretary of the Electrical Engineers' Union was said to have stated that the supply of electricity would be cut off from London if German prisoners were not removed from a certain farm within 14 days. That is to say, this Union will deprive London of light, power, and traction if the Government do not obey its orders in a matter with which the Union has nothing whatever to do. Obviously the same threat may be applied to any arbitrary purpose whatever, and if it succeeded, London would be at the mercy of an irresponsible dictator. But the inhabitants are a little tougher than that. The Germans thought they could frighten London into forcing the Government to surrender. They were mistaken, and the attempt recoiled on themselves. So will it be with anyone else who attempts to intimidate the public of London."

We entirely agree with this view, but are glad to learn that the alleged threat of the Electrical Trades Union was entirely unauthorised, and is repudiated by the secretary of the London Branch.

Whilst going to press we learn also that the Vehicle Workers' Union has agreed to recommend its members to volunteer to run a number of omnibuses on Christmas evening, but apparently there will only be a very few, and the tramways will be idle altogether, so that the inconvenience to the public will be very serious. Similar conditions are reported from provincial centres, in many of which the transport services will be at a standstill; but the effect will be felt most severely in London, owing to the greater distances to be traversed in our over-grown Metropolis.

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THE ELECTRIC TRACTION RETURN CIRCUIT.

By A. JOHNSTON, A.M.I.E.E.

In direct-current traction systems the length and size of the feeders are usually determined by the fall in voltage allowable.

On the positive side of the system, a loss of 10 per cent. in the voltage is frequently considered as being the maximum which should be permitted for satisfactory working, while the Board of Trade has fixed 7 volts as the maximum drop in potential which should take place between any two points on the rails.

There is no great difficulty in keeping within any reasonably prescribed limit on the positive side without undue expense, it only being necessary to correctly proportion the resistance of the feeders to the current; but on the negative side, when the traffic is heavy or the route is long, considerable trouble is frequently experienced, and several methods are adopted by engineers to surmount it.

It is usually less costly to increase the weight of the rails, if that would be sufficient to reduce the fall in potential to within the limit without the rails becoming too unwieldy; but where it is not sufficient, one of the following supplementary expedients is employed:—

An uninsulated copper conductor is laid between the rails, and is bonded to them, for a certain distance from the point of supply.

An insulated conductor is connected to the rails at one point only, which is some distance from the point of supply, and the other end is connected to the negative terminal in the supply station.

An insulated conductor is connected, as in the previous case, to the rails at a distant point, but the other end is conveyed to the negative terminal of a small auxiliary generator or "negative booster."

The field magnets of the negative booster are excited, either by being connected in series with the positive feeder which feeds the section nearest the point where the negative feeder is connected to the rails, or alternatively, the machine is a simple series generator placed in series with the negative feeder. The former method has the disadvantage that the current in any single positive feeder is seldom proportional to the fall of potential at the boosted point, since frequently the current from other feeders returns by the same rails.

To examine these methods of dealing with the problem a hypothetical single section of tramway will be considered the length of which from the terminus to the point of supply is X miles, over which a regular service of cars is run requiring a amperes per mile, the current being assumed to increase regularly from zero at the terminus, to xa amperes at any point x miles from the terminus instead of increasing in steps at each car, this way of dealing with the subject being convenient for general calculations, though not quite so accurate as the former method when reliable data are available. The resistance of the rails per mile is r ohms over the whole route. As a numerical example, and in the curves, the following values are taken:—The length of the route is six miles, which is laid with a double set of rails weighing 85 lb. per yard, the four of which bonded together would have a resistance of about ·016 ohm per mile. A service of single cars is run at intervals of six minutes in each direction, the average current per car being 20 amperes and the average speed eight miles per hour. Thus—

$$X = 6,\ r = \cdot 016, \text{ and } a = 32.$$

In order to provide for abnormal conditions the maximum permissible difference in potential between any two points on the rails is taken as 5 volts = V.

If the rails alone are used as the return conductor it is evident that—

$$dv/dx = -arx, \text{ and } V = M - \tfrac{1}{2} arx^2,$$

in which the value of M will depend on whether the potential of the rails is considered to be zero at the terminus or at the point of supply. Assuming it to be so at the latter place, then $M = \frac{1}{2} arX^2$, so that the potential at any point x, $V = \frac{1}{2} ar(X^2 - x^2)$, and at the terminus where $x = 0$,

$$V = \tfrac{1}{2} arX^2 \quad \ldots \quad \ldots \quad (1)$$

which formula is applicable to any simple section of electric tramway or railway; the curves in fig. 1 show the values of V and the current through the rails at any point x along the route.

If the rails are assisted by an uninsulated conductor bonded to them at frequent intervals, running either the whole length of the route or part of it nearer the point of supply where the current density is greatest, it will be equivalent to reducing the rail resistance to, say, R ohms per mile.

If this conductor starts at $x = Y$ its length will be $X - Y$, and the voltage curve from Y to X will be $v = \frac{1}{2} aRX^2 - \frac{1}{2} aRx^2$, and treating the section to Y by itself,

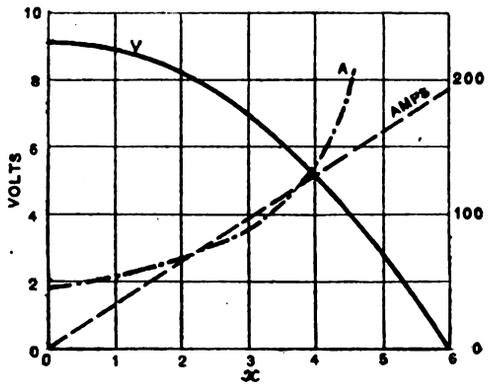

Fig. 1.—Voltage Curves, Rails alone.

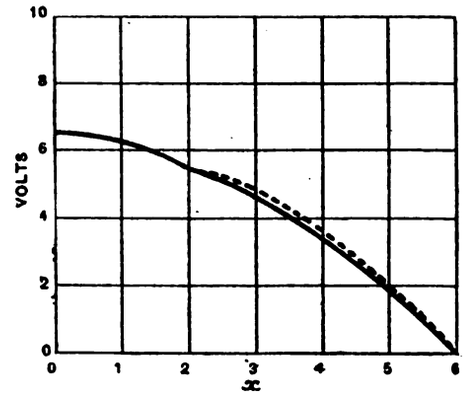

Fig. 2.—Voltage Curves, Rails assisted.

the voltage at any point $= v = \frac{1}{2} arY^2 - \frac{1}{2} arx^2$, so that the voltage at the point $x = 0$ will be—

$$V = \int_Y^X - aRx\,dx + \int_0^Y - arx\,dx,$$

from which—

$$V = \tfrac{1}{2} aRX^2 + \tfrac{1}{2} arY^2 - \tfrac{1}{2} aRY^2 \ldots \quad (2)$$

The full-line curve in fig. 2 shows V in this case, in which the resistance per mile of the uninsulated conductor is assumed to be ·032 ohm.

If the resistance of the supplementary conductor in (2) is t ohms per mile, then $(r + t)R = rl$, and rejecting R from (2) it will be found that—

$$t = (Vr - \tfrac{1}{2} ar^2Y^2)/(\tfrac{1}{2} arX^2 - V) \ldots \quad (3)$$

When an insulated conductor is laid from Y to X to assist the rails, no booster being used, and the current A returning through the negative feeder is less than a Y, then V will be the sum of—

$r_1 = \frac{1}{2} arY^2$, the fall over the section to Y,

$r_2 = (aY - A)(X - Y)r$, the fall over the section $(X - Y)$ due to the current $(aY - A)$, and

$r_3 = \frac{1}{2} ar(X - Y)^2$, the fall over the section $(X - Y)$ due to the current received between X and Y.

Hence $V = \frac{1}{2} arX^2 - rA(X - Y)$. ... (4)

The final voltage at the terminus, when an insulated negative conductor is used, is the same as when the conductor is uninsulated, assuming the same sectional area in

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both, but the voltage curve, shown dotted in fig. 2, is somewhat higher between Y and X.

If a booster is employed, and the current A is greater than aY, it is evident that the current passing through the rails will be zero at some point between X and Y. Let that point be m miles from the terminus; then it is clear that $m = A/a$ and that V may be considered to be the sum of three simple sections, viz. :—

$v_a = \frac{1}{2} ar\,(X - A/a)^2$ from m to the supply point;
$v_b = \frac{1}{2} - ar\,(A/a - Y)^2$ from m to Y; and
$v_c = \frac{1}{2} ar\,Y^2$ from Y to the terminus.

From which V = (4), which is therefore true whether A is greater or less than aY.

From (4) it is clear that the current which must be abstracted from the rails at the point Y is—

$$A = (\tfrac{1}{2} a r X^2 - V)/r\,(X - Y), \quad \ldots \quad (5)$$

and the problem, therefore, is the best means of removing this current, which is plotted with regard to Y in fig. 1.

If the resistance of the insulated negative feeder is s ohms per mile, then the current which will return by it, without a booster, will be due to the difference in potential between X and Y, which is—

$$v = \tfrac{1}{2} a r\,(X^2 - Y^2) - C r\,(X - Y),$$

and the resistance of the feeder is $s\,(X - Y)$.—
so that $C = \frac{1}{2} a r\,(X + Y)/(s + r)$;
substituting this value for A in (4),—

$$V = (\tfrac{1}{2} a r X^2 - \tfrac{1}{2} a r^2)\,(X^2 - Y^2)/(s + r). \quad (6)$$

From (6) $s = t$ in (3) showing that there is no advantage in insulating a negative feeder when laid parallel to the track if no negative booster is used, though in practice it

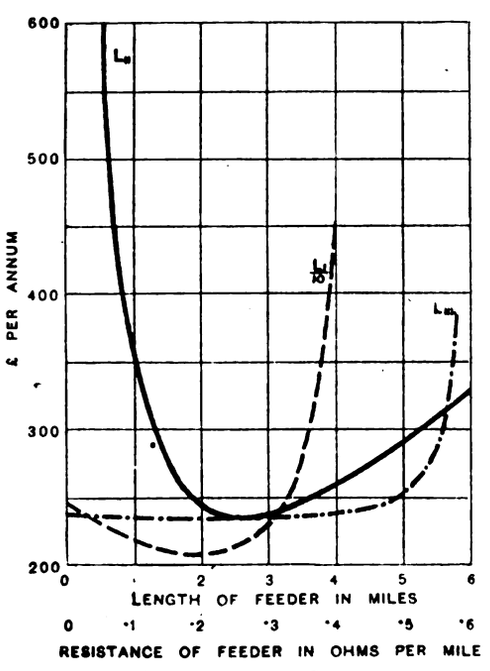

Fig. 3—Annual Cost.

is seldom possible to predict events and conditions with any exactitude, and it is, therefore, advisable in nearly all cases to lay an insulated cable for this purpose, as any increase in V can be dealt with by the installation of a negative booster.

When a booster is used, it is easily seen that the current which will return by the negative feeder will be—

$$C = \tfrac{1}{2} a r\,(X + Y)/(s + r) + u/(s + r)(X - Y), \quad (7)$$

where u is the effective voltage of the booster, and substituting this value for A in (4)—

$$V = \tfrac{1}{2} a r X^2 - \tfrac{1}{2} a r^2 (X^2 - Y^2)/(s + r) - r u/(s + r). \quad (8)$$

Comparing (1), (6), and (8), it is seen that the effect of the negative feeder is—

$$B = -\tfrac{1}{2} a r^2\,(X^2 - Y^2)/(s + r),$$

and of the booster alone is $D = -r u/(s + r)$, so that if it is found, where an insulated feeder is already installed, that the fall in potential is too high by D volts—that is, (6) = 5 + D without a booster, then the *effective voltage of the booster required* will be $u = -D(s + r)/r$ since $D = -r u/(s + r)$, and the current will be A in (5).

The annual cost of an insulated negative feeder may be taken, with a fair degree of accuracy, to be proportional to its weight. Thus if K is a fraction representing the annual cost of one mile of feeder having a resistance of 1 ohm, then the annual cost of the feeder is represented by—

$K\,(X - Y)/s$, or inserting the value of s in (3)—

$$L_1 = K\,(X - Y)/s = (K\,X\,V - \tfrac{1}{2} a r K X^2 - K Y V + \tfrac{1}{2} a r K Y X^2)/(\tfrac{1}{2} a r^2 Y)^2 - V r),$$

and by differentiating with regard to Y, the value of Y that will make $d L_1/d Y = 0$, or will make the annual cost a minimum, is—

$$X - Y = \sqrt{X^2 - 2 V/a r}. \quad \ldots \quad (9)$$

Taking K at 1,880 pence, the annual cost, L_1 of the insulated negative feeder is shown in fig. 3.

The cost of the booster may, for small machines, be considered as being proportional to its output, and if H is a fraction representing the annual cost per watt, then the total annual cost may be written $H C u$. H must be evaluated by taking all sources of loss and cost into account, such as the interest and depreciation on the capital cost, the overall efficiency, the hours run per annum, the watts taken to run the machine, the value of the energy used, &c.

In the curve H = 6·45.

Let the annual cost of the booster and negative feeder combined be $L_{11} = H C u + K (X - Y)/s$, then from (5) and (8)—

$$L_{11} = H\,(\tfrac{1}{2} a r X^2 - V)(\tfrac{1}{2} a s X^2 + \tfrac{1}{2} a r Y^2 - V - V s r)/r(X - Y) + K\,(X - Y)\,s,$$

and by differentiating L_{11} with regard to s, the value of s that will make $d L_{11}/d s = 0$, or will make L_{11} a minimum is—

$$s = \sqrt{(K/H)}\,(X - Y)\,r/(\tfrac{1}{2} a r X^2 - V), \quad (10)$$

and the current density per sq. in. in the feeder, from (5 and (10) will be—

$$\phi = \sqrt{K}/{\cdot}043\ \sqrt{H}.$$

Again, from (5), (8), and 10)—

$$L_{111} = H \frac{(\tfrac{1}{2} a r X^2 - V)}{r\,(X - Y)} \left(\sqrt{\frac{K}{H}}\,(X - Y) + \tfrac{1}{2} a r Y^2 - V \right) + \sqrt{\frac{H}{K}}\,\frac{(\tfrac{1}{2} a r X^2 - V)\,K}{r},$$

and $d L_{111}/d Y = 0$, when $X - Y = \sqrt{X^2 - 2 V/a r}$. (9)

From these results the following rule, independent of the controversial values of H and K, is obtained :—

The most economical length of a traction negative conductor is equal to the square root of [the route length squared, — 10 divided by the product of the amperes per mile into the track resistance per mile].

This rule assumes the limiting potential difference V to be 5 volts.

From (1) the longest length of line which can be worked without assisting the rails is $X = \sqrt{2 V/a r}$ and also the longest line possible with a single booster and feeder is $X = 3\sqrt{2 V/a r}$. In the latter case, according to the rule given, the most economical length of the negative feeder is $X - Y = \sqrt{8}\sqrt{2 V/a r}$, but it is evident that two-thirds of the total current sent out to the line must be returned by the feeder and that the length of the feeder must be $2\sqrt{2 V/a r}$, so that the most economical length cannot be used with a line of this length; in fact, the rule is not applicable to any line where $X > \sqrt{5}\sqrt{2 V/a r}$.

Examining the curve L_{111} in fig. 3, which shows the annual cost of the booster and feeder, it will be seen that it is almost flat until the value of X—Y becomes too small for practical purposes, and that, therefore, a considerable amount of variation from the correct length will make very little difference in the annual cost, but it must be borne in mind that it is probable that during many hours of each day the feeder alone will be sufficient to keep V down to 5 volts, and by inspecting the curve L_1, the annual cost of a negative feeder alone, it will be seen that a sharp rise takes place fairly near on each side of the correct length. A comparison of L_1 and L_{111} emphasises the futility of installing unboosted negative feeders from a financial point of view, it being observed that the curve is shown reduced, in the former case, to one-tenth its value.

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THE CONTRACTOR'S APPRENTICE.

By DONALD SMEATON MUNRO.

The new English and Scottish Acts decree that every little Briton must attend school between the ages of 5 and 15, and thereafter be compelled to go to continuation day classes for periods which shall aggregate 320 hours per annum until he, or she, is 18. The obligation to attend a continuation school is not to apply to young persons above 16 who have remained until that age under full-time instruction at an approved school.

The scheme is going to cost the country many millions a year for the maintenance of new schools, colleges, and salaried posts. It is going to involve millions of millions of commercially unproductive hours. Yet if the future mass of our people attains to a more efficient and happier life, and if our nation keeps her topmost place thereby, then surely the money and time will be well spent.

It is too late to argue that England's Shakespeare, or Scotland's Burns were not educational conscripts, and yet did pretty well. The boast of the self-made man will no longer be heard in the land—unless, indeed, he hails from a neighbouring isle where Education Acts will probably not be enforced.

The plan is too big and serious, however, to be joked about. It is a duty to grapple with its somewhat disturbing difficulties and develop the undoubtedly good elements which it contains.

How can we best apply the conditions to meet the case of the aspirant to electrical engineering? There will always be a class which will continue preliminary theoretical training at technical college or university till well on in the twenties. That section will not be affected by the Acts, except, possibly, by having to study longer or harder to keep relatively ahead.

Almost all divisions of the electrical industry require recruits of sound education.

In the reconstructed world we have to displace and far surpass the *Mittel Europa* technically trained man. It is important, therefore, that the bulk of our apprentices should be lads who have remained at school until the age of 16 or 17, and have thereby acquired, at least, the habit of learning. The majority of this class will quite eagerly continue their theoretical studies in the evenings—till well on in their teens.

If a boy displays no aptitude for study whatever, he will probably want to be released from school at the earliest possible age, and in this case even, the end is attained by remaining at full-time classes until he is 16. Probably he himself would prefer to secure complete freedom thus, to the alternative of giving up six hours per week until he was 18. Under the Acts, therefore, it would appear that both the scholar and the dunce would choose to attain liberty at 16. The former would then be free to continue his classes, and the latter to drop them.

It is not quite clear from a first reading of the clauses whether evening classes are, or are not, debarred to youths under 18 who have remained at school until 16. Surely it is not the intention to encourage idle evenings at that most critical age. We do not want to multiply that particular kind of imp we have seen going about in war time with spats and a fag.

Electrical engineering holds a fascination for the foreordained aspirant. If he knows he cannot commence his apprenticeship favourably until he is 16, he will likely work all the harder during his last year at day school, but the scope of the industry is so varied that I would not advocate, as an absolute necessity, that no apprentice be allowed to commence until he is 16.

The type of boy who would nowadays enter a factory at 14 should still be allowed to do so. Every factory will have to pay more attention to the boy's physical and mental training. Of course, many of our manufacturers have long been alive to this, and find that it pays to take interest in their youthful employés. It is to be hoped that the educational authorities will interpret the Acts with some degree of flexibility. It would be a pity if the new arrangement should interfere with some of these excellent schemes which have been proved to work well. Some are so complete that they provide not only for the adolescent stage of training, but carry the youth on to the universities while still keeping up his connection with the works.

In other divisions of the electrical field, it appears impracticable to employ boys in any number who are required to leave their employment for at least 320 hours per annum to attend schools.

In contracting, for instance, the apprentices are scattered all over a town. One day a boy is on a ship and the other perhaps down a mine. Even if the territorial range of his alleged duties is not too extreme, it is obvious that complying with the Acts' requirements is a much more onerous business for the contractor's as compared with the manufacturer's boy. In some cases it would be impossible to fulfil the conditions. In most, it would be difficult. And quite evidently the contractor, in the mass, would sacrifice many more hours annually of productive work than the manufacturers would. Again, as a class, he is probably less able to bear such loss.

It seems therefore that only in an exceptional case can an apprenticeship with an electrical contractor be commenced unless the boy is 16 and has attended the approved day courses till that age.

I do not wish to suggest that the peculiar conditions under which the contractor's apprentice serves should act as a pretext for his employer to evade the granting of facilities for continued mental training. Contractors could do far more than they have done by way of bringing out the abilities and improving the efficiency of their apprentices. The boys have been hitherto left too much to their own devices. The masters have not troubled to guide or keep in touch with their class work. Haphazard and false notions of electrical theory have been easily acquired, and bad theory has resulted in defective practice.

Employer, workman, and apprentice have all, probably, been too intent on the pay sheet, and have lost sight of the good of the craft, which should be the grand binding link between them.

A boy may owe much to the friendly skilled tradesman or foreman who has helped him tactfully. On the other hand, in some shops, apprentices have suffered by being in the company of that kind of man who objects to having what he calls his brains "picked." The man who is reluctant to impart his knowledge generally has a good reason for his reticence. In most instances, however, it is simply indifference that has put the drags on knowledge.

What we want to do now is to make every apprentice realise that his chance has come and is passing, and that with a slight but continued effort, he can conquer the giants on the path and find the electrical field opening out before him with mental delights beyond Elysia.

I do not think that the employers should attempt to interfere with the methods and work of the professional teachers. Anything they do should be superadded to the curriculum of the trained technical theorist, but there are ways in which they might peculiarly help the aspirant for electrical knowledge. These might be extended or modified later.

My first proposal would be that in each town the contractors would arrange a series of informal

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lectures on an approved set of electrical subjects. These would be held in a building which also contained an electrical library. The lectures would be, say, of one hour's duration, and, where possible, would be illustrated in a practical fashion. Every available apprentice would be required to put in attendance at two of these per week for six months in the year. There would be no examination, but questions would be encouraged. Each youth would have to keep a notebook, and every week would show what new set of facts he had added to his knowledge. To engrain the habit of systematic note-taking would in itself greatly add to efficiency.

Probably there would not be much difficulty in most towns in finding volunteers from among the more capable employers and their foremen, who would prepare and give each a short set of lectures on some approved subject in which they were more or less expert. Those who undertook the work would find the rubbing-up of great benefit to themselves.

There might be a set of two or three lectures on such subjects to begin with as "primary batteries," "bells," "switches," "motor connections," "heaters," &c., &c. Such a scheme would be quite popular if enthusiastically fulfilled, and the boys might earn tools, or badges—as the Scouts do—for proficiency in particular subjects. Holding such practical bi-weekly meetings under the charge of practical men does not get over the difficulty of dealing with the youths who are on a country job or cannot otherwise conveniently attend. The difficulty would be partly met if it were the rule not to keep the same boy away for a period of more than three months in the year.

My second proposal would be that in addition to the lectures, a card system of teaching elementary theory be applied to all apprentices. The subject of elementary electricity and engineering could be treated in a set of expressive paragraphs. These with illustrations and simple exercises should be attractively printed on cards. There would be a card for every week of a boy's apprenticeship, and it would be handed to him each week-end. No matter where he was employed the apprentice would have the opportunity of learning each week a progressive series of facts which would be useful to him. This "constant drip" plan of teaching has, of course, been applied with great success to the teaching of languages. It has even, to a limited extent, been applied to electricity. Glover's Almanac gave us some intermittent flashes of this mode of instruction.

I feel sure the method would well repay the small outlay. The instruction on the cards would require to be carefully considered by a good teacher, who also knows the practical work. It will not do simply to chop up some existing text book.

The purpose of this short article is to inform those contractors who do not already know it—that their apprentices will be affected by the impending English and Scottish Education Acts.

It also suggests that the interests of the craft as a whole would be well served if: First, apprenticeship starts at 16 at earliest after a year of special day-class preparation. Second, if employers encourage and help to provide facilities for lecture, library, and notebook-keeping on the part of their apprentices. Third, if a course of card training in electrical engineering lasting 250 weeks be given to each.

In many districts now the apprentices are registered by the local trade association, and the final certificate of apprenticeship is valued both by masters and men. Such certificate, if endorsed with marks which showed that suggested courses had been taken full advantage of, would indicate that the apprentice was progressing into the state of real electrical craftsmanship.

CHARGING ELECTRIC TRUCK BATTERIES.

By G. J. DUCKETT.

About four years ago I had to make provision to charge one of these vehicles; as they are of very low voltage (usually 24 volts), it is customary to install a motor-generator, the motor taking current at the district supply voltage—very often 200 or 400 volts—and the generator giving a supply at a pressure up to 50 volts.

The proprietors of the truck did not wish to go to the expense of installing a rather costly charging set, as the truck was purely experimental; and, therefore, it was charged off the supply company's mains, the voltage of which was 250, the current being reduced to a suitable amount by the use of cast-iron resistances.

The average capacity of the batteries of these trucks is approximately 240 ampere-hours, and the normal charging rate is 45-60 amperes. The cost of charging one of the trucks would therefore be :—

$$250 \text{ volts} \times 60 \text{ amperes}/1{,}000 = 15 \text{ units},$$

and, at 2d. per unit, would be $15 \times 2 = 2$s. 6d. per hour, or, for a full charge, it would work out at exactly 10s.

Now if the supply pressure was at the normal truck battery voltage, the cost would work out as follows (a 24-volt acid battery of 240 ampere-hour capacity would require between 30 and 32 volts to charge it at a 60-ampere rate, therefore we will assume that the average voltage required is 32) :—

$$32 \text{ volts} \times 60/1{,}000 \text{ at } 2\text{d.} = 3{\cdot}8\text{d. per hour},$$

or, for a full charge, the cost would be 1s. 3½d. approximately, thus showing a saving of 8s. 8½d. when compared with the 250-volt method, and, at the same time, obtaining exactly the same results.

Eventually the truck so proved its worth that it was decided to install a motor-generator, but, owing to war measures, we now found that we were unable to obtain one;

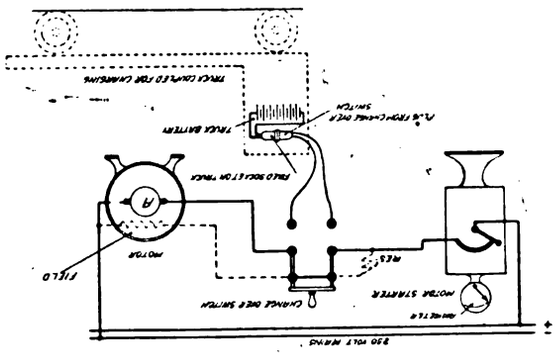

Fig 1.—Connections for Charging Battery through Change-over Switch.

also, the question of reducing the consumption of electricity cropped up, and it looked at first as though the truck would have to be put out of commission until such time as we were permitted to obtain a motor-generator.

Various methods of charging, however, were considered, and we eventually solved the problem by using the negative return circuit of a motor taking a fairly steady current of 40 amperes at 250 volts.

At first an ordinary change-over switch was used, as shown in fig. 1, but we found that this method was rather dangerous, and caused somewhat erratic running of the motor; so an automatic contactor switch was devised, as shown on the diagram, fig. 2. The arrangement operates in the following manner :—

When the motor M is running directly across the 250-volt supply, the contactor contacts F C, M C, and C_1, C_3 and C_4 are closed, but when the battery B of the truck is ready for charging, the plug P is pushed into the socket S, after which the push P_1 is pressed, and the contactor coil C C energises the contactor magnet C M with current from the battery B. On releasing the push P_1 a resistance R_1 is inserted in the contactor coil C C, but the pull of the coil core C M is sufficient to retain the armature A.

The contactor contacts F C and M C, which are mechanically fixed to the armature A, are now pulled off their respective contacts F_1 and C_1, resulting in an additional

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resistance F R being inserted in the field circuit and M C making contact with C_2.

The current which is being taken by the motor M now flows to the battery B, thus charging it. Under normal conditions, the speed of the motor M would be somewhat reduced owing to the loss of voltage due to the opposing voltage of the battery; but this reduction in speed is compensated by the resistance F R which is now inserted in the motor field, which, of course, speeds up the armature, and by adjustment it is possible to obtain exactly the same speed as was originally obtained.

Owing to the increase of field resistance the armature of the motor takes approximately 25 per cent. more current to drive it; therefore, the current passing through the battery during charging will be 50 amperes. Although the

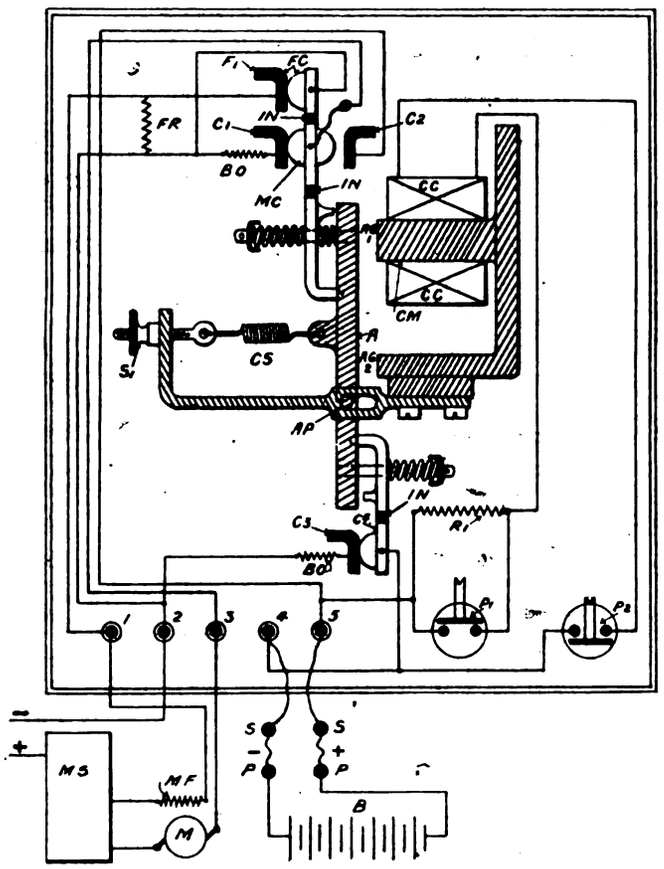

Fig. 2.—Diagram of Contactor Connections for Charging 24-volt Battery from 250-volt Mains.

M S, Motor starter; M, Motor; M F, Motor field; C M, Contactor magnet; C C, Contactor coil; B O, Blow-out coil; A, Contactor armature; F C, Field contacts; C_1, C_2, Fixed contacts; M C, Movable contact; C S, Contact adjusting spring; S_1, Adjusting nut; P_1, "On" Push; P_2, "Off" push; F R, Aux field resistance; C_3, Fixed contact; O, C, C, Movable contact; B, Truck battery; 1, 2, 3, 4, 5, Terminals; R_1, Contactor coil resistance; I N, Insulation; A P, Armature pivot; A G_1, Air gap; A G_2, Air gap.

battery is receiving a charge of 50 amperes, the actual increase in current used is 10 amperes, and the cost of charging is as follows:—

10 amperes × 250 volts/1,000 at 2d. = 5d.

per hour, or 1s. 8d. per complete charge—a saving of 8s. 4d. per charge when compared with the resistance method.

If the battery is fully charged, or the truck is required, the push P_2 is pressed, the contactor coil C M is de-energised and the armature A dropped off, allowing the contacts F C and M C to bridge their respective contacts F_1 and C_1.

If by accident or otherwise the plug P is withdrawn from its socket S before the push P_2 has been pressed, the contactor coil C M is energised from the 250-volt motor supply, and the tension spring S is overcome, and the contacts C_3 and C_4 are open-circuited, thus cutting off the main supply to the motor, and at the same time preventing serious arcing at the plug and socket contacts.

The charging arrangement I have described is situated near one of the loading stations, and we find it is not necessary to take the truck out of traffic for the purpose of charging, as the driver of the vehicle plugs in the battery of the truck every time he has a few minutes' stop during loading, &c.

WALSALL ELECTRICITY SUPPLY.

The following is an abstract of the report of a Committee which considered certain remarks made by Coun. Talbot at the Council meeting on November 13th with regard to interruptions to supply and coal consumption at the Birchills power station. Coun. Talbot at a later date disclaimed the broad statements which he had made. The report, which was adopted by the Council, stated that whilst the statements in question appeared to cast a reflection on the borough electrical engineer and his staff, Councillor Talbot, on this aspect of the matter being brought to his attention, disclaimed any intention to cast such a reflection; and the Committee placed on record its entire confidence in Mr. H. A. Howie and his staff. The report continued:—

Interruptions to Supply.—In connection with new plant of any kind difficulties must inevitably arise during the first months of working which might reasonably be expected to diminish or disappear in course of time, and the new station at Birchills had not been free from such difficulties. The stoppages which had occurred were not wholly or even mainly due to the station plant. Several tramway stoppages, for instance, occurred owing to the breaking of tramway wires and consequent short-circuiting.

During the past three months there had been altogether two general stoppages and five partial stoppages. Of those seven stoppages the most serious was that on Saturday, September 21st, when the tramway service was interrupted for a period of nearly four hours; all the other services, however, were maintained. This stoppage was due to an insufficient supply of town's water, caused by the breaking that day of one of the South Staffordshire Water Co.'s mains. That, however, would not have caused an interruption had it not happened to coincide with a date when one of the turbo sets was being overhauled. Arrangements had since been made whereby the supply would be maintained even in the extremely unlikely event of such a coincidence again happening.

Of the other six stoppages, one was due to the 250-kw. tramway rotary converter at Darwall Street sub-station being too small to deal with the Saturday evening load, and the Council had since approved the purchase of a new 500-kw. rotary converter to cope with that load. Two of the stoppages were due to the burning of low-grade fuel (anthracite slack and coke breeze dust) at the express desire of the Coal Supplies Committee of the Board of Trade. One stoppage was primarily due to an error of judgment on the part of the charge engineer. Of the two remaining stoppages, one was due to the safety overspeed device being set at too near the normal running speed. Owing to an external fluctuation on the load the safety device came into operation and shut off the steam, causing a stoppage of 15 minutes. The remaining stoppage was due to a hot bearing on the auxiliary plant.

In no case could the stoppages be attributed to any defect in the design or construction of the plant or station. There had been no stoppage whatever since October 24th last, though during that period there had been the maximum load and the largest output in the history of the undertaking.

Until a third generating set was installed at Birchills in accordance with the original design there would always be the risk of a short interruption of supply should the running set fail in any way.

Coal Consumption.—Since the question was considered and reported on by the Committee in detail 12 months ago, the Committee had had before it reports which showed that the results obtained were in accordance with expectations, and that the general efficiency of the Birchills power station compared very favourably with larger power stations operating under far better load conditions. The records also showed that the results were steadily improving with the growth of the load. In the four weeks ended November 17th, with poor quality coal containing 22 per cent. ash and with 10 per cent. of coke dust, the average fuel consumption per unit sent out was 4.97 lb. and per unit generated 4.19 lb.

After making proper allowance for the low value fuel and the fact that the turbine was only about half loaded, the figures obtained showed that the plant was being worked economically and was capable of 3 lb. per unit sent out when working under favourable conditions.

The committee had received from an independent and impartial source, viz., the technical adviser to the Coal Controller, London, who recently inspected the station and records, information which conclusively showed that the coal consumption at Birchills was lower and the overall thermal efficiency higher than at any of the other stations of comparable output in No. 10 (West Midlands) District. If the absolute figures were taken, without any reference to output or load factor, Walsall stood seventh among the 17 stations in No. 10 District (which included Birmingham, Coventry, Wolverhampton, West Bromwich, and the Shropshire, Worcestershire, and Staffordshire Power Co.'s and

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Midland Electric Power Corporation's Undertakings). The latest returns of coal consumption at the 17 stations in No. 10 District were given by the Coal Controller as follows:—

	Lb.
Highest consumption of coal per unit generated ...	9.0
Lowest consumption of coal per unit generated ...	3.19
Average consumption of coal per unit generated ...	3.77
Walsall consumption of coal per unit generated ...	4.19

These figures took no account of load factor; Walsall's load factor was low, and there was a much larger margin of spare plant at Walsall than at most other stations. Whilst that put Walsall in a peculiarly favourable position for development immediately war restrictions were removed, in the meantime the coal consumption figures could not be expected to be so good as they might be.

In view of the comparatively heavy coal consumption during periods of light loads, the suggestion that it might be advisable to install at Birchills a small turbo-alternator to take up the light loads had a certain amount of attractiveness on a superficial view, but the proposal was financially and economically unsound. The Council and the Committee were perfectly satisfied on the point.

In spite of all handicaps the progress of the undertaking, since the installation of the two sets was completed, had been eminently satisfactory. The Committee was confident that the most difficult period was now past, and that there was an excellent future before the undertaking if it was allowed to continue and develop the policy laid down five years ago.

TRADE STATISTICS OF CANADA.

The following figures, showing the imports into and exports from Canada of electrical and similar materials during the year ended March 31st, 1917, are taken from the recently-issued trade statistics. Figures for the year 1915-16 are given for purposes of comparison, and notes of any increases or decreases have been added:—

IMPORTS.

	1915-16. Dols.	1916-17. Dols.	Inc. or dec. Dols.
Copper wire, plain, tinned, or plated.—			
From United States ...	18,000	35,000	+ 17,000
Electric light carbons and carbon points.—			
From United States ...	50,000	66,000	+ 16,000
,, Other countries ...	2,000*	—	2,000
Total	52,000	66,000	+ 14,000
* Switzerland $2,000.			
Incandescent lamp bulbs, &c.—			
From France	1,000	1,000	—
,, United States ...	62,000	115,000	+ 53,000
,, Other countries ...	—	1,000	+ 1,000
Total	63,000	117,000	+ 54,000
Electric apparatus not mentioned (insulators, batteries, telegraph and telephone instruments).—			
From United Kingdom ...	207,000	109,000	— 98,000
,, France	2,000	2,000	—
,, Japan	—	1,000	+ 1,000
,, Sweden	3,000	3,000	—
,, Switzerland ...	—	5,000	+ 5,000
,, Italy	3,000	—	— 3,000
,, United States ...	3,367,000	4,174,000	+ 807,000
,, Other countries ...	—	1,000	+ 1,000
Total	3,582,000	4,295,000	+ 713,000
Manufactures of india-rubber and gutta-percha (except tires, clothing, and similar goods).—			
From United Kingdom ...	193,000	213,000	+ 20,000
,, France	2,000	3,000	+ 1,000
,, Japan	—	23,000	+ 23,000
,, United States ...	625,000	773,000	+ 148,000
,, Other countries ...	2,000	—	— 2,000
Total	822,000	1,012,000	+ 190,000
Gasoline engines.—			
From United Kingdom ...	32,000	26,000	— 6,000
,, United States ...	3,376,000	4,789,000	+ 1,413,000
,, Other countries ...	1,000	—	— 1,000
Total	3,409,000	4,815,000	+ 1,406,000
Steam engines.—			
From United Kingdom ...	12,000	1,000	— 11,000
,, United States ...	95,000	275,000	+ 180,000
Total	107,000	276,000	+ 169,000
Steam boilers.—			
From United Kingdom ...	33,000	55,000	+ 22,000
,, United States ...	81,000	155,000	+ 74,000
Total	114,000	210,000	+ 96,000
Concrete mixing, cement-making, and coal-handling machines.—			
From United Kingdom ...	1,000	—	— 1,000
,, United States ...	91,000	185,000	+ 94,000
Total	92,000	185,000	+ 93,000
Electric motors, generators, and dynamos.—			
From United Kingdom ...	35,000	66,000	+ 31,000
,, Sweden	2,000	3,000	+ 1,000
,, United States ...	863,000	1,397,000	+ 534,000
,, Other countries ...	1,000	—	— 1,000
Total	901,000	1,466,000	+ 565,000
Machinery not mentioned, except sewing machines, textile machinery, printing machinery, &c.—			
From United Kingdom ...	302,000	312,000	+ 10,000
,, France	2,000	—	— 2,000
,, Switzerland ...	46,000	8,000	— 38,000
,, United States ...	12,140,000	18,538,000	+ 6,398,000
,, Other countries ...	7,000	38,000	+ 31,000
Total	12,497,000	18,896,000	+ 6,399,000
Iron and steel wire, single or several, covered with cotton, linen, silk, rubber, or other material, including cables so covered.—			
From United Kingdom ...	5,000	25,000	+ 20,000
,, United States ...	160,000	188,000	+ 28,000
,, Other countries ...	1,000*	—	— 1,000
Total	166,000	213,000	+ 47,000
* France.			
Lighting fixtures of metal (including electric).—			
From United Kingdom ...	10,000	4,000	— 6,000
,, France	2,000	3,000	+ 1,000
,, United States ...	310,000	448,000	+ 138,000
,, Japan	5,000	15,000	+ 10,000
,, Other countries ...	3,000	—	— 3,000
Total	330,000	470,000	+ 140,000

EXPORTS.

Mica.—			
To United Kingdom ...	34,000	48,000	+ 14,000
,, United States ...	195,000	382,000	+ 187,000
,, Other countries ...	—	1,000	+ 1,000
Total	229,000	431,000	+ 202,000
Electrical apparatus.—			
To United Kingdom ...	142,000	295,000	+ 153,000
,, Newfoundland ...	17,008	36,000	+ 19,000
,, United States ...	52,000	179,000	+ 127,000
,, France	17,000	636,000	+ 619,000
,, Spain	340,000	193,000	— 147,000
,, Other countries ...	5,000	19,000	+ 14,000
Total	573,000	1,358,000	+ 785,000
Machinery (other than threshing, linotype, washing, and sewing machines).—			
To United Kingdom ...	252,000	521,000	+ 269,000
,, Newfoundland ...	23,000	38,000	+ 15,000
,, New Zealand	2,000	4,000	+ 2,000
,, Argentina	2,000	—	— 2,000
,, France	12,000	55,000	+ 43,000
,, United States	371,000	679,000	+ 308,000
,, Russia	34,000	55,000	+ 21,000
,, Australia	7,000	15,000	+ 8,000
,, Spain	2,000	23,000	+ 21,000
,, Other countries ...	35,000	55,000	+ 20,000
Total	740,000	1,445,000	+ 705,000
Gasoline engines.—			
To United Kingdom ...	10,000	—	— 10,000
,, Newfoundland ...	63,000	118,000	+ 55,000
,, United States	11,000	12,000	+ 1,000
,, Other countries ...	2,000	4,000	+ 2,000
Total	86,000	134,000	+ 48,000

Relaxation of Export Restrictions.—Further changes in Export Prohibition Orders appear in the *London Gazette* for December 13th.

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ELECTRICITY IN STONE HANDLING.

By G. BASIL BARHAM.

Every engineer is aware of the many uses to which electricity can be applied in stone handling and stone working generally, but so far few British firms have specialised in the manufacture of electrically-operated appliances designed for dealing with sand, gravel, ballast, and crushed stone. It may be that an opinion exists that there is an insufficient demand to justify the expenditure on designs and patterns, or it may be that due attention has not yet been directed to the subject. There is a lamentable lack of co-ordination between electrical manufacturers as a whole, and those responsible for the conducting of industrial undertakings. The former seem perfectly contented, as a general thing, to fill a demand if it is thrust upon them, and seldom seem to go out of their way to see what aditional demands can be created.

One of the most recent developments in connection with stone-handling machinery has been the production of an electric gravel shovel which travels on skids, digging a channel, and providing material at the same time. One of these is now at work in the construction of two retaining walls at Los Angeles. The river is being dredged out and confined to a narrower channel by means of two immense walls, one of which is 1,000 and the other 4,300 feet in length.

The electric shovel is mounted on skids, and is operated by means of a continuous-current motor which drives the excavator jaws, controls their movement so as to empty their contents into dump cars, and at the same time operates a slow-speed winch which winds a steel rope anchored some distance in advance of the machine, the whole of the operations being perfectly synchronised. In the ordinary type of excavator it is necessary to move the machine along on rollers, but the skids render these unnecessary.

The shovel, starting at a point near the concrete mixer, works its way along, digging out the bed to a depth of 20 ft., and filling dump cars which run alongside on a narrow-gauge track carrying the material to the mixer. At present these cars are hauled by a small engine, but ultimately they will be hauled by electric power, thus reducing working costs. The cars are drawn one at a time up an incline and dumped automatically into the concrete mixer in the following ingenious manner.

Two small supplementary wheels are mounted on the extended ends of the rear axle of each car. On reaching the top of the incline these wheels start to travel along beams, which are placed at a fairly sharp angle, so that the load is gradually tilted forward until past the centre of gravity. A tripping device fixed by the side of the road track then engages a catch holding the front of the car in place so that it is allowed to drop, and the stone or gravel falls forward into the mixer. For the purpose of providing conveyors whose range can be extended as the work progresses, sets of cables have been stretched from the stone-crushing plant and the mixers to points where the concrete is to be used. Frame sections are laid on these wires to form suspended supports, to the end of which the sand, stone, or concrete can be carried and dumped. As the work proceeds fresh sections are laid, these being removed from that part of the wall which has been completed. It is interesting to note that in order that the sorted material which is in excess of the requirements of the work can be easily loaded for delivery to purchasers, a reinforced concrete tunnel has been built along the length of the work. Into this passageway the delivery trucks are driven, and any superfluous material can be loaded into them by the simple expedient of removing one or more of the frame sections mentioned and dumping down the desired amount of sand or gravel.

An electric hoist has recently been designed by a leading firm of trans-Atlantic engineers especially for use in connection with slack-line, cableway excavators of the drag bucket type. This hoist is built for all sizes of buckets up to 2¼ cubic yards capacity. The rear drum is worked on a single speed, but the front drum is provided with two speeds, because it is used for the dual work of loading the bucket at a reasonably slow speed suited to excavating, and for hauling on the track cable to the dumping point as quickly as possible. Naturally, to obtain maximum capacity with this type of excavator, the bucket must be conveyed from the digging point to the dumping ground at the speediest possible rate.

In order to obtain two speeds on the front drum, two gear reductions are provided, one at either end, the drum being fitted with two specially designed, high-speed friction clutches. By means of engaging one friction clutch with the slow-speed reduction it is possible to obtain sufficient power to load the bucket at a speed of 200 ft. per minute. After the bucket is filled this slow-speed clutch is thrown off, and the friction clutch at the opposite end is engaged with the high-speed gear ratio. The duty of the drum is then sufficient to haul in the loaded bucket at a speed of 600 ft. per minute. After the load has been discharged, the front drum is thrown into the neutral position, at which point neither of the frictions are engaged, and the drum runs free on its shaft. The bucket is thus returned to the excavation by gravity at a high rate of speed. The rear drum of the hoist is used for tensioning the track cable, and delivers a duty sufficient for this purpose at a speed of 200 ft. per minute.

Another newly-designed form of electrically-operated stone-handling plant is a skip hoist, which consists of a bucket running on inclined or vertical tracks, and hoisted by means of a steel cable attached to an electrically-driven drum. The bucket consists merely of a rectangular, steel box open at the top, and fitted with guide rollers and hoist bale.

The bucket is started by a rope attached to the motor controller, or, if preferred, a push button control, such as is used for "inching" with electrically-driven printing machinery can be installed. Automatic control is fitted to the bucket so that it discharges on reaching a given position and returns to the pit. It is possible also to synchronise the movements of the bucket with a filling device so that as soon as a desired amount of material is loaded the bucket automatically starts. This hoist can be used with a small electric car to move the material a short distance to the loading hopper, or it can be used with a drag-line bucket.

It is claimed that a 35 cubic ft. trolley hopper car on a 130-ft. haul, travelling at a speed of 400 ft. per minute, can make a round trip in two minutes, including filling and dumping, assuming that the material will flow by gravity into the car. This equals 40 tons per hour for the extreme, or 20 tons per hour for the average haul. A skip, consisting of two buckets, one going up whilst the other is coming down, can make a trip in 90 seconds, including filling and dumping. If the buckets are 35 cubic ft. capacity each, it would give 28 tons per hour at 50 cubic ft. per ton and a 50-ft. lift. The 20 cubic ft. single-bucket skips, on a 50-ft. lift at 40 ft. per minute, can handle 8 tons per hour, and this size of hoist only requires a 6-H.P. motor. Only one attendant is required to fill the hopper and start the hoist, and where a continuously operating excavator is used, and automatic filling adopted, one man is sufficient to handle even the largest plant.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Super-Stations and Aircraft.

I regret that in my letter of the 4th instant a typographical error was made. The waterways—Clyde, Solway Firth, and Ribble—were omitted between the words Caledonian Canal and Mersey.

C. T. Allan,
Assistant Manager, South Wales E.P.D. Co.
Cardiff, *December 16th*, 1918.

A Six-Hour Day?

I notice that for a long time past Lord Leverhulme has been delivering speeches advocating a six-hour day. Many extracts to this effect have come before me, but I have not notice that other manufacturers are replying to, or approving of, his proposals. Does this mean that there is general agreement in industry that the two-shift, six-hour day giving employment to double the number of workers is the right thing? If such is not the case it is a little dangerous to allow the idea to spread. Are the conditions everywhere the same as prevail in a soap works? In one of his latest speeches, Lord Leverhulme gives as one reason for his proposal the fact that new factories to give employment for demobilised workers will cost 75 per cent. more than the old, and that the cost of machinery is doubled. What are the industries that he has in mind when he talks of the need of new factories for the employment of millions of workers? It might be helpful if he would particularise a bit. Does he overlook all the new works that have been erected by private concerns and by the Government itself?—works that will be free for ordinary industry, and presumably in the disposal of "war stores, &c.," will be offered at something less than the present-day high cost of factory erection? Shorter hours as a means of giving employment to larger numbers of workers—let us have these wherever we can give a living wage; but an indiscriminate and general cry for six hours seems more likely to hinder than to help us in discovering a solution to the difficulties of demobilisation. Surely when the engineering employers—who know their own industries better than they know the soap business—arrive at an agreement with the men for 47 hours a week, and only the very advanced section of the men clamour for 44, it is confusing when a leader of industry encourages the idea that 36 hours is all that any man ought to be required to work. Railway workers are to have the eight-hour day early in the year, and even the transport workers are only *asking* for a 44-hour week. It is true that there is a 36-hour demand among some of the trades on Tyneside, the Clyde, and at Belfast, perhaps fed by Lord Leverhulme's speeches, and it will be interesting to hear what the employers have to say. It may be easy to make a demand without allowing properly for the technical difficulties which may stand in the way of its realisation. I do not desire to be too critical

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of the efforts of those who are trying to secure the introduction of improved conditions and hours of labour, but I should very much like to see the views of some industrial leaders, who must be thinking a great deal, though saying little, on this important subject.

A. H. B.

London, *December 16th*, 1918.

Smooth versus Undercut Commutators.

I have been very interested in the correspondence on the above subject in your columns, and I note that practically all your correspondents have had the same experience as I have, namely, that, provided the undercutting is properly done, and care is taken that the conditions are suitable, it has very great advantages. I have always found trouble resulting from it when care is not taken to do the work properly.

In the case of an electric railway company in Mexico, with which I was connected, they were operating motor-cars and locomotives at 1,100 volts D.C., under very severe conditions of grades and loads. They had no sparking trouble with the motor cars which had 1,100-volt motors and undercut commutators, but with the locomotives which had 550-volt motors permanently connected in series, and a much lower rate of commutation and lower voltage between segments, they had a great deal of sparking trouble, until the mica was undercut about 1½ mm., when it practically all ceased. They also had considerable trouble on the 50-cycle rotary converters with sparking and flashing, on those without undercut commutators, but on two 550-volt rotaries which were built with the mica about 8 mm. below the copper, no trouble was ever experienced. Neither did any trouble due to dirt between the segments occur in these, in spite of the very deep undercutting and the use of soft graphite brushes; this I attribute to centrifugal force throwing the dirt out, as the commutators were about 800 mm. diameter, and ran at 1,500 R.P.M.

G. H. E. Vivian, A.M.I.E.E.

Newark-on-Trent, *December 14th*, 1918.

May I add my experiences to those of your correspondents who are in favour of undercutting the mica insulation of commutators?

I am in charge of a number of rotary converters, some of which are of an old type. Two of them gave more trouble than the rest, sparking badly at the D.C. brushes.

I had the mica undercut, with the result that they gave much improved service, the sparking in the case of one being almost entirely eliminated, even on overloads.

Hard carbon brushes work well, but, as it is advisable not to lubricate the commutators much, they are rather noisy. A little paraffin wax lightly applied is a good lubricant. Morganite brushes are very successful, as they do not require any lubrication.

My experience is that the brushes last longer and do not get so hot as they did before the slotting was done.

The mica should be cut down occasionally, a hacksaw blade passed along the slots will clear them of any accumulation of grease or carbon dust.

J. Hunt.

Ramsgate, *December 14th*, 1918.

I had thought quite enough had been said in favour of undercut commutators.

Since reading a letter in your issue of the 13th on the above subject, I feel I ought to write fully endorsing the views of Mr. W. Parker.

I have had over 17 years' experience in gas engine stations where machines all run under the worst possible conditions, all brass and copper work soon loses its brilliancy, and polishing is only a waste of time and material, the commutators on my machines from ¼ to 300 H.P. are almost as black as ink, having become oxidised by the gas, but commutation is perfect and the commutator cool. Whatever theory may have to say on the matter, the proof of the pudding is in the eating. I have the mica filed down, for which purpose I use "v" files, and once done it is an easy matter to run them through about once a month, but the surface of the commutator is untouched with either emery or carborundum cloth.

The greatest difficulty to overcome in a gas-driven station working on producer gas is the oil vapour drawn in by the machines, which adheres to the windings and the back of the commutator, on which dust readily collects. The exterior parts are easily cleaned, but what about the interior? I ought to say even with "totally enclosed" machines the same trouble arises unless they are pipe-ventilated.

Now here I must say a few words which I hope my manufacturing friends will treat kindly—approaching them on the subject, their only cure so far is an extra coat of varnish, which is by no means sufficient; ventilation, as we know, is an important factor, so also is high efficiency and cheap production, but surely a little ingenuity on their part would not impair the above factors, but obviate this oily vapour nuisance. May I make a suggestion? which I am almost afraid to do, namely, a belt of fine gauze or oil filter pad strapped round the protruding end of the armature, which could be taken off and cleaned occasionally.

I have tried to be as brief as possible, but shall be pleased to give any information to either users or makers of machines of my experiences on the above subjects.

A. Preston.

Ammanford, *December 16th*, 1918.

Gas versus Electricity.

I have pleasure in enclosing copy of my letter of December 5th, addressed to the Director of Electric Power Supply, and copy of Mr. Gridley's reply on December 6th, for publication in your Journal.

The matter will, I feel sure, be of general interest to your readers.

H. Faraday Proctor,
Hon. Sec., I.M.E.A.

Bristol, *December 13th*, 1918.

[COPY.]

December 5th, 1918.

Arnold B. Gridley, Esq.,
Director of Electric Power Supply,
Room No. 401,
Ministry of Munitions of War,
8, Northumberland Avenue,
London, W.C. 2.

DEAR MR. GRIDLEY,—At the last meeting of the Council of the I.M.E.A. the letter of Mr. Rogerson, borough electrical engineer of Halifax, dated November 14th, and addressed to yourself, was considered. The letter contains the following paragraph:—

"It is presumed the chief reason for encouraging the use of gas, namely, the one referred to in your circular of September 17th last (the importance for war purposes of the residuals from the gasification of coal) has now lost its force with the reduction or cessation of the demand for explosives."

The Council requested me to write to you asking whether you would secure freedom of choice in the use of gas or electricity to consumers or prospective consumers in preference to the existing arrangement, which favours the utilisation of gas due to war requirements.

Yours very faithfully,
(Signed) H. FARADAY PROCTOR,
Hon. Sec.

[COPY.]

Ministry of Munitions of War,
8, Northumberland Avenue,
London, W.C. 2.

H. Faraday Proctor, Esq., *December 6th*, 1918.
Hon. Secretary,
Incorporated Municipal Electrical Association,
The Exchange,
Bristol.

DEAR SIR,—I am directed to refer to your letter of the 5th inst., and to say that the fact that a gas supply may be available on the premises need now no longer be a reason for declining to entertain applications for supplies of current for domestic purposes.

In modifying to this extent the restrictions which have hitherto held, I would remind you that until the coal situation has materially improved, the Electricity (Restriction of New Supply) Order, 1918, must unfortunately remain in operation.

I am, Sir,
Your obedient servant,
(Signed) A. B. GRIDLEY,
Director of Electric Power Supply.

LEGAL.

THE FLEMING VALVE.—PETITION FOR PROLONGATION OF PATENT.

(*Concluded from page* 570.)

Cross-examined by Mr. COLEFAX, K.C. (for the British Thomson-Houston Co., Ltd., and others, opponents of the petition), in connection with the patents of Dr. de Forest and his grid patent of 1908, Mr. PLETTS said it was the contention of the Marconi Co. that all grid valves that rectified infringed Fleming's 1904 patent.

There has been nothing during the life of this patent to interfere with the free use by the Marconi Co. and all their customers or associated companies making use of the Fleming valve?—No.

Cross-examined by Mr. T. TERRELL, K.C., for the Crown, witness said he was aware that the Marconi Co. had been in litigation with the Post Office for breach of contract, and that they were claiming damages for loss of royalties which they would have earned under the contract if it had not been broken, for the use of their patents.

And this patent forms the most important factor in that claim for damages?—It forms, I should say, the most important patent from this year onwards.

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And for past years?—The Lodge patent expired in 1917.

Re-examined by Mr. J. H. Gray, K.C.: It is quite wrong to say royalties are being claimed. The fact is, it is a percentage of the cost of the messages which would have been sent during the year in any particular year.

Witness further said that licences had been granted for the English or foreign patents to other companies. The Marconi Co. had shares in those other companies.

By Mr. Justice Sargant: Did you push the sale of this apparatus commercially in the market just as if you had been only non-users, so as to sell to all your rivals and everybody in the market?—There were customers; we sold to people who had our apparatus.

Mr. Pletts added that, so far as he knew, they sold them to any person who wanted them.

Mr. William Walter Bradfield, manager of the Marconi Co., produced a document showing in the case of each of the subsidiary companies of the Marconi Co. the number of shares held by the Marconi Co. in those companies, and the total dividends which had been received in each year from them. Generally speaking, in the case of each of the subsidiary companies, as part of the consideration from the Marconi Co. to them, there was either an assignment in general of all patents of licences for all patents present and future made by the Marconi Co. in the particular country. The first was the Marconi International Marine, which showed by far the largest total dividends received—£84,500. The number of patents involved in the various transfers amounted to 160. The Marconi Wireless Co. of America paid a dividend of £4,082 in 1912. In 1917 the American Marconi Co. paid the Marconi Wireless Telegraph Co. £10,000 in dividends. That was chiefly attributable to the fact that the American Co. was doing a tremendous amount of work. It was selling all sorts of military apparatus, both to the Army and Navy authorities. The French Marconi Co. had paid the English Co. £1,446, rising gradually to £7,760 in 1917. The Belgian Co. had paid no dividend since 1911. The Russian Co. paid up to the time of the trouble in Russia in 1916 a dividend of £2,971. The Australian Co. paid dividends from 1913 up to date amounting in the last year to £1,800. He believed the Australian Co. had something like half a dozen ships that had been fitted with valves during this last year. Witness was of opinion that the other companies had not used valves, at any rate commercially, but might have done so experimentally.

Prof. E. W. Marchant and Sir Dugald Clark said they regarded Prof. Fleming's invention as of very great importance.

The petitioners' case was closed, and

Mr. Moritz, addressing the Court on the evidence, said the two main features in the case were outstanding merit and insufficient remuneration.

On Wednesday, December 11th, Mr. Colefax, opening the case for the opponents (six), said it was not that they feared an issue of infringement or an issue of validity with regard to the patent, but they had been made aware of the extraordinary claims which the Marconi Co. had been making in respect of the patent, and accordingly they thought it right to enter opposition to the petition for prolongation. One matter that had not escaped the notice of those interested in such matters was the subtle transition that appeared in the Marconi patents when referring to the three-electrode valve. Up to a certain time it was recognised by that name, by which it was known in the electrical world, and then it came to be called the Fleming valve. The case was unique almost in this respect, that there never had been any difficulty whatever or any disinclination on the part of the public to use the invention, or any difficulty on the part of the company in putting the invention into operation. During the whole of the life of the patent, subject only to the growth of the use of wireless, it had been of equal value. His contention was that there was no invention at all. There was no conflict that the instrument was old; its use for rectifying alternating currents was also old. Whatever use, if any, there had been of the invention Dr. Fleming made in 1904, it was absolutely negligible. The kind of case that was suggested for the petitioners was that long-distance wireless was rendered possible by it, or rendered more efficient by it. They said that, in substance, long-distance wireless dated from 1908. But in a wireless book it was stated that in 1902 long-distance signalling was done at 1,550 miles. There was plenty of evidence that what they did was to use the Fleming valve (as a matter of fact, it was not the Fleming valve, but the de Forest valve) as an amplifier, which they admitted was outside the invention in the patent. It was a grid valve used as an amplifier. Counsel also submitted that this patent as it stood to-day was invalid.

Mr. Courtney Terrell, on behalf of the de Forest Automatic Telephone Co. (also opponents), said the whole of the merit claimed in this case was the property, not of Fleming, but of de Forest. He appeared for the man whose clothes had been stolen in this case. Dr. de Forest, whose main patent—that was to say, the three-electrode patent—dated from 1908, was at the time when the renewal fees for these patents became due in extremely difficult circumstances, and he could not afford to pay the renewal fees. He allowed the patent to lapse, and after the patent had lapsed, and had become open to the world, they then suddenly saw an enormous development of the use of valves in this art, and the valves that were used were not Fleming's valves, but de Forest's valves. In continuous-wave telegraphy the three-electrode valve continued to be used.

Mr. Kerly, on behalf of the Controller, said he was of opinion that a prolongation ought not to be granted. What was here asked was to have the opportunity of levying an immense tax upon the public in the future. If this invention was of great public utility, why had it not come into general use? The answer was because it did not suit the Marconi Co., and there was no other answer. That there was sufficient merit in the invention had not been proved; neither had inadequate remuneration of the patentee been proved.

Mr. P. H. Pettifer, giving evidence, said he was in the employ of the Marconi Co. from May, 1912, to May, 1916, and during that period he was employed at the long-distance station of the company at Clifden, Co. Galway. In the receiving apparatus there no use was made of a Fleming valve. A carborundum crystal was used as detector, and after that a three-electrode valve.

Prof. C. V. Boys, F.R.S., said the specification of the 1904 patent of Dr. Fleming included the use of a bulb in which there was a hot cathode and a cold anode for the purpose of detecting high-frequency oscillations, such as they had in wireless telegraphy.

Mr. R. P. H. Graham, called for the de Forest Co., said he was employed by Government Departments for the purpose of research on the subject of wireless telegraphy. In the course of his experience he had never seen any practical application in wireless telegraphy of the Fleming invention as described in Fleming's specification.

Mr. Jas. Swinburne gave evidence for the Crown, and described the development and use of valves for the detection of oscillating electric currents.

Mr. Justice Sargant concluded the hearing of the evidence and arguments on Friday, December 13th, and gave judgment on Monday, the 16th, the case having occupied the Court for nine days. In giving judgment, he said that the case was of great commercial interest; the legal and scientific importance was much less, and the elaboration of the technical evidence appeared to be due to the fact that other proceedings in connection with this patent were pending. In one respect the claim of the specification was too wide, and an application to amend it was to be made; it was sought to extend the life of the patent with the limitation comprised in the amendment.

The objectors had failed to show that there was no subject-matter in the invention. It was a pioneer invention, and was one of considerable utility, but could not be regarded as epoch-making, or even in the first rank as regarded utility.

As to the remuneration received, the first item, actual cash profits on the sale of valves, was £8,500. As to the second item, shares received on sale of foreign rights to subsidiary companies, £1,200,000 share capital had been received for the company's Argentine patents in 1907, and £100,000 was to be received for other patent rights. Even if only 1 per cent. of the aggregate price was to be appropriated to the Fleming patent, over £13,000 had to be added to the petitioner's remuneration on this score alone. The third head of remuneration consisted of pending claims against the American Government and some of the Departments of the British Government—particularly the Post Office, the Admiralty, and the War Office.

The claims against the Admiralty and War Office were admitted to be very large, and arose from the extraordinary and unexpected use of valves of this kind on aeroplanes. The petitioners would be in a substantially better pecuniary position than they might have expected to reach had not the recent war resulted in so unexpected an enlargement of the field of use of their invention. In view of the foregoing estimate of the three heads of remuneration the petitioners could not be held to have established the case of inadequate remuneration. In the result, he dismissed the petition.

Scoular v. Notable Electric Co., Ltd., and Warner.

In the Commercial Court of the King's Bench Division, on December 9th and 10th, Mr. Justice Bailhache had before him an action brought by Mr. James Alexander Scoular, of Merton Road, Wimbledon, against the Notable Electric Co., Ltd., of Kingston Road, Merton Park, and Mr. F. Warner, of the same address, plaintiff claiming the sum of £300 balance of moneys which the plaintiff alleged was due to him for goods sold, work done, and materials provided.

Counsel for plaintiff said he understood the Notable Electric Co. was a limited company in which Mr. Warner had considerable interest. Mr. Warner was minded in 1917 to start a factory for the purpose of manufacturing electric lamps. Mr. Scoular, who had been familiar with the work for some time, was approached for the purpose of entering into a contract to equip the factory. Premises had to be obtained, and they were obtained ultimately by the defendant company at Merton.

Plaintiff's case was that in June, 1917, it was agreed that he should provide the defendants with an equipment for making drawn-wire tungsten filament lamps, which, when

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the necessary hands had been trained properly, would produce an output of 1,000 ordinary lamps per day of ten hours, that the plaintiff should instruct the defendants' managers and employés to the best of his ability in the manufacture of the lamps, for a period not exceeding six hours per day, for three months, commencing June, 1917; that the defendants should provide all raw materials of suitable quality, including uniform drawn wires, and finished caps, and also good quality bulbs, and tubing necessary for the manufacture of the lamps, and that the cost of the equipment and instruction should be £2,000. Defendants had paid to the plaintiff on account sums amounting to £1,700, leaving a balance of £300 still due and owing to the plaintiff under the agreement.

Defendants alleged that the plaintiff did not complete his part of the agreement, failing to provide the defendant company with an equipment which when the necessary hands had been trained properly would produce an output of 1,000 ordinary 60-watt lamps per day of ten hours. It was alleged that the motor supplied by the plaintiff was incapable of doing the work required, and fired and became useless, that the gas fires fitted by the plaintiff to the machines were defective and insufficient and inadequate for the output required, and that the machines supplied were in such a condition as to continually break down and require repairing. Defendants counterclaimed for £1,637, the principal item being loss of profit on 42,000 lamps, being the difference between 64,000 lamps that the equipment should have turned out between November, 1917, and February, 1918, and the number of lamps actually turned out, 22,000—6d. per lamp, £1,050.

Witnesses were called on both sides, and counsel addressed his lordship, Mr. J. A. Hawke, K.C. for the defendants, and Sir Ernest Pollock, K.C., for the plaintiff.

Mr. Justice Bailhache gave judgment for the plaintiff for the amount he claimed, £300, with costs, and he gave judgment for the defendants for £435, with costs, on the counterclaim.

Breach of Mining Regulations.

In Ayr Sheriff Court a miner was fined £5 for having, in No. 4 Auchencruise Colliery (1) failed to keep five detonators issued to him in a suitable case, and having given them to a roadsman in the colliery, and (2) being the person authorised by the manager to fire shots electrically, and being provided with the electrical-firing apparatus, with removable handle, having failed to keep the handle in his personal custody.

Linsdell v. Paignton Electric Lighting Co., Ltd.

Before his Honour Judge Lush-Wilson, at Paignton County Court on Monday, Mr. William Linsdell, of the Cinedrome, Plymouth, sued the Paignton Electric Lighting Co. for £30 1s. 2d.—Mr. Hutchings, for the plaintiff, said the company supplied current at two prices, 7d. per unit for lighting and 3d. per unit for power, and the question in dispute was which charge should be made in the present case. Plaintiff offered 3d. per unit, but the defendants cut off the supply. Plaintiff lost two performances (for which damages were asked), and then paid at the rate of 7d., and now sued for the return of the money. There was a second supply to the operating room, where a much lower voltage was required for the arc throwing the light on the screen. Plaintiff contended that he should be charged at the power rate for the amount registered by the meter. The Electricity Acts were silent on the point.

The Judge: It is power, no doubt, but the ultimate result of that power is the production of electric light.

Mr. Hutchings replied that at Plymouth the plaintiff paid for the current as power.

Charles T. Instrell, an electrical engineer, said the current was used to excite, or cause to revolve, the field magnets.

Mr. Kenny (for the company): Does any part of the current supplied at 440 volts communicate with the arc lamps?—No; there is no contact direct with the arc lamps.

Mr. E. W. Jeffs, an expert, said there were two different sets of windings, the primary and the secondary, and the current supplied to the former caused or excited the motion in the other, which generated current.

The Judge: There is no junction or connection?—Witness replied, no. At Plymouth and Dartmouth, where the same thing existed, current was charged as power.

The Judge regarded it as a nice point involving a mixture of fact and law which he should not like to settle by himself. He adjourned the case to allow of the parties agreeing upon an electrical arbitrator.

Workmen's Compensation.

At the Bow County Court, on Tuesday, an application for a new trial was made to Judge Graham, K.C., in the action already reported (Elec. Rev., December 13th) in which T. E. Knight, of 7, Cooper Street, Canning Town, an engineer, was awarded £75 damages for personal injuries against the Charing Cross, West End, & City Electricity Supply Co., Ltd. The application was on the ground that the verdict was against the weight of evidence. The defendants alleged that the jury found that the negligence was in not having put up a fence until afterwards, and they would like to call evidence to prove that no such fence had been put up, nor was it necessary.

Judge Graham said he could see no ground for the application, and said the verdict must stand.

Allowance was then asked for for the £5 which the plaintiff had been paid under the Workmen's Compensation Act, to which he agreed, and the amount was reduced to £70. Leave for stay with a view to an appeal was then asked for, but his Honour refused it, saying he would have acceded to the request had there been the slightest chance of the defendants' success, but there was none.

BUSINESS NOTES.

The Christmas Holidays.—We shall be glad if our readers will take note that, owing to the Christmas Holidays, the Electrical Review for December 27th will have to be printed two days earlier than usual. All matter intended for that issue, whether editorial or advertisement, should be in our hands at the earliest possible moment. All new advertising copy and alterations to existing displayed advertisements must be received here not later than this morning, Friday, December 20th. Official Notices and small prepaid advertisements can be received up to Tuesday morning.

Trading with the Enemy.—The *London Gazette* for December 13th contains further lists of persons and bodies in the following countries with whom trading is prohibited:—Paraguay, Brazil, Chile, Guatemala, Honduras, Mexico, Morocco, Netherlands, Netherland East Indies, and Spain.

Canadian Trade.—A Canadian Trade Commission has been appointed to co-operate with the Canadian Mission in London with a view to securing a share in reconstruction work in France and Belgium, and to develop Canadian export trade. Sir Charles Gordon, Mr. C. B. Macnaught, and Mr. H. B. Thompson compose the Commission.—*The Times.*

Agreement Between German Employers and Trade Unions.—An agreement has been arrived at between the German Employers' Associations and the Trade Unions. The text of the agreement, which consists of 13 clauses, is given in *Soziale Praxis* (November 21st), as follows:—

1. The Trade Unions are recognised as the competent representatives of the working classes.

2. No restrictions may be placed upon the right of the workers, of both sexes, to combine.

3. The employers and Employers' Associations will, for the future, refrain from any interference with the Labour Associations—the so-called economic Peace Associations (Wirtschaftsfriedliche Vereine), and will not support them either directly or indirectly.

4. All workers returning from military service are entitled, after giving due notice, to be reinstated at once in the posts they occupied before the war. The employers and Employers' Associations must endeavour fully to comply with this obligation by procuring raw material and orders.

5. Labour Bureaux must be ruled and administered by equal numbers of employers and workers.

6. Labour conditions for all workers of both sexes are to be determined in accordance with the circumstances of the industry concerned by mutual agreements with the trade associations of the employés.

7. In each business establishment employing at least 50 hands a Workers' Committee is to be appointed, which will represent the workers, and, in conjunction with the owners of the establishment, see to it that the labour conditions in the establishment are regulated in accordance with the mutual agreements.

8. The mutual agreements must provide for Arbitration Committees or Conciliation Boards, composed of equal numbers of employers and workers.

9. The maximum regular daily working time in all business establishments is fixed at 8 hours. No reduction of wages consequent upon this curtailment of working hours is permitted.

10. In order to carry out this agreement the employers' and workers' Associations will establish a Central Committee on the basis of equal representation, to which special members of the trade will be attached, for the purpose of regulating the measures necessary for demobilisation, for the maintenance of the economic position, and for securing for the workers, especially those severely injured in the war, the possibility of existence.

11. The Central Committee will also be responsible for the settlement of fundamental questions such, for example, as arise from the mutual regulation of wage and labour conditions, as well as the settlement of disputes, which affect various trade groups at the same time.

12. The decisions of the Central Committee are binding for both employers and workers unless they are challenged within seven days by one of the two trade Associations concerned.

13. This agreement comes into force on the day on which it is signed, and remains valid, in default of other legal regulation, until further notice, subject to three months' notice by either party.

This agreement, in its general purport, is also to govern the relations between the Employers' Associations and the Associations of Clerks.

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The Holidays.—MESSRS. HIGGS BROS., of Birmingham, are closing their works and offices from Tuesday night until the following Monday morning.

MESSR. J. H. TUCKER & CO., LTD., Birmingham, are closing their works and offices from Tuesday evening until the following Monday morning, 30th inst., for the Christmas Holidays.

Federation of British Industries.—This Federation has issued a full report of 30 pages, of the proceedings, including the resolutions passed, at the second annual general meeting held in London in October. We have already published a necessarily abbreviated account of the proceedings, but those who want the complete report should apply for a copy of this document (39, St. James' Street, London, S.W. 1).

The Coming Boom.—The following review of the situation appeared in the *Engineer*, last week, from our contemporary's always interesting correspondent at Sheffield:—"Things in this industrial centre are certainly beginning to assume more definite shape regarding reconstruction. . . . . It is really too early to expect definiteness, yet it is clearly manifesting itself. Perhaps the most important direction this manifestation is taking is towards the reconstruction of labour staffs; at least, it seems to me the most important at the moment, because no headway can possibly be made until the labour dislocation period has been safely negotiated. That it is being negotiated cannot be gainsaid. The operation is taking almost a normal course. This is a surprising promise of a rapid recovery when all the circumstances are remembered. The general forecast of the early post-war days included a certain period of unemployment before anything like an industrial boom could be entered upon. Instead of that, there is in this area already a pressing demand for men, especially for skilled and semi-skilled workers, and for the present it looks as if the available supply is seriously deficient. It means that the peace-trade boom is already leaving the slips, and will take the water long before many thought it possible. Two hindrances to more rapid progress are the general election and the coming Christmas holiday. The workers are preparing to keep the latter in a way which has been impossible to them since the Christmas of 1913, and it is being freely stated that many firms intend closing their works for a full week or even longer. It may, therefore, be taken as certain that the trade boom will not be actually launched until the early days of 1919. In the meantime the important work of reconstructing labour staffs is proceeding satisfactorily up to a certain point. Men who came to the Sheffield district from other callings and towns are departing. Colonials who came over to augment engineering staffs, when such help was vitally needed, are booking their passages home again. Belgians are seeking repatriation. Shopkeepers whose knowledge of lathe-work gained during the war is quite passable in a crowd, are returning to reconstruct their businesses. Sheffield men who, under the National Service system, were drafted away to various munition-making centres, are coming back. But the point at which difficulty is experienced is the pressing need now for the return of the skilled men—or those of them who survive and are fit—who left in large numbers for the Colours in the early days of the war. They ought never to have been allowed to go, as their services were needed badly at home, and the question with which employers are confronted now is whether the demobilisation of 'pivotal' men, and the release of thousands of skilled and semi-skilled young men who were demanded by the military authorities in more recent days will take place in time to permit this labour staff reconstruction to be completed early in the new year, or to a sufficient extent to allow the coming trade boom to develop unhindered. Demobilisation is a big problem, and if it is found by experience that, though launched, the boom cannot be made ready for sea for a few months, that fact must be borne in mind."

Boiler Orders Revoked.—The Minister of Munitions has revoked the Boilers Returns and the Boilers Control Orders which provided respectively (*a*) for the making of certain returns; and (*b*) that no person except with a permit might purchase, sell, or deal in any second-hand steam-pressure boiler other than boilers for use in locomotives, motor-cars, vehicles, or ships. The Order did not, however, authorise dealing in boilers for which a permit is required under the Railway Material (Second-Hand) Order, 1916.

Reconstruction Problems.—The Ministry of Reconstruction has now issued No. 8 of its series of pamphlets. It deals with the "Re-settlement of Civil War-Workers," and discusses such matters as the demand for labour, new openings for labour, the Re-settlement Department, measures of re-settlement, measures for extending existing employment, the release of munition workers and the terms of unemployment remuneration.

Stocks of Non-Ferrous Metals.—In order that the trade may know the position in regard to stocks of the important metals, the following particulars are published of the stocks (exclusive of old metal and scrap) in this country in the possession of the Minister of Munitions on December 1st, 1918, viz.:—

Copper	27,580 tons.
Spelter G.O.B.	18,768 ,,
,, Refined	6,544 ,,
Aluminium	10,715 ,,
Soft pig lead	49,111 ,,
Nickel	1,735 ,,
Antimony regulus	3,303 ,,

It is intended to publish, at monthly intervals, the stocks held on the first day of each month. In addition to the above, the Minister holds large quantities of scrap, mainly brass, of which it is impossible to give any figures at present.

For Sale.—Hackney B.C. electricity department invites offers for 393 10-ampere open-type arc lamps and about 13,000 solid and 11,000 cored carbons. Particulars are given in our advertisement pages to-day.

Catalogue Standardisation.—According to the *Board of Trade Journal*, the National Association of Purchasing Agents of the U.S.A. has finally adopted two sizes for all catalogues and booklets—namely, 7½ in. × 10⅝ in. and 5½ in. × 7½ in. The Graphic Arts Section of the Canadian Manufacturers' Association has also approved a table of standard sizes for catalogues and booklets.

German Demobilisation.—According to the *Kölnische Zeitung* (November 18th), the first men to be released from the German Army are workers and employés connected with the means of communication (railways, shipping, tramways, &c.); then those connected with power stations (electric, gas, and water-power). This measure does not imply any special preference shown to these particular men, but is to the advantage of every soldier, as it will facilitate his return home.

The Formation of Whitley Industrial Councils.—In a publication issued by the Ministry of Reconstruction there is given a list of industries in which industrial organisations have been formed along the lines of the Whitley Report. In addition to the Joint Industrial Councils (J.I.C.) already set up, there are also 29 Interim Industrial Reconstruction Committees (I.I.R.C.) at work, some of which are reaching the stage at which they will soon be convertible into full Joint Industrial Councils. We give below a selection of industries in which organisations have been established, and the names and addresses of secretaries:—

Brass and Copper Trades (I.I.R.C.) (Provisional).—Liaison Officer: F. W. Raffety, Ministry of Reconstruction.

Building (J.I.C.).—Secretaries: Employers, A. G. White, 48, Bedford Square, London, W.C.1; operatives, W. Bradshaw, 15, Union Street, Ardwick Green, Manchester. Liaison Officer: A. L. Dakyns, Ministry of Labour.

Cable-Making (P.D.C., J.I.C.).—The Secretary, Provisional Drafting Committee, Ministry of Labour.

Commercial Road Transport (P.D.C., J.I.C.).—The Secretary, Provisional Drafting Committee, Ministry of Labour.

Electrical Contracting (P.D.C., J.I.C.).—The Secretary, Provisional Drafting Committee, Ministry of Labour.

Electric Power and Supply (P.D.C., J.I.C.).—The Secretary, Provisional Drafting Committee, Ministry of Labour.

Glass (I.I.R.C.).—Major Hazzledine (*pro tem.*), Board of Trade, 1, Horse Guards Avenue, S.W. 1.

Iron and Steel Trades (Commercial Committee).—Mr. N. H. Deakin, O.B.E., Sheffield Telegraph Buildings, High Street, Sheffield. The work of this Committee will be limited to commercial and technical questions.

Railway Carriage and Wagon Building (I.I.R.C.).—Sir W. B. Peat, 11, Ironmonger Lane, E.C. Liaison Officer: F. W. Raffety, Ministry of Reconstruction.

Tramways (P.D.C., J.I.C.).—The Secretary, Provisional Drafting Committee, Ministry of Labour.

Wire Manufacturing (I.I.R.C.).—J. W. Wyatt (*pro tem.*), Ministry of Reconstruction.

Zinc and Spelter (I.I.R.C.).—F. W. Raffety (*pro tem.*), Ministry of Labour.

Calendar.—THE SUPERHEAT FURNACE CO., LTD., Bradford, has issued a wall calendar with a block of daily slips for 1919.

Strike Troubles at German Electrical Works.—The Hague correspondent of the *Times* says that in response to Liebknecht's appeal for a general strike, 54,000 men at Siemens's works threatened to come out, but abandoned their intention through Herr Barth's intervention. The workers' officials, it appears, made such demands as would have rendered the firm's continuance impossible. It is also stated that at Bergmann's electrical works at Rosenthal, differences occurred between workers and the managers, but the differences were adjusted. On Friday last, however, Liebknecht entered the building by force, and persuaded the workers to attend a meeting, after which they did not return to work. At other places men are threatening to destroy the mines and to sink all merchant ships unless their demands are granted.

The *Daily Mail* prints dispatches in the course of which it is stated that the demands made by the workers in various factories have been on a most ambitious scale, meaning nothing short of ruin. The head of "one of the largest companies in the electrical industry in Berlin," who has to do "with highly-educated workers," said that demands amounting to £2,000,000 had been made to him, which far exceeded the company's revenue.

In one case at Leipzig a supplement to wages from August 1st, 1914, was demanded at a works employing 700 persons, which meant that the proprietor must lay on the table £85,000 to satisfy the demands of the moment. Thousands of pounds were to be paid in coin, and the stipulations for the future included one for a full month's salary as a Christmas-box.

In the ELECTRICAL REVIEW for August 30th we discussed the reductions of wages that were being made in some of the German factories, including one of the branch works of the Siemens-Schuckert Co. In referring to the big war profits of the German firms which they had put into reserves in German War Loan for after-war trade, we remarked: "If the German workers' claims for war profits to be disgorged were to become general, there would not be even those depreciated 'scraps of paper' left."

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Concert.—The electrical employés of Messrs. Higgs and Hill, Ltd., contractors, will hold a concert at the Crown Works Canteen, South Lambeth Road, S.W., on Saturday, December 28th, at 7 o'clock.

Non-Ferrous Metal Industry Act.—A further list of licences granted under this Act appears in the *London Gazette* for December 17th.

Pivotal Mining Men.—We read in a financial daily that the Institution of Mining and Metallurgy has been appointed by the Ministry of Labour as the central authority for the demobilisation of pivotal men connected with metalliferous mining and non-ferrous metallurgy.

Bankruptcy Proceedings.—William T. Smith, electrical and mechanical engineer, Victoria Street, and 60, Hampden Street, Bolton.—This case was again mentioned at Bolton to the Registrar on 11th inst. It had previously been adjourned to enable debtor to carry out his desire to make an amended composition for an increased amount. An application was now made for the extension of the adjournment to March 12th. The Registrar agreed.

E. Cull, electrical fitter. "formerly licensed victualler," Plymouth.—Trustee, Mr. A. N. F. Goodman, released November 28th.

E. Cloney, tramway divisional superintendent, 5, St. Albans Road, Parliament Hill Fields.—Receiving order discharged conditionally.

A. Matson, lately electrical engineer, Stockton-on-Tees.—Application for discharge to be heard at Stockton-on-Tees, January 14th, 1919.

S. Smith (Smith & Sons), "music and musical instrument dealer, electrical engineer, and general dealer," Widnes. — Discharge suspended for two years.

Italian Company Notes.—Under the auspices of the Gouppo Quartieri (S.T.P.E.) there has been established at Milan the Fabbrica Italiana Apparechi e Materiali Elettrico, with a capital of 1,500,000 lire.

By the issue of 2,655 shares the Società Telefonica Cisalpina, of Bergamo, has increased its capital to 750,000 lire.

The Società Elettrica Sarda, of Leghorn, has increased its capital to 10,000,000 lire, and shifted its headquarters to Milan. This company works in conjunction with the Società Elettrica de Tirso.

By the issue of 3,000.000 bonds the Società Varesina per Imprese Elettriche, of Varese, has augmented its capital to 12,325,000 lire.

The Società Anonima Materiali Elettrico, of Milan, has increased its capital to 450.000 lire, and the Adamello Co. from 20,000,000 to 30,000,000 lire.

Italian Machine Tool Trade.—The provision of machine tools for their expanding industries after the war is exercising the minds of prominent Italians. One-tenth of these imports before the war were supplied by England, three-tenths by America, and six-tenths by Germany. The last-named country will, however, cease to count among Italy's suppliers, and her requirements will have to be met elsewhere. To this end a company was recently formed at Milan under the style Associazione fra gli Importatori di Machine Utensili, which, pending the time when Italy is able to provide for her own wants, will control the business of machine tool imports, among which agricultural motors and machinery take a leading place.

Trade Announcements.—During the war the lowering-gear business of the London Electric Firm has been carried on to a considerable extent, mostly for munitions and similar factories. The firm's operations, however, have been mainly devoted to searchlights for various Government Departments—the War Office, the Admiralty, the Air Board, &c. They will now continue with their lowering gear, winches, wire rope, pulleys, &c., also searchlights of Army, Navy, mercantile, canal, Fire Brigade, and yacht types. They are also making machines with electric, pneumatic, hydraulic, and rod-distance control, parabolic and other mirrors, combined auto and hand-feed lamps, &c.

The Stanton Ironworks Co., Ltd., near Nottingham, have entered into a working arrangement with Messrs. James Oakes and Co., of Alfreton Ironworks, Derbyshire, under which the Stanton Co. will, from January 1st next, act as sole selling agents for the products of Messrs. Oakes's blast furnaces and foundries.

Liquidations and Dissolutions. — Larne Electric Light Works, Ltd.—Winding up voluntarily. Liquidator, Mr. J. D. A. Norris, Suffolk House, Laurence Pountney Hill, E.C.

Herrtage, Lester & Co., electrical engineers, 4, Queen Street Place, E.C.—Mr. S. E. Herrtage and Mr. G. W. Lester have dissolved partnership. Mr. G. W. Lester will continue the business under the same style at the old address.

The Johnson Secret Wireless Telegraph and Telephone Testing Syndicate, Ltd.—Meeting January 18th, 1919, at 2 and 3, West Street, E.C., to hear an account of the winding up from the liquidator, Mr. J. A. Robertson.

Accumulator Service Co., 7 and 9, Station Approach, Wanstead Park Station, Essex.—Messrs. S. T. Jolley & A. H. Knight have dissolved partnership. Debts will be attended to by Mr. S. T. Jolley, who will continue the business.

Exports to China.—The *London Gazette* for December 17th contains additions to the list of persons and bodies in China to whom exports may be consigned.

Coal and Industry.—At the adjourned meeting of the Federation of British Industries, a resolution was passed setting forth the Federation's ideas regarding Peace Aims. Other resolutions included one as follows concerning coal supply :—"That the position of industry with regard to priority of coal supply is a serious menace to employment and the speedy conversion from War to Peace production; and that the War Cabinet should take the matter into consideration immediately."

Catalogues and Lists.—British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, E.C. 4.—New price list No. 10,401—10 A and 10 B, showing the new type of "Efracta" lantern and the light-distribution curve.

Messrs. Mavor & Coulson, Ltd., 47, Broad Street, Mile End, Glasgow.—Leaflet particularising C.C. generator and motors held in stock.

Messrs. Plaistowe & Co., Ltd., Wharfdale Road, King's Cross, London, N. 1.—Leaflet relating to "Nettol," a cold-water preparation for cleaning machinery, varnished surfaces, &c.

Belgium and German Goods.—There is an important and influentially-supported movement on foot in Brussels for preventing the employment of manufactures of German origin in future commercial enterprises in that city. Our readers know well enough to how large an extent German industrial and financial concerns had worked their way into Belgian affairs before the war. In Belgium the beast has left its trail wherever it has passed, and the determination to prevent repetition of former penetration and commercial domination will be as strong there as in any other country. But the Belgian electrical men have not concealed their anxiety regarding future possibilities if England or the Allies are unable to meet requirements. Precisely the same fear was expressed at different periods of the war by Russian engineers in regard to Russia's vast needs. The call to England, the United States, and other exporting countries is loud, and the penalty of ignoring it will be to throw both Belgium and Russia into the arms from which they shrink. There is a need for a large co-operative effort on the part of the manufacturing concerns of Allied countries in dealing with the situation. The decision arrived at by the College of Aldermen at Brussels is that a clause shall be inserted in the conditions of contracts for commercial enterprises in the city providing that no product of German origin shall be employed therein, and that any infraction of this regulation shall be punished by the forfeiture of 25 per cent. of the total amount involved. The Alderman of Public Works has issued a notification discountenancing the reopening of business relations in any form with enemy nations; but he goes even further, and adds, "or with nations which have been working in the enemy's interests." Such a decision gives the manufacturers of this and Allied countries an opportunity for trade and work that should not be missed.

Book Notices.—*L'Electricité.*—Under this title a new electrical journal is about to be inaugurated in France, to fill a gap which at present appears to be open. The existing publications—excellent of their kind—are over the heads of the less highly trained engineers and electricians, and it is to serve the needs of this class that our new contemporary is designed—to provide technical and commercial information for electrical workers, and for those who are not electrical specialists. Being tied to no sectional or financial interest, *L'Electricité* will have a free hand to deal with all questions on their merits, and will play its part in promoting the expansion of the French electrical industry; it will be directed by our esteemed *confrère*, M. J. B. Nouet, formerly commercial manager of *La Lumière Electrique*, and *La Revue Générale de l'Electricité*, to whom we wish all success. The foreign subscription will be 25 fr.; address, 2, Rue de la Pépinière, Paris.

"*Proceedings* of the Physical Society of London." Vol. XXXI, Part 1. December 15th, 1918. London: Fleetway Press, Ltd. Price 4s. net.

"Science Abstracts." Vol. XXI. Part XI. November 30th, 1918. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

LIGHTING AND POWER NOTES.

Arbroath.—Street Lighting.—After considering the changes in connection with electricity supply foreshadowed by the Government, the E.L. and Power Co. has inquired whether the Council desires the electrical street lighting to continue, as the company has a favourable opportunity of disposing of its standards, lamps, and apparatus. The Council has asked the company on what terms it will carry on the street lighting, on the basis of the 50 per cent. now allowed.

Australia.—E.L. Schemes.—The following municipalities are considering the question of installing electricity schemes within their areas:—Bland (N.S.W.) Shire Council; Junee (N.S.W.); Millicent (S.A.); St. George (Q.); Penguin (Tas.); and Ithaca (Q.). The Elmore E.L. and P. Co. has received permission to install electricity at Elmore (Vic.). The Mirboo North Dairy Co. has decided to supply the town of Mirboo with electricity. The Cessnock (N.S.W.) Shire Council has entered into an agreement with the Hetton Coal Co. to install electricity at Bellbird.

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QUEENSLAND.—The Government, which had definitely refused to grant any further permits for private companies to install electricity supply undertakings, has now stated its willingness to grant permits to local authorities, or combinations of local authorities, for the purpose.—*Tenders.*

MELBOURNE.—The City Council has schemes in hand, estimated to cost £225,000, for the improvement of the electricity undertaking during the next three years. The E.S. Committee proposes to purchase energy from the Railway Department, and to erect a new sub-station, at a cost of £100,000.

VICTORIA.—The Government is considering the utilisation of the Upper Goulbourn, Acheron Valley, Snob's Creek, and other rivers, for the generation of electricity.

Bideford.—PROPOSED E.L.—The local Chamber of Commerce has passed a resolution in favour of an E.L. scheme for the district, and has decided to further the proposal.

Broadstairs.—STREET LIGHTING.—The U.D.C. has decided to arrange with the Thanet Electric Tramway and Lighting Co. for the provision of 11 additional electric street lamps on the Parade.

Canterbury.—STREET LIGHTING.—The T.C. has decided that from the quarter ending December 31st the charge for street lighting by electricity shall be the present charge for capital and interest, plus consumption at power prices and the cost of renewals. Messrs. Pritchett & Gold have been granted an increase of 5 per cent. on the contract price for the maintenance of the accumulators for each £1 by which the price of lead exceeds £18.

Chelmsford.—PRICE INCREASE.—The Electric Supply Corporation has applied to the B. of T. for powers to increase the charge for electricity from 6½d. per unit to 8½d.; the T.C. has considered the matter, and considers that 1d. per unit increase would be sufficient, and that the minimum charge should be abolished altogether.

Chester.—EXTENSION OF SUPPLY.—The E.L. Committee has recommended the T.C. to apply for B. of T. consent to supply electricity by overhead mains to the premises of Messrs. Webb and Sons, which are in the area of the Hawarden U.D.C., and an additional supply to Messrs. J. Crichton & Co. The capital cost, estimated at £4,572, is to be provided by the firms in question, and repaid by the Corporation before the end of seven years.

A Special Committee has been appointed to report on all questions relating to the development of the city.

Chester-le-Street.—ELECTRICITY SUPPLY AND THE FUEL CONTROLLER.—The action of the Electric Supply Co., in refusing to comply with a request by the U.D.C. Fuel Control Committee to have check meters installed at houses where electricity is supplied unmetered, has been upheld by the higher authorities.

Continental.—FINLAND.—WATER POWER.—The Government has decided to purchase the waterfalls in Northern Finland for 10,000,000 marks, and proposes to lease them to different companies, in which the State will hold a certain number of shares. *The Times.*

Chertsey.—CORRECTION.—The note headed "Chertsey" in our last issue should have been headed "Weybridge."

Dover.—E.L. CHARGES.—The B. of T. has refused sanction for the T.C. to increase the maximum charge for electricity.

Edinburgh.—PRICE INCREASE.—The E.L. Committee has recommended the Corporation to increase the price of electricity for lighting purposes from 3¾d. to 4d. per unit, and by ½d. per unit for power.

Leiston.—PROPOSED E.L.—The Lighting Committee has recommended the Council to consider the advisability of installing an E.L. scheme for the town.

Lincoln.—L.G.B. INQUIRY.—On December 10th the L.G.B. inspector (Mr. T. C. Ekin) held an inquiry into the application of the Corporation to borrow £250,000 for electricity purposes. The Council is seeking to acquire Messrs. Clayton & Shuttleworth's generating station for the purpose of supplying electricity to the general public and large works in the district. The Town Clerk stated that there would be a great demand for electricity from the engineering firms in the district, and one firm alone estimated that 2,000 houses would be required to house the additional workmen who would be employed by them. Sir John Snell stated that unless there was a big industrial development in the area between the generating stations at Rotherham and Sheffield and on the River Trent it would not be commercially possible to transmit energy a distance of 30 miles. Lincoln being 30 miles from any source of supply, the only alternative was for the city to develop its own power supply. The present station of the Corporation was inadequate, and the proper course was for the Corporation to put down a generating station capable of supplying all present and future demands for power. Negotiations for the acquisition of Messrs. Clayton & Shuttleworth's power station had been entered into, and agreements for the supply of power to that firm and to Messrs. Ruston & Hornsby had been entered into for 11 years.

London.—FULHAM.—The L.C.C. Finance Committee recommends the sanction of the Council to the borrowing of £7,230 by the B.C. for electricity purposes.

HACKNEY.—STREET LIGHTING.—The Electricity Committee reports that, in order to comply with the lighting restrictions, the 496 arc lamps used for street lighting in the borough were replaced by 32-C.P. carbon-filament lamps. The Committee now recommends that 404 of the arc lamps be not reinstated, but that 600-C.P. half-watt lamps be used in their place. The cost is estimated at £3,026, less the amount obtained by the sale of the obsolete lamps.

Newark.—E.L. BILL.—The local Tradesmen's Association has asked the T.C. to oppose the Gas Co.'s Bill for powers to supply electricity, and has recommended the Council to obtain powers to supply electricity itself.

Shanklin.—STREET LIGHTING.—The U.D.C. is considering an offer from the Isle of Wight E.L. & P. Co. to light half the public lamps in the town at £415 per annum.

Swindon.—EXTENSIONS.—The T.C. has approved of an agreement for the supply of electricity to the Government ammonium-nitrate factory at Stretton.

Warrington.—LOAN SANCTION.—The T.C. has received sanction to loans of £10,330 for boiler plant and £1,670 for a mechanical stoker, &c., at the electricity works.

Wigan.—In moving the confirmation of the minutes of the Electricity Committee, Alderman Grimshaw stated that he considered that Wigan would be called upon to supply the surrounding district with electricity, in connection with the proposed centralisation of supply. Wigan was surrounded by a thickly-populated district, and the demand could not be less than 50,000,000 units per annum, and if the works of the Metallurgical Corporation assumed the proportions which were expected, the demand would be about 100,000,000 units per annum.

TRAMWAY AND RAILWAY NOTES.

Australia.—VICTORIA.—The first train was run on the Melbourne-Flemington electric railway at the end of October; a full service is not expected for several months.

The Legislative Assembly has voted against the nationalisation and State control of the Melbourne tramways.

QUEENSLAND.—A scheme for the electrification of the Rockhampton tramways is being prepared by Mr. W. J. S. Jones, consulting engineer, Brisbane.—*Tenders.*

Blackpool.—PROPOSED PURCHASE.—The T.C. has unanimously decided to promote a Parliamentary Bill to acquire the property of the Blackpool and Fleetwood Tramroad Co., and to carry out tramway extensions in the borough.

Bristol.—COLLISION.—A collision occurred between two tramcars at Perry Road, last week, resulting in both cars leaving the line. Ten persons were removed to the infirmary.

Burnley.—At a conference with the T.C. officials, last week, Major G. Stewart, of the L.G.B., stated that the embargo on the borrowing of money had now been removed. The tramway manager stated that £10,000 would be spent on necessary work in connection with the tramways.

Continental.—SWITZERLAND.—The Swiss Federal Railways Administration has been granted a credit of Fr. 16,800,000 for the purchase of 20 electric locomotives, of which sum Fr. 5,600,000 will be regarded as a supplementary credit for the Construction Budget, 1918.—*D.A.Z.*

GERMANY.—It is announced that the eight-hour day was to have been introduced on the system of the Grand Berlin Tramways Co. on December 15th. It was calculated that if the undertaking was to remain remunerative it would be necessary to raise the fares from the present charge of 12½—15 pf. to 20 pf. (2½d.)

Delagoa Bay.—The report of the Delagoa Bay Development Corporation for the year ended June 30th states that passengers carried on the electric tramways numbered 1,661,429, an increase of 208,736.

London.—DERAILMENT.—The L.U.T. tramway system was disorganised, late on Saturday night, by the derailment of a car at Brentford.

The B. of T. has extended the time for the construction of new works authorised by the L.E.R. Act of 1913, to August 7th, 1919.

All the tramway services of the L.C.C. are to be suspended on Christmas Day, from 4 p.m.

WOOLWICH.—The B.C. has provisionally approved of the scheme for the construction of a railway on the Kearney system from the Arsenal gates to N. Woolwich Railway Station, a distance of half-a-mile under the Thames.

MOTOR-BUS SUBSIDY.—The L.C.C. Highways Committee has issued a report on the Government subsidy paid to the L.G.O. Co. in respect of its services in South-East London. The grant amounted to £44,312 for the year ended June 30th, 1917, and was made in respect of 17 omnibus routes, 10 of which were in competition with the tramways; the grant was made in order to obtain a good service for the munition workers at Woolwich, but many of the subsidised routes extended to the north and west of London. At a meeting of the L.C.C. on Tuesday, it was stated that the total grant amounted to nearly £100,000, and the opinion was expressed that the Council should receive the same treatment as the L.G.O. Co.

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Manchester.—As a result of the recent decision of Mr. Justice Bailhache, at the Assizes, that "a person who gets up in a tramcar before it stops, does so at his own risk," a public announcement is to be made by the Tramway Committee bearing on the Judge's ruling.

Oldham. — Proposed Extensions.—The T.C. has decided to apply to the B. of T. for a prov. order for powers to construct new tramways to the Chadderton and Werneth districts.

Stirling. — Proposed Electrification.—Negotiations are to be reopened by the Stirling and Bridge of Allan Tramways Co. with the T.C. for the purchase of the system by the Council, with a view to its electrification. Failing the taking-over by the T.C., the company will consider the question of the application of mechanical traction.

Tynemouth. — Proposed Purchase. — The T.C. has decided to promote a Bill in the ensuing session of Parliament for powers to construct and work trolley vehicles and omnibuses, and to acquire and work the tramway system.

United States.—A charge of manslaughter is being brought against the president, four officers, and a driver of the Brooklyn Rapid Transit Co., in connection with an accident on November 1st, reported in this column at the time, in which 85 persons were killed. The accident occurred during a strike, and was alleged to have been due to the inexperience of the driver.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—With further reference to our note on November 8th, it is stated by the Sydney evening Press that Mr. Jensen, Federal Minister of Customs, who had resumed his position in the Cabinet, after an investigation into a war purchase of a wireless station, finally gave up his portfolio on a threat by Mr. Watt, Acting Prime Minister, that otherwise the whole Cabinet would resign.—*The Times.*

Telegraphic Delays.—*The Times* states that complaints have been received from business houses recently regarding the delays which are experienced in the transmission of cable telegrams. Messages to India take five to six days, and deferred cables 10 to 15 days sometimes, while messages at ordinary rates between London and Australia take four to six days to arrive, and those at deferred rates six to nine days. In view of the congestion of traffic, which apparently is the cause of these delays, it is suggested that the list of approved codes should be extended. This would reduce the enormous expense which is at present thrown on commercial houses, which have to pay ordinary rates for messages delivered at about the same speed as week-end messages in pre-war days. It would also reduce the congestion. If the freer use of codes cannot be allowed, it is suggested that the cable companies should reduce the rates they charge for ordinary messages, which take so long to reach their destination, to the rates quoted for deferred messages.

United States.—Mr. Moon, Chairman of the Post Office Committee of the House of Representatives, has introduced a Bill for the permanent Government ownership of the telegraph and telephone lines as auxiliary to the Post Office Department. The Postmaster-General states that President Wilson is in favour of the measure. The Bill authorises the purchase of the telephone systems and a preliminary survey of telegraphs.

Mr. Carlton, president of the Western Union Telegraph Co., has been placed in charge of the submarine cables of the country.—*The Times.*

Mr. Vail, the president of the American Telegraph and Telephone Co., announces a new multiplex installation which enables one wire to do the work of 10 used heretofore. A pair of wires carries five conversations simultaneously, or 40 telegraph messages.

A joint resolution has been introduced in the House of Representatives continuing the control by the Government of telegraph and telephone systems until otherwise ordered by Congress.

The Commercial Cable Co. has taken legal steps to prevent the American Postmaster-General from retaining, operating, or amalgamating any other line with its concern. The Postmaster-General nominated Mr. Geo. G. Ward, vice-chairman of the company, as manager of the joint system, but Mr. Ward refused to act. Ex-Judge Hughes, who represents the company, contends that the signing of the Armistice deprives the Government of the power to make further seizures, and that Government control is now inoperative, except for winding up matters.

Wireless Operators.—Inquiries made by *The Times* indicate that during the next few months, at least, the number of applications for employment as wireless operators will far exceed the number of vacancies occurring. In addition to the men coming from private wireless schools, there will be a very large number released from the Navy and Army who will seek employment with the Marconi Co, and who will, in all likelihood, be given preference. The company has about 400 of its own men whom it has lent to his Majesty's Forces, who will be returning probably within the next three or four months, and at the present moment the company has 106 applicants, all men with first-class certificates on the waiting list.

Wireless Telegraph Invention.—Our American contemporary, the *Electrical Review*, of November 23rd, contains a statement issued by Mr. E. J. Nally, general manager of the Marconi Wireless Telegraph Co. of America, of considerable importance. We learn that Mr. R. A. Weagant, chief engineer of the company, just before the entry of the United States into the war, had made a discovery whereby the trouble due to the interference of static electrical disturbances was completely eliminated, while the use of tall towers and elevated antennæ was rendered unnecessary, and interference between adjoining stations was obviated. No details are disclosed. The invention was placed at the disposal of the United States and the Allied Governments, and is being adopted in all the Marconi high-power stations; it will render long-distance wireless communication continuous throughout the 24 hours of the day, regardless of the atmospheric conditions.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Sydney.—April 28th. City Council. Supply and erection of power house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.

Victorian Railways Department.—January 15th. Supply of battery cells. Particulars from Agent-General for Victoria, London, S.W.

Dublin.—December 23rd. Electric Supply Committee. 200 single-phase and 100 three-phase, A.C. meters. See "Official Notices" to-day.

Manchester.—Electric passenger lift. Particulars from R Cheetham & Co., 25, George Street.

New Zealand.—Wellington.—January 6th. Public Works Department. Electric current transformers. Copies of the schedules, &c., may be seen at the Inquiry Office of the Department of Oversea Trade (Development and Intelligence), London.

Sheffield.—January 7th. Corporation Tramways and Motor Committee. 50 double-decked top-covered vestibule tramcar bodies with trucks. Mr. A. R. Fearnley, General Manager, Division Street.

Spain.—The municipal authorities of Puente Genil (Province of Cordoba) have lately invited tenders for the concession for the electric lighting of the town during a period of ten years.

CLOSED.

Glasgow.—The Electricity Committee has recommended the Corporation to accept the tender of Messrs. Babcock & Wilcox, Ltd., at £140,282, for the equipment of the second boiler house at the Dalmarnock station, consisting of eight boilers and accessories.

E.C. recommended :—

Handrails on gangway and ladders at the Dalmarnock station, £1,115.—Messrs. Donald Clark, Ltd.

Rolled steel beams for turbine room floors, £2,441.—Messrs. P. & R. Fleming.

Steam piping, £1,88.—Messrs. Stewart & Lloyds, Ltd.

Norway.—The Norske Aktiebolag Elektro-Kemisk Industrie, of Christiania, has lately placed a contract with Messrs. Piccard-Pictet & Co., of Geneva, Switzerland, for the supply of a Pelton turbine, of 12,000 H.P. capacity, for its new hydro-electric generating station.

Wolverhampton.—T.C. Additional payments in respect of contracts owing to revision of labour rates and increased cost of material :—

Willans & Robinson.—5,000-kw. turbo-alternator set, £650.

Ferguson, Pailin & Co.—Reactance sets, £20.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, December 20th. At 7.30 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. Presidential address: "What War has done for Engineers, and the Part Engineers will have to play in Reconstruction," by Col. R. E. B. Crompton, C.B.

(Midland Section).—Friday, December 20th. At 7.45 p.m. At the University, Birmingham. Paper on "The Manufacture of Cast-iron Pipes," by Mr. T. E. Dimbledy.

(Sheffield Section).—Friday, December 20th. At the Cutler's Hall. At 7.30 p.m. Ordinary meeting.

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NOTES.

Institution and Lecture Notes.—Institution of Electrical Engineers.—At the meeting of the Institution held on Thursday last week, the president (Mr. Wordingham) read a letter from Mr. Robert W. Paul, M.I.E.E., offering a sum of £500 to found a premium for the best paper read before the Institution on the subject of electrical measurements and measuring instruments, as an encouragement to young engineers to take more interest in the subject. The Council accepted the offer. Mr. Wordingham also read a most interesting document dated London, 1871, for which the Institution was indebted to Mr. A. H. Preece, M.I.E.E., touching on the foundation of the Society of Telegraph Engineers. Referring to the destruction by the enemy of libraries in Serbia, the president announced that the Council had decided to make a donation of £50 and a set of bound volumes of *Proceedings* of the Institution dating back 20 years, towards the re-establishment of such libraries. A member of the Council (Mr. L. B. Atkinson) had also offered to give a complete set of bound volumes of *Proceedings* of the Institution of Civil Engineers for the same purpose. The president announced that arrangements were being made to celebrate Peace by some suitable function to take place in the early summer. It had also been decided to re-establish the annual Institution dinner, which would probably be held about April next.

Royal Institution of Great Britain.—Friday discourses at 5.30 o'clock :—

January 17th.—Prof. Sir James Dewar, F.R.S., "Liquid Air and the War."
February 28th.—Prof. J. A. McClelland, D.Sc., F.R.S., "Nuclei and Ions."
March 7th.—Prof. H. C. H. Carpenter, F.R.S., "The Hardening of Steel."
March 28th.—Sir John H. A. Macdonald, F.R.S., M.I.E.E., "The Air Road." (Illustrated.)
April 11th.—Prof. Sir J. J. Thomson, O.M., Pres. R.S., "Piezo-Electricity and its Applications."
"Study of Electric Arcs and Their Applications," by Prof. J. T. MacGregor-Morris, M.I.E.E., East London College. Two lectures on Tuesdays, February 4th, 11th.
"Clutches," by H. S. Hele-Shaw, D.Sc., F.R.S. Two lectures on Tuesdays, March 4th, 11th.
"Spectrum Analysis and its Application to Atomic Structure." By Prof. Sir J. J. Thomson, D.Sc., Pres. R.S. Six lectures on Saturdays, March 8th, 15th, 22nd, 29th, April 5th, 12th.

Junior Institution of Engineeers.—The current number of the *Journal* contains an account of the annual general meeting, at which the chairman stated that 28 members of the Institution had fallen in the country's service. The accounts showed an excess of expenditure over income for the year of £126. The benevolent fund stood at £359.

Keighley Association of Engineers.—A party of 120 connected with this Association was shown round the works of the Phœnix Dynamo Co., Ltd., Bradford, last Saturday week.

Association of Mining Electrical Engineers.—At a meeting of the Yorkshire Branch, at Leeds, on December 14th, Mr. J. R. Haigh read a paper on "The Electrification of Old Collieries." He referred to pits 40 or 50 years old, a great many of which, he said, were working under conditions that were not conducive to efficiency, but at which the expenditure of a few thousand pounds would repay itself in a few years, and would afterwards yield a good dividend for the shareholders. Taking a colliery with an output of 1,200 tons per day, and winding engines of 1,100 H.P., he estimated that the amount of steam wasted would give 2,390 KW. of electricity. He proceeded to show in detail how this could be utilised, and how it had been utilised at the colliery with which he was connected.

Birmingham and District Electric Club.—At the annual meeting of this club the following officers were elected for 1919 :—

President ...	...	Mr. W. H. Varnom (Donovan & Co., Birmingham).
Vice-Presidents	...	Mr. H. W. Wolton (H. James & Co., Smethwick) and Mr. A. C. Wynne (Wandsworth Electric Manufacturing Co., Birmingham).
Treasurer ...	...	Mr. A. E. Cunningworth (Buttons, Ltd., Birmingham).
Secretary ...	...	Mr. N. Deykin (Berry's Electric, Ltd., Suffolk Works, Birmingham).

The headquarters of the club have been removed to the Grand Hotel, Birmingham.

The secretary (Mr. N. Deykin) was re-elected for the fifth year in succession, and was presented by the old members of the club with a pair of handsome three-light candelabra and a tankard suitably inscribed.

Patents and Alien Enemies.—A B. of T. Order in connection with patents in respect of which licences have been granted by the B. of T. or the Public Trustee by virtue of the Patents, Designs, and Trade Marks (Temporary Rules) Acts, 1914, and the Trading with the Enemy Amendment Acts, 1914, and 1916, states that in the event of the renewal fees not being paid by the patentees, such fees may be paid by the licensees. Application for permission to pay such fees must be specially made to the Comptroller-General of Patents, Designs, and Trade Marks.

Electric Cooking in Railway Trains.—The danger of cooking with gas fires on railway trains has been shown by the disastrous effects in recent railway accidents in Germany. As a consequence, the Association for Promoting the Utilisation of Electricity has taken steps to co-ordinate the efforts of manufacturers, public bodies, and other interested parties to secure early tests with the object of introducing electric cooking on the German restaurant cars.

The Dilutee.—According to a statement appearing in *The Times*, a Joint Conference of employers and employés in the engineering, shipbuilding, and allied trades, on Tuesday, discussed questions of importance in regard to the future administration of these industries. It seems that the vexed question of the dilutee—whether he or she should now give place to the skilled man returning to take up his original job—was dealt with, and the matter stood adjourned until next week.

Mine Cables.—To obviate fire and other risks to miners consequent upon the presence of transmission cables in the operating shaft, the Anaconda Copper Co. has driven 3½-in. diamond drill holes through solid rock to provide for carrying electric cables to the 1,200, 2,200, and 2,800 ft. levels for operating pumps, blowers, and fans. The cable is three-conductor 400,000 circ. mil., with varnished cambric, ¼-in. lead, and 0·18-in. galvanised steel wire. The over-all diameter is 2·03 in., and the weight 16·6 lb. per ft. The cable is suspended from a cable bell at the surface, and the greatest length of cable let down in one piece is 650 ft. The pumping loads supplied on the three levels are about 1,200 H.P., 1,200 H.P., and 900 H.P. respectively.—*Electrical Review*, Chicago.

Plant for Sale.—Bolton Corporation Electricity Committee has for disposal two 2,000-H.P. steam engines, complete with barometric condensing plant and 3-phase, 50 cycles, 6,600-volt alternators. Loughborough Corporation Electricity Department invites offers for one Drybank marine boiler, fitted with Bennis mechanical stoker. For particulars see our advertisement pages to-day.

Proposed Reunion of Divisional Engineers.—In 1914 the Institutions of Civil, Electrical, and Mechanical Engineers assisted in the formation of a unit known as the Divisional Engineers, which was attached to the Royal Naval Division. As many of these men are now discharged, or are being demobilised under the present scheme, Mr. C. Saxton is anxious that members of the original No. 3 Section of the 1st Field Company should communicate with him at the United Glass Bottle Manufacturers, Ltd., care of Nuttall & Co., Ltd., Ravenhead, St. Helens, Lancs. Mr. Saxton and several others are very anxious to get in touch with as many of the original men as possible, with a view to making arrangements for a reunion.

Inquiries.—Mr. W. H. Miller, electrical engineer, of Fleetwood, has in use in connection with prepayment meters several snap locks, the keyhole of which is covered, when locked, by a paper seal, duly initialled, on the back ; the insertion of a key destroys the seal. The lock is stamped, "Tourtel's Patent." Mr. Miller would be glad if any other engineer using these or similar locks would kindly inform him where they can be obtained.

Appointments Vacant. — Electrical plant attendants (72s. 6d. + 12½ per cent.), for R.E. Lighting Plants, near Plymouth ; two switchboard attendants (68s. 6d.), for the Burnley Corporation Electricity Works ; telephone electrician for the Birmingham Corporation Tramways ; distribution superintendent (£300), for the Wolverhampton Corporation Electricity Department ; chief clerk (temporary), for the Rhondda U.D.C. Electricity Department ; switchboard attendant (62s. 3d.), for the Lancaster Corporation Electricity Works ; shift engineer (£208), for the Tunbridge Wells Corporation Electricity Department ; assistant instructors, (part time) in electrical engineering and installation and maintenance work, for the Croydon Central Polytechnic. See our advertisement pages to-day.

Electrical Tides.—*Le Génie Civil* of October 26th contains a note by M. Branly on M. Marc Decheverens's observations, made from October, 1917, to August, 1918, at the St. Louis Observatory at Jersey. We learn that the two underground pipe systems which supply the Observatory with gas and water, on being connected through a sensitive galvanometer, indicated the existence, through the earth, of an E.M.F. of 0·1 volt, the variations of which have been registered photographically during the past two years. The current was manifestly affected by the moon, not directly, but through the contraction of the oceanic tides. In effect, twice each day the voltage reached a maximum value and twice a minimum value. The duration of a complete variation was about 25 hours, solar time, the maxima and minima for the day being recorded 50 minutes later than the day before, lagging behind the daily tide. The influence of the highest tide is not apparent until after an interval of 40 hours 30 minutes. It was found that the greatest variation of the E.M.F. at that particular time was recorded as a minimum voltage about 38 hours 30 minutes after the new moon, or two hours before the highest tide of the year. These and other observations by M. Decheverens lead to the supposition that there may exist, on every seashore, underground electric tides caused by, and following the essential features of, the oceanic tides.

Electricity on the Farm in Southern California.—The actual use of electricity on the farm is best gauged by the agricultural load reported by the Southern California Edison Co. The president of the company reports the increase of foodstuffs to the amount of $21,000,000 a year as the result of bringing 75,000 acres of arid land under production by electric irrigation during the past year. A total expenditure of $5,614,581 for new properties was necessary in order that the company and its subsidiaries could, during 1917, increase the production of hydro-electricity and provide transmission and distribution lines, in a region of 50,000 sq. miles, to meet the demands of new business chiefly created by agriculturists, who are complying with the policy of the Government in increasing the food supply.

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Training Disabled Men for Electrical Work.—The Kent County Council is training disabled soldiers in electrical engineering at Erith, and subjoined are the results of the first batch of men who have had the six months' course, the words in brackets being the pre-war occupations of the men :—

Number beginning course, 16. Number placed, 12.

Number not completing course, 4 (one owing to illness, three owing to inability to understand the work).

Assistant in power house in engineering works, £3 per week (Army).

General electrician, 1s. per hour (Army).

Assistant in electrical test-room, 1s. per hour (labourer).

" " " 1s. per hour (Army).

" " " 1s. per hour (printer).

2nd Class examiner in Royal Dockyard, testing of manufacturers' instruments, &c., 55s. per week (kinematograph operator).

Inspecting in Royal Dockyard, 55s. per week (joiner).

3rd Class examiner in Royal Dockyard, 42s. per week (farm labourer).

Instrument test-room assistant in Electric Co., 1s. per hour (chauffeur).

Repairing and assembling motors and dynamos, £2 14s. 6d. per week (clerk); ditto (farm labourer); ditto (colt-breaking, rough riding).

The A.S.E. Chairmanship.—By an overwhelming majority, Mr. J. T. Brownlie was elected chairman of the Amalgamated Society of Engineers, in the recent ballot.

Volunteer Notes.—The Headquarters of the Royal Engineers, Volunteers, London Army Troops Companies, will be closed from Monday, December 23rd, to Saturday, December 28th.

Blowing Air into Electric-Furnace Steel.—Constant progress is being made in the means and methods of producing electric steel. The latest advance is a process for which a patent has been granted to Ernest Humbert, an American engineer, for blowing air into the solid charge of the furnace. After the furnace has been tapped, and any necessary repair to banks and bottom has been made, it is charged with scrap. This immediately absorbs heat from the lining. By the time the principal portion of the charge is in the furnace, the lower part will have become incandescent. The electrodes are then lowered and the current is turned on. Air is led into the incandescent part of the charge, at any convenient pressure, through a 1-in. pipe connected to a flexible hose. The carbon-monoxide formed at the point where the air strikes the metal is converted at once into carbon dioxide, burning with a white flame, and melting the charge very quickly. The pipe is raised from time to time to keep the air playing on the solid portion of the metal until all is melted. The oxygen in the air, by oxidising the carbon, silicon, and phosphorus, causes a great rise in temperature, thereby reducing the melting time. By using this process the time saved on each heat is from 25 to 50 per cent., varying with the composition of the charge and the metal to be produced. This means a saving of 175 to 350 KW.-hours per ton of metal produced.

Silvering Glass Mirrors.—In the ordinary process of silvering glass mirrors by chemical decomposition the metal is deposited upon the glass container. In this manner a great deal of silver which might have added to the thickness of the mirror is lost. This is an important item when silvering mirrors 25 cm. or more in diameter.

A note appears in *Science* of October 4th, from Mr. W. W. Coblentz, of the Bureau of Standards, calling attention to the usefulness of ordinary "granite-ware" enamelled iron pans, which do not attract the silver, and hence increase the supply of material available for deposition on the mirror. During the past year he has had frequent opportunties to verify this observation and to apply it in producing thick deposits of silver on glass.

Those German Scientists.—The *Times* correspondent at Brussels says that the Belgian Surgical Society, at its first meeting since July, 1914, solemnly repudiated the notorious defamatory manifesto of 93 German *savants*, and resolved to break off all relations with German scientists until the calumnies, especially against Belgian medical men, are publicly disavowed.

An Armistice Soirée.—In order to celebrate the signing of the Armistice, a soirée, concert, and dance was held on Wednesday evening, 18th inst., in the Council Chamber at Caxton Hall, Westminster, by the Designs and Production Drawing Office Staff of the Tanks Department of the Ministry of Munitions. The chair was taken by Lieut. F. B. Shaw, the vice-chairman being Mr. F. G. Wiles (chief draughtsman), while the organising committee consisted of Mr. A. G. Sanders, M.I.E.E., Mr. A. Stapley, A.M.I.M.E., Mr. C. J. Stenholm (acting M.C.), and Miss Mercer. The company numbered about 150, and included some well-known members of the civil, mechanical, electrical, and motor-car professions.

Fatality.—While moving an electric radiator used for drying plaster at Messrs. Osborne, Graham & Co.'s shipyard, Hylton, Sunderland, J. E. Berry (17), received an electric shock, and was killed instantly.

A Technical Union in Poland.—According to the *Dziennik Poznanski* (November 13th), at a meeting held in Posen on November 11th, 30 Polish architects, engineers, and technicians decided to form themselves into a Wielkopolski (Duchy of Posen) Technical Union, which will be the one Polish institution in the Prussian partition to settle questions of architecture, land surveying, communication, road and bridge making, chemistry, machinery, and shipbuilding.

Engineers in the Académie des Sciences.—On the proposal of M. André Blondel, a division of the Académie has been formed which is reserved for engineers, and represents science applied to industry. The first election has taken place, resulting in the choice of M. Maurice Leblanc by a large majority. Five other engineers remain to be elected to complete the new division, which it is hoped will exercise a favourable influence on the alliance of science with industry.—*Génie Civil.*

Electroculture.—A Sub-Committee of the Chester Corporation has been appointed to supervise experiments made by the electrical engineer (Mr. S. E. Britton) in the development of electricity as an aid to agriculture.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Central Station and Tramway Officials.—Mr. W. R. MURRAY, assistant engineer at Ayr Corporation electricity works, has been appointed head engineer at Stirling electric station. There were 112 applicants.

Shoreditch B.C. Electricity Committee recommends that the salary of Mr. C. N. RUSSELL (borough electrical engineer) be increased from £825 per annum (which includes a war bonus of £75) to £1,000 per annum, inclusive of war bonus and all other existing emoluments; that the salary of Mr. W. S. CLARK (electricity department) of £330 per annum, which includes a war bonus of £30, be increased to £400 per annum, to be inclusive of war bonus.

Mr. A. E. MCKENZIE, M.I.E.E., deputy chief engineer to the Manchester Corporation electricity department, has resigned his position in order to join the staff of Messrs. C. P. Sparks, consulting engineers, of London. Mr. McKenzie has been in the service of the Manchester Corporation for the past 17 years.

The Bridlington Electricity Committee has increased the salary of Mr. F. FFRENCH, deputy electrical engineer, from £185 to £235, to include all bonuses, and has granted him £25 in lieu of eight weeks holiday.

General.—Mr. C. H. WORDINGHAM, C.B.E., who since 1903 has been head of the Electrical Department of the Admiralty, and, as such, responsible for the design and supervision of the construction and completion for service of the electrical equipment of all H.M. ships, as well as for advising on all important questions of electric lighting and power in connection with dockyards and other naval shore establishments, has resigned his appointment as Director of Electrical Engineering in order to return to consulting practice. His address after January 1st next will be 7, Victoria Street, Westminster, S.W.1. Mr. Wordingham has been retained by the Admiralty to continue acting in an advisory capacity. In our issue of October 19th, 1917, we gave a biographical sketch of Mr. Wordingham, and as we then said: "His was the great responsibility of the design and supervision of contracts for the electrical equipment of all His Majesty's ships, and he has had the unique experience of having seen his designs and arrangements satisfactorily withstand the supreme test of action with the enemy." To this we may now add that the final victory, complete and overwhelming, has set the seal of success upon his great work; he completely reorganised the electrical engineering practice of the Admiralty, and seeing that a warship over 15 years old is practically obsolete, we may safely say that every vessel of the Royal Navy which was engaged in the war bore the marks of his handiwork. Thus Mr. Wordingham leaves his high position with the consciousness of having rendered eminent service to the State; he has not lost touch with civilian interests during his stay at the Admiralty, and we hope, not doubtfully, that he will be no less successful in his new sphere of labour. In view of the peculiar methods of the Government in distributing honours, which rarely fall to the lot of distinguished engineers, it may appear too optimistic for us to anticipate that the President of the Institution will receive appropriate recognition for his national services; but that such recognition has been richly earned will be acknowledged by all who know something of his indefatigable activities both in naval and civil affairs pertaining to the electrical industry.

In view of the recent rapid progress of events affecting British engineering industry and the export trade, the Council of the British Engineers' Association, in order to cope with the vast amount of important work which will devolve upon it in the immediate future, has decided to strengthen its administration by the appointment of a director, who will be the chief organising and executive officer of the Association. To fill this responsible position the Council has secured the services of Mr. D. A. Brenner, O.B.E., who, as an engineer, business organiser, and administrator has had a wide experience at home and abroad. Mr. Brenner will assume his position on January 1st next.

Mr. CLIFFORD C. PATERSON is terminating his appointment at the National Physical Laboratory, Teddington, and is joining the General Electric Co., Ltd., as director of research

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laboratories as from January 1st, 1919. Pending the erection of the necessary laboratory buildings, the temporary offices and address of the research laboratories of the General Electric Co., Ltd., will be at the Osram-Robertson Lamp Works, Hammersmith, London. Mr. Paterson is one of the Principal Assistants of the Director of the Laboratory, in the Physics Department, and has been at the head of the "Electrotechnics" Branch, in which capacity he has been responsible for investigations covering a wide range of subjects, especially in connection with photometry, in which his work has attained world-wide reputation. He has also been continuously engaged in carrying on the routine testing of instruments, &c., which constitutes a large proportion of the work of his department, and with his colleagues has developed many novel devices and processes of great value to the electrical industry. In his new post he will have an ideal opportunity for organising a research department on the most up-to-date lines, and we congratulate him on his taking up a task so thoroughly congenial, interesting, and useful to the national industries.

Sir WILLIAM MAXWELL, formerly Director-General of Indian Posts and Telegraphs, has retired from that appointment, says *Indian Engineering*.

According to a New Zealand paper, Mr. EVAN PARRY, the chief Government electrician, has resigned. An offer of double remuneration did not induce him to withdraw his resignation.

Mr. ERNEST HOTOPF-HOLDEN has returned to England after four years' internment at Ruhleben Camp, Germany. Previously he was the foreign representative of the Morgan Crucible Co., Ltd., Battersea, resident in Berlin, and he expects to resume work for that firm early in the New Year.

The Board of Trade have appointed Sir JOHN SNELL to act as their adviser on all matters arising out of the report of the Electrical Power Supply Committee.

Mr. A. G. WARREN, assistant electrical inspector, has been appointed electrical inspector to the Indian Government, United Provinces, from September, 1918, vice Mr. Bell, who has returned to the Municipal Board, Mussoorie.

The *Manchester Daily Dispatch* reports that the Manchester District Engineering Trades Employers' Association, at the annual meeting on Tuesday, elected Mr. H. MENSFORTH, of the British Westinghouse Electric & Manufacturing Co., Ltd., as president. During the war period he has been chairman of the Manchester and District Armaments Output Committee.

On Monday last Mr. L. V. HAMBLIN, the Birmingham manager of the B.E. Co. (of London and Birmingham), Ltd., was married to Miss N. J. Tallis, of Moseley, at the Parish Church, Yardley Wood. Mr. L. V. Hamblin, who has been with the firm for 12 years, was the recipient of many handsome presents. The departmental heads in London and Birmingham gave a dining-room clock and a cutlery cabinet, suitably inscribed, these being presented by Mr. C. D. Falcke, A.M.I.E.E., the managing director of the B.E. Co. (of London and Birmingham), Ltd.

Roll of Honour.—Second-Lieutenant the Hon. E. F. FRENCH, R.F.A., who died in November from influenza, at a prisoners' camp, aged 32 years, matriculated at London University, and, according to the *Times*, became a student at Faraday House, afterwards working in Mexico and the U.S.A.

Lance-Corporal J. A. CHALLIS, who has died at Alexandria from malaria, was formerly engaged at the Marconi Works at Chelmsford.

Corporal G. H. WALKER, R.E., who has died in France from pneumonia, was trained for electrical engineering at the works of Messrs. Mather & Platt, of Manchester, and was awaiting his discharge to enable him to take up an appointment at Liverpool.

Private J. DUNN, Gloucestershire Regiment, who has been killed in action, was formerly engaged at the Preston electricity works.

Second-Lieutenant F. A. STRANGE, Royal Berkshire Regiment, who has gained the Military Cross for gallantry and devotion to duty, was on the electrical staff of Messrs. Strange & Sons, Ltd., of Tunbridge Wells.

Private A. W. BENNETT, R.A.M.C., who has died of pneumonia at Salonika, was previously employed at the Manchester Corporation electric power station, Clayton.

Private A. E. RICHARDS, King's Liverpool Regiment, who has died of wounds, was employed in the electricity department at the Manchester Town Hall.

Sergeant J. HAWORTH, D.C.M., South Lancs. Regiment, who died of wounds whilst a prisoner of war in Germany, was employed at the Manchester Corporation electricity works.

Private S. FLETCHER, Durham L.I., who has been killed in action, was formerly with Messrs. Sykes & Sugden, electrical engineers, of Huddersfield.

Corporal W. RASTRICK, West Yorks. Regiment, who has been awarded the Military Medal, was formerly with Messrs. Barraclough Bros., electricians, Brighouse.

Private H. EDGECOMBE, Argyle and Sutherland Highlanders, formerly in the general office of the India-Rubber Co., Silvertown, has been awarded the Military Medal.

Obituary.—HERR W. LINKE.—The death is announced from Berlin, as the result of a railway accident, of Herr W. Linke. The deceased, who was only 38 years of age, was one of Germany's coming men in the field of wireless telegraphy, and was associated with the business of the Electrizitats Gesellschaft vorm. H. Poege, of Berlin.

MR. E. J. HOUGHTON.—We regret to learn that Mr. E. J. Houghton, formerly electrical engineer of the L.B. & S.C. Rly. Co., passed away at his residence at Croydon on 16th inst., aged 74 years. Mr. Houghton retired from the railway service in September, 1909, after more than 50 years' service, during 34 years of which he held the position of chief electrical engineer of the company. He was the pioneer of electric train lighting in this country, a train equipped with the system he designed having first run between London and Brighton in the year 1881.

Wills.—Mr. THOMAS DENCE, a director of Johnson and Phillips, Ltd., and other companies, left £916,672 gross, and £868,340 net personalty.

Mr. H. C. WATERS, who was a director of the Vera Cruz Electric Light, Power & Traction Co., Ltd., and other companies, left £101,957.

NEW COMPANIES REGISTERED.

Boucher Bros., Ltd. (152,198).—Private company. Registered December 11th. Capital, £6,000 in 5,000 pref. shares of £1 each and 20,000 founders' shares of 1s. each. Electrical and mechanical engineers, motor and aeroplane manufacturers, &c. First directors: H. Boucher, 180, High Street, Redcar, Yorks; P. J. Boucher, 16, Gainsboro' Mansions, Queen's Club Gardens, S.W. Registered office: 16, Regent Street, S.W.

B. Wortman & Son, Ltd. (152,187).—Private company. Registered December 10th. Capital, £10,000 in £1 shares (4,000 7½ per cent. cum. pref.). To take over the business of an aircraft manufacturer carried on by B. Wortman; also to carry on the business of electrical engineers, &c. The subscribers (each with one share) are:—B. Wortman, 42, Waterloo Street, Hammersmith, W.6, aircraft manufacturer; L. Jacobs, B.Sc., &c., 31, Hayes Court Mansions, S.E.5. First director: B. Wortman. Registered office: 42, Waterloo Street, Hammersmith, W.6.

High-Temperature Generators (1918), Ltd. (152,217).—Registered December 12th. Capital, £150 000 in £1 shares. To take over the business of a company of similar name, and to carry on the business of engineers, manufacturers of appliances for transmitting heat by superheating or otherwise, electrical engineers, &c. The subscribers (each with one share) are:—C. Breambery, Monument Buildings, E.C., master mariner; L. J. Davis, 5, Talbot Road, W.13, chemical agent; J. J. Bond, 93, Park Avenue South, N.8, merchant; J. L. Bolton, 85, Brigstock Road, Thornton Heath, Surrey, gentleman; Amy Bolton, 24, Harberton Road, N., clerk; R. England, 77, Wool Exchange Building, E.C., chemical agent; J. R. Johnson, 54, Old Broad Street, E.C.2, clerk. Minimum cash subscription: Seven shares. First directors: S. Wickens and W. H. Manning.

Universal Valve Co., Ltd. (152,240).—Private company. Registered December 13th. Capital, £25 000 in £1 shares. Manufacturers of and dealers in valves and valve fittings for engines, machinery, motors, motor cycles and vehicles, and for power, lighting, heating, and general purposes, &c. The subscribers (each with one share) are:—C. J. Withington, 29, Bowyer Road, Saltley, Birmingham, accountant; H. C. Chambers, Kerri, Blakesley Road, Yardley, Birmingham, secretary. First directors: H. Jelley and C. Sangster. Solicitors: Pinsent & Co., Birmingham.

McWhirter & Sons, Ltd. (10,177).—Private company. Registered December 4th, in Edinburgh. Capital, £10,000 in £1 shares (3,000 pref.). To acquire the business of electrical and mechanical engineers and electricians carried on by William McWhirter & Sons at Holm Street, Glasgow. The subscribers (each with one ord. share) are:—W. McWhirter, 17, Douglas Street, Glasgow, electrical engineer; A. S. McWhirter, 17, Douglas Street, Glasgow. First directors: W. McWhirter, A. C. McWhirter, and A. S. McWhirter. Registered office: 17, Douglas Street, Glasgow.

British Spiro Turbine, Ltd. (152,171).—Private company. Registered December 9th. Capital, £50,000 in £1 shares. To acquire from Sir W. E. Garforth the benefit of a patent relating to rotary engines and the like, and to carry on the business of engineers, manufacturers of and dealers in steam, oil, gas, and electrical engines, manufacturers of coal-cutting and conveying machines &c. The subscribers (each with one share) are:—Sir W. E. Garforth, Snydale Hall, Pontefract, colliery owner; Capt. G. M. Bles, Beechwood, Knutsford; J. Lithgoe, Rawnscliffe, Wakefield, general manager; T. Boardall North View, Altofts, colliery correspondent. First directors: Sir W. E. Garforth (permanent director and chairman), Capt. G. M. Bles, J. Lithgoe, and T. Boardall. Registered office: City Chambers, Infirmary Street, Leeds.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Veritys, Ltd.—Mortgage on leasehold house in Birmingham, dated December 2nd, 1918, to secure £400. Holder: J. Ansell, Birmingham.

Engineering Accessories Co., Ltd.—Mortgage debenture dated November 23rd, 1918, charged on the company's undertaking and property, present and future, including uncalled capital, securing £1,500. Holders: T. Hancox, C. B. Lee and H. Beesley, all of Coventry.

Mica and Micanite Supplies, Ltd.—Satisfaction in full on November 15th, 1918, of mortgage dated April 17th, 1918, securing £1,400.

Also registered: Mortgage on leasehold premises at Islington, dated November 15th, 1918, to secure all moneys due from company to Barclay's Bank.

Renew Electric Lamp Co., Ltd.—Particulars of £4,000 debentures created November 28th, 1918, filed, the amount of the present issue being £1,550. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Electro-Mechanical Brake Co., Ltd. (98,276).—Return dated June 28th, 1918. Capital, £30,000 in 2,500 pref. and 27,500 ord. shares of £1 each. 1,500 pref. and 22,500 ord. shares issued; £17,965 paid on 1,500 pref. and 16,465 ord.; £6,035 considered as paid on 6,035 ord. Mortgages and charges: £7,500.

Barsi Light Railway Co., Ltd. (44,589).—Return dated October 29th, 1918. Capital, £300,000 in £10 shares. 26,000 shares issued; £260,000 paid. Mortgages and charges: £140,000 4 per cent. debenture stock and £120,900 Latur Extension debentures (part of £125,000 issued, £4,100 having been redeemed).

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CITY NOTES.

Western Telegraph Co., Ltd.

Sir J. DENISON PENDER, presiding at the annual meeting on December 4th, said that the company was to be congratulated on having surmounted the many war-time difficulties which had occasioned anxiety as to the maintenance of communication. These included the restriction of shipping, the supply of material and stores to their many stations, delays and danger to repairing steamers in restoring interrupted cables, transport of staff, &c. The revenue from messages, &c., for the year showed an increase of £392,000, but the ordinary expenses and those for cable maintenance advanced by £131,000, and income tax and excess profits duty by £236,000, so that the big surplus fell to £25,000. Letters had been received from shareholders suggesting that some part of the reserve funds should be distributed to the proprietors in the form of "bonus shares." As foreshadowed at the last meeting, the company had now been granted a concession by the Brazilian Government to lay a submarine cable from Rio de Janeiro to the Island of Ascension, where it would join their other cables landing at that island; also they had secured a concession to lay a cable from North Brazil to the Island of Barbadoes. The length of these new lines together would be considerably over 3,000 nautical miles, and would entail an expenditure of many hundreds of thousands of pounds. Furthermore, since war was declared it had been impossible to carry out renewals to the several existing sections which were now urgently in need of renovation, proved by the constant interruptions to which they were subject. These renewals had to be suspended over the last four years, and time had shown the necessity of resuming this work at once, in spite of the high prices which at present prevailed for cables. They were also threatened with further competition; the Western Union Telegraph Co. had secured a concession to lay cables between various ports from the north to the south of Brazil, thus making another communication between Brazil and the United States. The Central & South American Cable Co., which for many years past had owned cables and land-lines from the United States to the Argentine, had also obtained a decree from Brazil sanctioning the laying of two cables to the River Plate, one from Rio de Janeiro and the other from Santos. These cables would connect that company's existing system at Buenos Ayres with its lines serving Chile, Peru, Central and, finally, North America. They were also advised that a few weeks ago a concession for a submarine cable from Rio de Janeiro to Cuba had been granted to an American citizen, but as yet they had no further particulars with regard to this. The necessary steps were being taken by their legal advisers to protect this company's interests where this proposed competition was considered to affect those interests and their concessions. In July last at a meeting of a wireless company the chairman stated that an eminent authority in the United States had expressed to him the opinion that no long-distance cables would ever again be laid, and that, in his view, wireless telegraphy was thoroughly efficient for all telegraphic purposes. This opinion was evidently not shared by North American cable companies, as was proved by the efforts they were making to lay new submarine cables over a distance of many thousands of miles, entailing an expenditure of close upon, if not over, £2,000,000. The directors had, however, no fear but that they would be able to hold their own in the future as in the past, but what he had told them furnished another reason for maintaining the strong financial position in which the company stood at the present time. Under these circumstances he felt sure the shareholders would support the board in declining to consider in any form the issue of bonus shares.

Twice during the war one of the islands where they had a cable station was bombarded by an enemy submarine. The company's buildings were particularly aimed at, but on the first attack no damage was caused. On the second occasion a shell severely damaged a church facing their station, and splinters penetrated the staff quarters, going through the floor and ceiling of two rooms which fortunately were unoccupied at the time. Several people were killed and wounded, but no member of the staff or their families were amongst the number. At another island where the company's office was also close to the sea an enemy submarine appeared actually in the harbour and did considerable damage to shipping, but no bombardment of the town took place. The staff throughout remained cool and resourceful. Arrangements had been made in 1914, after the war broke out, for the maintenance of communication, even if their buildings here or abroad had been wrecked. The staff, seniors and juniors, at home and at all their foreign stations, had had no easy time during the last four and a half years.

The delay in transmission was regrettable, especially at a time when expedition in Press and commercial telegrams was of even more importance than in normal times, but this was a matter which had been beyond their power to rectify. He, however, now looked forward, if they could only get favourable weather for their ships, which were all at their posts ready to effect repairs, to reduce this delay very materially before the close of the present year.

German Companies.

The Rheinische Elektrizitats A.G. (late Rhein-Schuckert Co.), of Mannheim, records net profits of £50,000 for 1917-18, as against £46,000 in 1916-17. It is intended to pay a dividend of 5 per cent., being the same rate as in the previous year.

The directors of the *Hoch Frequenz Maschinen, A.G. fur Drahtlose Telegraphie, of Berlin*, presenting a joint report for the past four years, state that the large wireless stations for transmarine service had stood the test during the war. It did not appear appropriate to give full information, owing to the political situation, the pending negotiations, and the action instituted in America by the Compagnie Universelle de Télégraphie et de Telephonie sans Fil. After providing for depreciation, the net profits are stated to have amounted to £26,000 in 1915, £27,000 in 1916, and £29,000 in 1917. A dividend and bonus at the rate of 15 per cent. have been declared on the A shares for each of the four years, and 28.8 per cent. on the B shares for each year, but no profits are disclosed for 1914.

The Norddeutsche Kabelwerke A.G., of Neu-Kölln, Berlin, whose share capital of £125,000 is held by the Neu-Kölln municipal council, the Mix & Genest Co., and the Mansfeld Corporation, reports net profits of £18,900 for 1917-18, compared with £18,600 in the preceding year, £13,000 and £11,000 having previously been written off for depreciation in the two years respectively. The directors state that orders are on hand in sufficient volume, especially for export, although in estimating for these the demands since put forward by the workmen and officials had not been taken into consideration. It was therefore not possible to foresee whether, and if so at what time, the orders would be carried out. The dividend for 1917-18 is at the rate of 15 per cent., this comparing with 12 per cent. in 1916-17.

The Rhein Westfalisches Elektrizitats Werk A.G., of Essen, which is the greatest supply undertaking, partly from pit-bank stations, in the West, reports an increase in the turnover from 555,060,000 KW.-hours in 1916-17 to 772,470,000 KW.-hours last year. The directors state that owing to the increased costliness of plant, a contribution of £200,000 was made to the company from public sources, but this did not by a long way suffice for the purpose. Including £200,000 set aside for special depreciation the total amount written off was £900,000 in 1917-18, as contrasted with £204,000 in the previous year. The net profits were £211,000, as against £213,000, and the dividend on the ordinary share capital of £2,500,000 is 8 per cent., a rate which has been regularly paid since 1911-12.

The report of the *Berliner Elektrizitats A.G., of Berlin*, which undertaking is now purely an investment company, states that a syndicate had taken over the shares of £800,000 in the A.E.G., which devolved upon the company from the sale of the Elektro Werke, as it was not intended to retain permanently a large holding in the A.E.G. The gross profits earned in 1917-18 reached £436,000, as against £408,000 in the previous year, and the net profits—no provision being made for depreciation as in 1916-17—were £272,000, as contrasted with £229,000. It is intended to pay a dividend of 10 per cent. on the ordinary capital of £2,205,000, this comparing with 8 per cent., 7 per cent., and 9 per cent. in the three preceding years respectively.

The Zurich Bank for Electrical Undertakings.—The Bank fur Elektrische Unternehmungen, of Zurich, whose extensive interests are of a world-wide nature, has now been compelled to pass the dividend for the year ended June 30th, 1918, owing to the further unfavourable influences exercised by the war on the company's investments. During the years immediately preceding the war the company regularly distributed 10 per cent. on the ordinary share capital, but in 1914-15 and 1915-16 the rate declined to 8 per cent. in each case, and a further decrease to 5 per cent. took place in 1916-17. The net profits, which reached £330,000 in 1913-14, gradually receded to £160,000 in 1916-17, and the total for the past financial year is returned at only £27,000. The directors state that the dividend rates of further companies in which the company is interested had to be reduced in 1917-18, that further losses arose on the dividends and interest receipts in foreign currency on account of the low rate of exchange, and that as a consequence of this reduction large sums had to be written off the assets in foreign currency. It is reported that the principal securities concerned were those held in Italian and Spanish companies and in the German Transmarine Electricity Co.

Allgemeine Elektrizitats Gesellschaft.

The report of the directors of this company, dealing with the financial year 1917-18, states that the degree of activity in all the works was greater than in the preceding year. It was necessary to erect new buildings and make extensions, which were carried out as war work, and the cost had to be defrayed to a large part out of current working. The electro-steel works and the rolling mill works, which chiefly worked up the company's own scrap, were brought into operation, whilst the sales of the aeroplane department increased fourfold. Orders for the Army and Navy were accepted according to the company's capacity, although the sale prices could not be brought into harmony with the constantly growing cost of production. At the same time, preparations had been made for work on peace manufactures in the ordinary departments, and in this connection it was frequently possible with lasting advantage to meet the scarcity of materials by

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the use of substitutes in metals, fibres and insulating materials. The organisation in Germany and in those foreign countries which could be reached had worked satisfactorily, and any ousting of the company's manufactures from accessible markets had nowhere taken place. The railway department completed the Merseburg-Muchelon railway section, and as the province of Saxony had now participated in this undertaking the railway would be extended in the new financial year. On the other hand, the work on the A.E.G. high-speed railway at Berlin was limited to the execution of the most difficult construction. An 100,000-volt transmission line from the Zschornewitz power station to Berlin was completed, and the company participated in the formation of a transmission company constituted with the co-operation of the Government of Bavaria. The accounts are abstracted as follows:—

	1916-17.	1917-18.
Share capital	£9,200,000	£10,000,000
Gross profits	2,339,000	3,116,000
General expenses ...	103,000	130,000
Taxes	160,000	249,000
War allowances	507,000	764,000
Depreciation	55,000	170,000
Net profits and balance forward	1,518,000	1,860,000
Directors' fees	34,000	40,000
Bonuses	100,000	125,000
Pension fund	100,000	150,000
War benevolence	75,000	75,000
Dividend	1,150,000	1,400,000
Dividend, per cent. ...	12½	14
Carried forward	59,000	52,000

The rate of dividend was 12 per cent. in 1915-16, 11 per cent. in 1914-15, and 10 per cent. in 1913-14. According to the balance sheet, the loan debt amounts to £5,226,000, as compared with £5,274,000 in 1916-17, and the mortgage debt to £178,000, as against £135,000. The company's liabilities, which rose from £7,300,000 in 1915-16 to £8,400,000 in 1916-17, have further increased to £9,910,000. On the other hand, the company's credit at the banks is stated to have increased from £5,570,000 in 1916-17 to £7,635,000 last year, and the aggregate credits from £10,712,000 to £11,838,000.

Prospectus.—*Morgan Crucible Co., Ltd.*—This company is issuing through the British Trade Corporation, Ltd., £500,000 first mortgage 6 per cent. redeemable debentures (£100 each). The following facts concerning the company's position are set forth in the prospectus:—

The company is the largest manufacturer in the world of crucibles, and the only British manufacturer of carbon brushes for electrical machinery.

The works at Battersea are freehold and cover seven acres. The buildings, plant, and machinery are substantial, up-to-date, and perfectly equipped. The floor space now amounts to 600,000 sq. ft., an area twenty-fold larger than in 1880.

During the war the increased demand for the company's products has necessitated the accumulation and financing of stocks much in excess of those held in the pre-war period. This is illustrated by the fact that the stocks in the company's balance-sheet on December 31st, 1914, stood at £190,902, whilst the corresponding figure on December 31st, 1917, was £689,719 the latter being taken at cost and below market value.

This large expansion has been financed out of funds due to the Government and advances by the company's bankers. These sums have now to be repaid, and the directors have resolved to arrange for the issue above referred to.

The company has, during the period of the war, largely increased its manufacturing plant, and its output capacity is now three times what it was in the pre-war period. The additional expenditure in connection with the expansion has all been charged against revenue.

The list of applications closes to-morrow (Saturday).

Electrical Securities Trust, Ltd.—The report for the year to November 14th states that an opportunity occurred to realise the debentures and "B" debentures of the North Wales Power & Traction Co., and as it was desirable to close the debenture-holders' trust the trustees made arrangements for selling the remaining assets held as security for the debentures to a syndicate or pool. The debenture-holders approved, and on the sales being completed the trustees had in hand £62,834. After meeting fees and expenses, £58,000 was available, and was accepted by the debenture-holders in full discharge and satisfaction of all claims against the trustees or the company. £55 per £100 had already been repaid; and this further distribution gave each debenture-holder repayment of the balance of £45 of his capital and £13 per £100 towards payment of premium and interest. The discharge by the debenture-holders cancelled £20,966 premium and accrued interest. The board are considering the question of winding up the company.—*Financial Times.*

Companies Struck Off the Register.—The following companies have been struck off the Register, and are accordingly dissolved:—

Aero Fire Alarm, Ltd.
Asbestos & Asbestic Co., Ltd.
British Manganese Co., Ltd.
Curative Electricity Co.
Float Electric Co., Ltd.
Light Railway & General Construction Co., Ltd.
Platinum Substitutes, Ltd.
Waterworks, Lighting & Power Investment Corporation, Ltd.

Manx Electric Railway Co.—Year ended September 30th. Receipts £17,554, gross expenditure £11,741. The debit balance on revenue account is now £31,411. Passengers carried 173,005, against 119,683 last year. Debenture interest has been funded by the issue of second debentures.

Provincial Tramways Co.—Year ended September, 1918. Net revenue from local companies, £69,054. After meeting debenture interest, income-tax, and other charges, £12,000 is put to depreciation and reserve, and £15,000 to reserve account for deferred repairs. A final dividend of 10d. per share on the ordinary shares and a bonus of 6d. per share makes 10 per cent. for the year. £7,804 is to be carried forward.

Vulcanite, Ltd.—Net profit, after providing for excess profits duty, £16,344, including £3,252 brought forward. After meeting preference interest, 10 per cent., less tax, is paid on the ordinary shares. In addition, the pref. and ordinary both receive a bonus of 6d. per share.

British Westinghouse Electric and Manufacturing Co., Ltd.—At an extraordinary general meeting held in London on December 12th, the resolutions passed on November 25th were confirmed.

East London Railway Co.—10s. per cent., less tax, is to be paid on the "B" debenture stock for the year.

Marconi International Marine Communication Co., Ltd.—Interim dividend 5 per cent. (1s. per share), less income-tax.

STOCKS AND SHARES.

Tuesday Evening.

The week before Christmas is not noted for activity in Stock Exchange markets, and, although there have been exceptions to this in the past, the present day is evidently not going to prove one of the latter. Business in all the markets is quiet, and the influence of Christmas is felt everywhere. One of the few outstanding features in the electricity departments is a rise in Edison-Swan shares in anticipation of the report. The price was run up from 17s. 6d. to 19s., and even the safer prophets were inclined to revise their earlier estimates of a 5 per cent. dividend, having regard to the nature of the buying. The estimates ranged finally from 5 to 10 per cent., but caution was inclined to place 6 per cent. as the probable maximum, with a strong balance-sheet behind it. It may be the announcement will be out before these notes are, and it would not be very surprising to see the price react after the declaration is made, in conformity with the usual Stock Exchange practice to run up any price in anticipation of a favourable statement, and then, however favourable the statement happens to be, taking profits immediately upon its publication.

Other manufacturing shares are quietly good, and British Aluminiums exhibited a considerable degree of activity, the price touching 39s. before it went back a few pence, leaving it 38s. 9d., and so showing a rise of 3/16 in a fortnight. There has already been noticeable demand for Callenders. The ordinary have risen no less than 12s. 6d. to 10¼, and the preference at 5¼ are 5s. up. This, of course, has affected the quotations for the new shares, and the ordinary are quoted 9¼, the preference 5 5/16. Henleys remain at 2¼, at which they have stood since the opening of the market in the new shares, the preference in their case being quoted 4 middle. Some ask why Henleys do not follow the example of Callenders, and raise the dividend rate upon these 4½ per cent. preference. India-Rubber shares maintained their advance to 17½, and British Westinghouse preference continue dull at 2⅜. Amongst the engineering issues, Babcock & Wilcox have barely budged from 3¼, while the activity that characterised the explosives group a week ago has practically evaporated, and the excitement has blown over for the time being.

Disquieting news respecting Mexico has had a depressing effect upon all the securities connected with that country. Instead of a restoration to peaceful conditions, affairs in Mexico seem to be going once more from bad to worse, and no astonishment would be felt if another revolution were to break out. Evidently there is great local dissatisfaction at the government at Carranza. The high hopes which were entertained with regard to the likelihood of the United States taking a strong line in Mexico at the conclusion of the war have given way to a feeling approaching despair of Mexican matters ever mending. This, of course, is a temporary phase, but its influence is marked in all Mexican issues, and the Utilities have suffered, though slightly, with the rest. It is a curious thing that Mexico Tramways 6 per cent. bonds should be quoted nominally higher at 56, though actually the price is more like 54.

Brazilian Tramway, and Brazilian Traction varieties are rather better, although little nominal alteration has occurred in the prices. British Columbia Electric deferred stock has fallen a point. A private letter from Vancouver just to hand speaks of the prosperity which the city is enjoying, although the writer, who is a mechanic, admits that the after-war problems are certain to become pressing in a short space of time. The Argentine stocks and shares are steady, attracting no particular attention, and prices remain unchanged on the week.

Amongst electricity supply shares, the decline to 13 in City of London ordinary is the only quotable change. The rest of the list is well maintained, though perhaps there is not quite so much demand for the shares as there has been just lately. This, of course, is simply due to the fact that investors are holding back their money for window-dressing purposes before the New Year.

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In the telegraph and telephone market, Eastern Extensions and Eastern Telegraph ordinary stock have given way to a slight extent, and Westerns at 16¼ are about 7s. lower, taking into account the 3s. net dividend deducted from the price a few days ago. Marconis managed to maintain their position pretty well, without there being much activity in their department. Americans have sagged away to 30s. 6d., while Marines remain about 3½, the parent shares holding an even keel at 4⅛. Great Northern Telegraphs are 10s. higher on the week.

Nationalisation is still the word to conjure with in the railway market. The first blush of enthusiasm over the stocks has suffered, however, a set-back in consequence of profit-taking sales. These were supplemented by realisations on behalf of people who are not inclined to take a particularly rosy view of the chances that the Government will pay such fancy prices as are contained in the estimates worked out by statisticians. Unless the market is supported by a fresh set of buyers every day the tendency of prices is bound to be somewhat breaking. Underground Electric income bonds have shed ¼, and the ordinary shares, after rising ¼ up to 3½, reverted to 3⅜. Metropolitans are ½ down, but Districts maintain their advance. Unless interest is revived by some fresh official announcement, the inclination will probably be for prices to ease off.

Castner-Kellner shares have given way 3/16 to 3 7/16, notwithstanding the maintenance of the 20 per cent. dividend. Apparently some had hoped for the distribution to be replaced by the 22 per cent. paid for 1916. The rubber market is a shade better on removal of restrictions in the United States. Copper and other base-metal shares have weakened, for the same reasons as mentioned here previously to account for the dulness prevalent in this market for the past month.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Dec. 17, 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	7½	—	£6 18 0
Charing Cross Ordinary	5	4	3⅝	—	5 14 0
do. do. 4½ Pref.	4½	4½	3⅝	—	6 13 4
Chelsea	8	5	4	—	6 5 4
City of London	8	8	13	—½	6 3 1
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 5
County of London	7	7	11⅛	—	6 5 7
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 5
Kensington Ordinary	8	7	5⅞	—	5 19 2
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	4	5	4	—	6 5 0
Metropolitan	8	4	8½	—	6 8 1
do. 4½ per cent. Pref.	4½	4½	3½	—	6 18 6
St. James' and Pall Mall	8	9	7½	—	6 6 4
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	7⅛	—	6 6 4
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	99	—	6 1 0
do. Def.	1½	1½	23⅛	—	6 9 6
Chile Telephone	8	8	7⅞	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 18 4
Eastern Extension	8	8	15½	— ½	*5 3 3
Eastern Tel. Ord.	8	8	157½	—2	*5 1 7
Globe Tel. and T. Ord.	7	7	14½xd	—	*4 16 5
do. do. Pref.	6	6	10½xd	—	5 14 3
Great Northern Tel.	24	22	83½	+ ½	6 11 5
Indo-European	13	13	58½	—	5 11 0
Marconi	15	20	4⅜	—	4 6 7
Oriental Telephone Ord.	10	10	3⅝	—	2 17 2
United R. Plate Tel.	8	8	7½	—	*5 3 3
West India and Panama	6d.	1/3	1½	—	*3 12 6
Western Telegraph	8	8	16¼xd	—7/-	*4 18 7
Home Rails.					
Central London Ord. Assented	4	4	65½	—	6 2 2
Metropolitan	—	1	30½	— ½	3 5 6
do. District	Nil	Nil	25	+ ⅛	Nil
Underground Electric Ordinary	Nil	Nil	3⅜	— ⅛	Nil
do. do. "A"	Nil	Nil	9/-	—	Nil
do. do. Income	6	4	91	— ½	*4 8 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅜	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	4⅜	—	—
do. do. 2nd Pref.	5⅜	—	3⅛	—	—
do. do. 5 Deb.	5	5	75½	—	6 12 5
Brazil Tractions	—	—	56	—	—
Bombay Electric Pref.	6	6	103	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	67⅛	—	7 11 5
do. do. Preferred	Nil	Nil	52⅛	—	Nil
do. do. Deferred	Nil	Nil	46⅛	—1	Nil
do. do. Deb.	4½	4½	62	—	6 17 8
Mexico Trams 5 per cent. Bonds	Nil	Nil	67	—	Nil
do. 6 per cent. Bonds	Nil	Nil	56	+1	Nil
Mexican Light Common	Nil	Nil	38xd	—2	Nil
do. Pref.	Nil	Nil	49	—1	Nil
do. 1st Bonds	Nil	Nil	71	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	81	—1⅛	4 0 0
British Aluminium Ord.	10	10	31⅛	+1/9	5 8 1
British Insulated Ord.	20	20	2½	—	4 9 0
British Westinghouse Pref.	7½	7½	2⅝	—	5 14 1
Callenders	20	25	10½	+ ⅝	6 2 0
do. 5 Pref.	5	5	5½	+ ¼	5 0 0
Castner-Kellner	22	20	3⅛	—⅛	5 10 4
Edison-Swan, "A"	—	—	—	+ ⅛	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	10	1½	—	8 0 0
Gen. Elec. Pref.	6	6	10⅝	—	6 2 4
do. Ord.	10	10	17½	—	*5 12 8
Henley	25	25	2½	—	5 11 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	—	*5 12 8
Telegraph Con.	20	20	48	—	*5 0 0

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, December 18th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/5	1d. dec.
a Ammoniac Sal	per ton	£80	£20 dec.
a Ammonia, Muriate (large crystal)	"	£77	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£43	..
a Copper Sulphate	"	£60	..
a Potash, Chlorate	per lb.	2/1	3d. dec.
a " Perchlorate	"	1/9	3d. dec.
a Shellac	per cwt.	£17 10/-	..
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	"	£34	..
a " Lump	"	£36	..
a Soda, Chlorate	per lb.	1/1	..
a " Crystals	per ton	170/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 3" to 12" basis)	per lb.	..	..
c " Tubes (solid drawn)	"	..	..
c " Wire, basis	"	..	..
c Copper Tubes (solid drawn)	"	1/7½	¼ to 1½ dec.
g " Bars (best selected)	per ton	£150	£11 dec.
g " Sheet	"	£150	
g " Rod	"	£150	
d " (Electrolytic) Bars	"	£125	£12 dec.
d " " Sheets	"	£161	..
d " " Wire Rods	"	£135	£12 dec.
d " " H.C. Wire	per lb.	1/4	1½d. dec.
f Ebonite Rod	"	8/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/6	..
h Gutta-percha, fine	"	11/-	..
h India-rubber, Para fine	"	2/8	2d. dec.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£37	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	9d. to 4 6	..
e " " " medium	"	5/- to 10/-	..
e " " " large	"	12/6 to 25/- & up.	..
d Silicium Bronze Wire	per lb.	1/8	2½d. dec.
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	..	..
n " Wire, Nos. 1 to 16	per lb.	4/6	6d. dec.

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

American Emergency Acts Abandoned.—The Priorities Commissioner of the War Industries Board announces that the Board has rescinded the entire "preference list." This means that the classification of the industries as essential or less essential has been abandoned, and that the Government will not longer direct the distribution of materials and facilities to industries engaged particularly in war work. Meanwhile, to aid reconstruction, preference in the allocation of materials and facilities will be granted to public utilities and to enterprises of greatest civilian importance.

The so-called War Emergency Power Act, under which Congress was to have appropriated $200,000,000 for assisting in the supply of power by privately owned companies will be abandoned.

The U.S. Fuel Administrator has given notice that the rules and regulations and the supervision of the fuel administration now in force will continue until the promulgation of the treaty of peace.

Electricity in Agriculture.—M. T. Lecler presented a report to the French Civil Engineering Congress on the means that should be adopted to extend the use of electricity for agricultural purposes. According to an abstract of the report in the *Revue Générale de l'Electricité* of September 28th, petrol-driven tractors have been tried and found to give unsatisfactory results in unskilled hands. The electric motor has many advantages in its reliability, simplicity, ease of operation, and low first cost and maintenance. Furthermore, an electric supply may be used for purposes of electroculture. The report suggests the appointment of a committee of experts to supervise the improvement of agricultural electrical apparatus, to guide research on its use, and to administer Government funds for these purposes. It then investigates the power required to operate various agricultural devices. An obstacle to the development of electricity for agriculture is presented by the low consumption usually required for a given area. This amounts generally to about 20 kw-hours per hectare per annum. The consumption could, however, be increased to at least five times this amount by an extension of the uses to which the electric supply is put. At this figure it would become profitable to the supplier. Common action should be taken by agricultural workers, suppliers of electrical energy and manufacturers of the appliances.

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THE SUPPLY OF SINGLE-PHASE POWER FROM THREE-PHASE SYSTEMS.

By PROF. MILES WALKER, D.Sc., M.I.E.E.

(Abstract of paper read before the Institution of Electrical Engineers.)

(Concluded from page 587.)

From the power company's point of view, the inductance is not an unmixed blessing. By reducing the power factor it calls for more copper in the mains for a given load, and reduces the output of the generators. Sudden heavy calls for low-power-factor current have a bad effect upon the regulation of the whole system. But so greatly does the stability given by the inductance help towards economy in furnace linings, that large numbers of furnaces in this country and in America are run at 0.7 power factor. The single-phase furnace, having only one carbon at the top, presents a smaller area of roof lining to the fierce radiation from the arc, and for this and other reasons set out above it is more economical than the three-phase furnace.

It will be seen, then, that in designing a balancer to provide a single-phase furnace load from three-phase power mains it is desirable that the single-phase winding should have such a high inductance that the current will lag 45 deg. at full load. At the same time, it is desirable that the three-phase winding should be operated at unity power factor. These conditions can be met by building a three-phase synchronous motor having an ordinary three-phase armature winding lying in slots near the working face of the stator (see fig. 7), and provided with a single-phase winding lying in slots further removed from the rotor than the three-phase slots and arranged so that very considerable magnetic leakage occurs between the two windings at full load.

The dimensions of the three-phase slots near the surface of the armature and of the single-phase slot lying in the centre of the punching are shown in fig. 8. This figure also shows a narrow slot 0.45 cm. wide, across which the leakage flux finds its way at full load. The machine described is one of two designed for the Snyder Electric Furnace Co., and now in successful operation in this country. Another, somewhat similar, machine has been designed to be built by the Allis-Chalmers Co., of America, and several machines of larger output are in contemplation. The British machines are required for furnaces to make steel for war purposes.

In the case of the 400-kw. balancer here described, the following were the particulars of the conditions to be met:—

Three-phase supply. Line voltage	6,000 at 50 cycles.
Input to furnace	350 to 400 kw.
Voltage on arc and connecting cables in phase with the current	156.
Effective inductive drop in furnace and cables	25 to 50 volts.
Single-phase voltage at terminals of balancer	160.
Inductive drop in windings of balancer ...	110 to 130.
No-load voltage...	220 to 247, say 234.
Single-phase amperes	2,400 to 2,700.
Temperature rise of balancer after full load for three hours	45° C.

One of the special features of this type of balancer is a compensating winding designed to inject a boosting voltage into the two phases of the three-phase winding that lie adjacent to the single-phase winding, in order to prevent those windings from taking more than their share of the load. If this winding were not provided, phases A and C

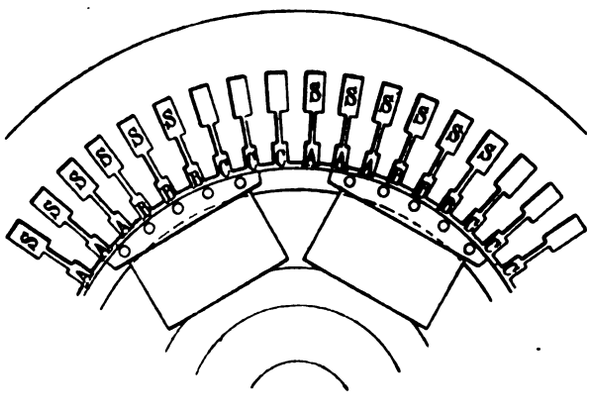

Fig. 7.

(adjacent to which the single-phase slots are placed) would take a load equivalent to a single-phase load on the three-phase system by reason of the fact that the magnetic coupling between these phases and the single-phase coils is more complete that the coupling between the single-phase winding and phase B. Another way of looking at the matter is this: When current passes through the single-phase winding, it drives magnetic flux* across the three-phase slots of phases A and C and causes an inductive drop in these phases; so that there will flow from the line a current of such value and of such phase that it produces an impedance rise sufficient to balance the inductive drop produced by the single-phase magnetomotive force. Since the resistance drop is small, compared with the reactive drop, the excess current that would be taken by phases A and C would be almost in exact opposition of phase to the single-phase current.

One way of preventing this action is to inject into phases A and C an electromotive force which shall at all times be exactly equal and opposite to the electromotive force generated in the three-phase winding by the interlinked flux from the single-phase magnetomotive force. The most direct way of doing this is to wind a few turns of wire interlinked with the main leakage path of the single-phase winding, and electrically connect these to phases A and C so that the E.M.F. generated in the turns by the main leakage shall oppose the E.M.F. generated in the three-phase winding by the small leakage across the three-phase slots. As the leakage flux

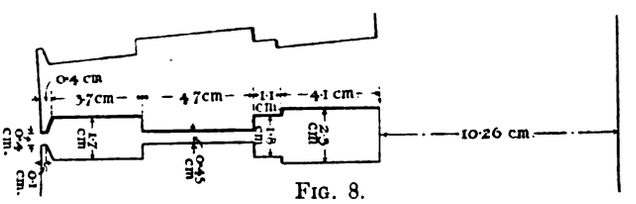

Fig. 8.

across the leakage air-gap is great, compared with the leakage across the three-phase slots, only very few turns of compensating winding are required to balance the E.M.F. in the 16 conductors per slot of the three-phase winding. The counter magnetomotive force set up by these few turns is so small, compared with the magnetomotive force of the single-phase winding, that it can be neglected in roughly estimating the number of compensating turns required. The manner of winding and connecting the compensating conductors can be seen from figs. 9 and 10.

In order to provide a means of making small adjustments in the balance of the load on three-phase winding after the machine was built, three tappings were taken off each of the phases near the star point. The tappings give a choice of cutting out 1.56 per cent., 3.12 per cent., or 4.68 per cent. of the phase voltage. In practice it was found that the connection that gave the best result with only three compensating turns connected was that shown in fig. 11. The effect of this slight dissymmetry in the connections was to give a slight dissymmetry at no load; this dissymmetry is of no importance in practice, and can be eliminated in future by a better adjustment of the compensating winding. When there is no load on the single-phase winding, there is no E.M.F. in the compensating winding;† and as it is the same magnetomotive force that operates upon the compensating winding as operates upon the three-phase winding and creates a tendency to unequal back E.M.F., the right adjustment of the compensating winding should bring about a nearly exact balance of the phases. The currents in the

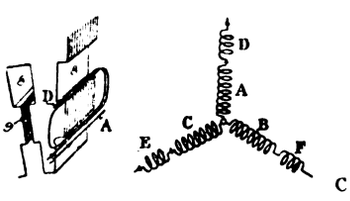

Fig. 9.

Fig. 10

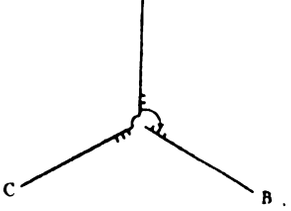

Fig. 11.

damper on the field poles also tend to create a disturbance in the balance of the load; this disturbance is of a very complex nature, but is not of very great moment.

The damper consists of 9 drawn-copper bars of taper section, held in dovetail slots in the pole face, and pinned and sweated to a copper casting encircling each pole. The copper castings are bolted together from pole to pole so as to form a complete squirrel-cage winding. In order to avoid any inductive action between the individual stator slots and the bars of the damper, the slots on the field poles are skewed through a complete stator slot pitch. With this arrangement the damper showed no signs of heating at no load, and only very slight heating at full load.

Apart from the special features above mentioned, the design of the balancer follows very closely the design of an alternating-current generator or synchronous motor.

An allowance of 8 kw. has been made for extraneous loss

* It should be noted that any change which occurs in the field flux due to the single-phase load (except in so far as it is exterior to the damper) affects phase B as much as phases A and C.

† Except a very small inductive drop due to the three-phase load, which can be compensated for by the addition of a small choke coil in phase B.

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at full load, bringing up the total losses at full load to 42.4 KW. Thus the efficiency works out at 90.4 per cent.

A full-load test was made after the machine had been delivered to the works of Messrs. Summerson, Ltd., Darlington. Characteristic figures of the test are given. When running light there is a dissymmetry in the power taken by different phases, due to the arrangement of taps shown in fig. 11, but does not cause any measurable interference with the voltage at the end of a long feeder. When the furnace is in circuit, the amount of load can be varied slightly by altering the distance between the electrodes. The point

TESTS ON SITE.

Speed.	Exciting amps.	Three-phase side.						Single-phase side.			Remarks.
		Volts.	Amperes.			KW.		Volts.	Amps.	KW.	
			A	B	C	A-B	C-B				
750	29	6,100	3·2	3·4	1·4	9	14	224	0	0	Running light.
750	39	5,960	45	45	49	200	232	1·6	2,450	190	Full load.
750	39	5,960	18	18	18	38	83	Not readable	3,520	75	Carbon short-circuited.

of maximum load is in practice found by trial. Any increase or decrease of the length of the arc from this maximum-load point causes a decrease in the load. It is sometimes convenient to vary the load by changing the length of the arc, but the steadiest conditions are obtained when the arc is on the maximum-load point. The balance of the load is quite good, the currents in the three lines A, B, and C being 45, 45, and 49 amperes respectively. The deviation from the perfect balance is not more than is often found on standard polyphase machines.

A very interesting experiment is to screw down the top carbon until it dips into the metal in the furnace. As the arc is shortened, the voltage falls; when the carbon is in contact with the metal the voltage cannot be read on the voltmeter, and the watts fall to a small amount of the order of 75 KW., depending upon the condition of the charge. The current rises to somewhere between 3,500 and 3,800 amperes. The load on the three-phase side falls to about 121 KW. This is satisfactory from the power company's point of view.

In ten appendices full details are given of the calculations involved in the design of the machine, and various propositions referred to in the paper.

REGULATIONS FOR ARC WELDING.

By H. M. SAYERS, M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

ELECTRIC arc welding shows promise of extensive developments. The practice at present is maily empirical. In view of the possibilities of its application to shipbuilding, one of the Admiralty Departments has set up an Electric Welding Research Committee, including a number of unofficial members representing important interests who offered to render voluntary assistance in the development of electric welding.

One of the points which has come before the Committee is the question of regulations in respect of (*a*) safety of operators, (*b*) conditions of supply; and it has been thought essential to have a discussion in order to get the views of members of the Institution on these matters.

The Home Office at present has made no regulations, but is keeping an eye on the processes, and wishes to obtain the views of the industry. The Board of Trade has no regulations specifically dealing with welding, but it is clear that some modifications and additions to the existing regulations may be required. In both cases it is desirable that there may be no regulations issued which may be found to hamper progress.

A very large and influential Research Committee has been formed in the United States.* It is communicating all its proceedings and reports to the Admiralty Committee, and among them the discussions and reports on regulations.

The Admiralty Committee has already drawn up a skeleton form of regulations based on experience in this country and the communications from the United States.

This paper is therefore brought forward to introduce a discussion, and to set out the points as they at present appear to arise in practice.

Necessary regulations are conveniently divided into two heads:—

1. Regulations affecting the safety of operators and workers in their vicinity.

2. Regulations affecting the reliability and regulations of general supply systems.

Taking the first heading, there are two main points:—(*a*) Protection of operators and neighbouring workers from the effect of the radiations from the arc; (*b*) protection from shock.

(*a*) *Protection from Radiation.*—It is well known that the light from a naked arc has a serious effect upon the eyes and the skin. This is more serious with the iron arc than with the carbon, as the iron-arc radiation is richer in rays of short wave-length; including ultra-violet rays, which are specially detrimental. Welding arcs require large currents, *e.g.*, a No. 10 welding rod requires up to 120 amperes, and as the extension of the arc to heavier work is clearly foreshadowed, arcs carrying several hundred amperes have to be reckoned with in considering protective appliances.

Where welding is carried out in a factory under stationary conditions the provision of screens, masks, &c., for the welders can be readily arranged, and each operator's position can be isolated from neighbouring workers by suitable screens.

More difficulty arises in such work as welding the hulls of ships, where the welders must work on stages; and most, perhaps, in repair work.

The object to be attained in every case is that arc radiations shall not reach the eyes or skin of either the operators or persons in the vicinity, except through screens which obstruct the injurious rays.

The welder himself and any assistant must be able to see his work, and it is therefore necessary that such screens as they use shall be reasonably transparent to ordinary light. It has to be remembered that the skin of the hands, arms, face, and neck needs protection. This can be given by any opaque material. Glass can be obtained which is practically opaque to the most injurious rays, and yet fairly transparent to ordinary light. Combinations of coloured glasses are also in use, which are fairly satisfactory. The U.S. Research Committee has recommended certain combinations of this kind.

It is clearly important that the screen or mask used shall be such as not to restrict the operator's movements or to cause discomfort. Goggles protect the eyes only. Masks, which protect the face as well, are open to objection on the point of comfort. A screen held in the left hand carrying a sufficient area of suitable glass, and an apron to shield the left arm, are satisfactory for stationary work. It may not prove so good for shipbuilding and repair work, where the left hand may be required for other uses.

There is a danger radius from an arc of given power, beyond which no screening is necessary. But intense lights within the usual field of vision are objectionable, quite apart from directly injurious effects, so that screening seems desirable in any case. In shipbuilding it is probable that whilst welding is in progress on any section all the near-by workers will be welders, and their mates who will have their individual protection.

In repair work, especially in ship spaces, exigencies of time may require other workers to be employed close to the welders, and perhaps the only possible regulation would have to be in the general terms that efficient shielding from the arc must be employed in such cases.

It may be said that whilst the short-length waves are responsible for the damage to the eyes and the skin, the long-wave or heat radiations also produce sunburn effects on the skin, which must be guarded against. This effect is, however, essentially of short range, and mainly affects the welders themselves.

(*b*) *Protection from Shock.*—The pressure across a welding arc is quite low. Both for direct and alternating-current arcs it is of the order of 25 to 30 volts. But there is always a steadying resistance or choker in series, and when the arc is broken there is the full supply pressure on the electrode. It is at this time that there is more danger of shock, both because of the higher pressure and because the electrode is not visibly dangerous. It may be inadvertently touched.

It has to be remembered that in working from a stage, &c., the danger of shock is from indirect effects such as those causing a start or stumble, or loss of balance. With D.C. arcs there need be no danger if the supply conditions are properly adjusted; 100 volts is the maximum supply pressure necessary either for carbon or for metallic electrodes, including steadying resistances, and 100 volts D.C. will not make a man start or stumble. Therefore, as regards direct-current welding, the maximum voltage needed is below the danger point, and it is only necessary to limit the supply pressure to some such figure as 100 volts. Even 200 volts can hardly be called dangerous.

In the case of alternating-current welding the conditions are rather different; whilst the actual arc voltage as shown by a voltmeter is quite low, 30/35 volts, practice shows that a considerably greater circuit voltage must be available. This matter is under special investigation. It must meanwhile be accepted that at least 65 volts is needed for A.C. welding. This pressure is capable under certain conditions of giving a severe shock. A welder is certain to have his skin damp with perspiration, which is one condition favourable to a shock.

A welder will normally wear a protecting gauntlet of leather, so that there is little risk of shock through the hands unless working in conditions leading to wetting of the gloves. It may perhaps be necessary to lay down the rule that for A.C. welding the gloves must be waterproof. The most likely chance of getting shocks seems to be when the electrode is laid aside and the welder has his hands bare. It is suggested that this danger can be averted by a "no current" circuit breaker in the circuit, which could be cut out by a pedal switch for the purpose of restarting the arc. This "no current" breaker would serve another useful purpose in preventing the use of too long an arc, which makes bad work.

* ELEC. REV., December 6th, 1918, p. 555.

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It is submitted that both for A.C. and D.C. welding the work should always be earthed, or connected to the earthed pole of the supply circuit.

It should be a rule that a proper hook or receptacle should be always provided for an electrode not in actual use, and should always be used. Possibly this rule might dispense with the "no current" breaker in A.C. work. The flexible lead to the electrode must necessarily be somewhat heavy in copper section. The insulating covering must be strong and flexible. Armouring is scarcely admissible on account of weight and stiffness. It should be readily detached from the connecting socket, for ease of exchange, and there should be a switch or breaker between the supply and socket.

The insulation of the flexible near the electrode holder is exposed to considerable heat, conducted and radiated. It must not be damaged by this heating.

The steadying resistances require just the same precautions as resistances for arc lamps, but as the currents are heavy and pass during the whole of the welding operation ventilation must be good. The resistances, chokers, &c., must be capable of carrying the short-circuit current without rising to a dangerous or destructive temperature. The same regulations as for other similar operations should suffice.

Supply Regulations.—The conditions of welding are not favourable for direct supply from the mains of a supply undertaking. The maximum voltage needed is considerably below most supplies. The condition that the work must be earthed is also objectionable from the point of view of a supply authority. A higher supply voltage may be used by using a larger resistance in the welding circuit, but this is wasteful, and increases shock dangers. It is not likely to be used where welding is in constant or frequent use.

Where the general supply from the mains is direct-current the pressure will be 200 volts or over from each outer to earth. This is much higher than needed, and it brings in a distinct danger of shock, besides being wasteful of energy. It can be excluded from consideration for equipment in steady use. It will pay the user to put in a converting set yielding the desired voltage.

The case of occasional welding may need consideration. It may pay the user to throw away 75 per cent. of the energy in resistance rather than incur the cost of a converting set. In such cases the safety arrangements must be similar to those provided for A.C. sets. The supply interests, it may be suggested, will be sufficiently protected by providing that the current taken shall be limited in the same way as to any other power circuit. It seems obvious that welding supply-circuits must be run separately from any others from the consumer's main fuses. It should be arranged that the work connection can only be made to the earthed lead of the supply. But it must be expected that the work will be earthed in many cases, and it is suggested that supply engineers should tolerate this with such reservations as to power to disconnect for testing purposes, &c., as they think necessary to protect their systems. The Board of Trade regulations will need an exception to be made in the same sense.

Where, as in most cases, motor-generators are used for supplying D.C. welding sets, the supply mains have better protection. Where single welding units are installed, some such device as the "Daysohms" magnetic clutch* between the motor and generator is an added protection to the plant.

Alternating-current Welding.—Owing to the cheapness and efficiency of transformers, they will always be used between the mains and the welding circuit. From safety considerations alone these should be of the two-circuit type and have earth shields.

Where single-phase is given, the supply undertaking hardly needs special protection, excepting those common to other power uses. It may perhaps be thought advisable to require that part of the resistance in the electrode circuit shall be in the form of choking coils to limit the current on striking the arc, and on making accidental contacts.

Where the supply is given from a multi-phase system, questions of balancing arise. The simplest connection is to put the welding transformer across one phase. If a number of welders are in use and they are equally divided between the phases, they will approximately balance each other.

A single-phase supply can be obtained from either two-phase or three-phase systems, loading each phasing. With two-phase three-wire distribution a single-phase supply can be obtained from the two outers, giving 1.414 times the voltage of either phase. This can be transformed in a single-phase transformer to the welding pressure. Whilst this connection loads each phase equally as regards current, the resultant current is out of phase, lagging on one side and leading on the other, reducing the power factor and tending to unbalance the voltage on the two phases.

Alternatively single-phase current can be taken from each phase directly, and where a number of welders are in use this is the simplest and most satisfactory connection, the welders being equally divided between the phases. There is the probability that unequal numbers will be in simultaneous use on the two phases, producing some unbalanced load.

With three-phase distribution single-phase current can be taken from a three-phase transformer with its secondaries connected in a particular way. This connection gives currents largely out of phase in opposite senses in two of the windings, tending to unbalance the voltage and reducing the power factor.

*Elec. Rev., January 25th, 1918, p. 94.

Welders can obviously be fed from the separate phases, and if a fair number are distributed between the phases the resulting out-of-balance loads will be only those due to differences in the numbers in simultaneous use.

The whole question from the supply point of view is one of magnitude of the effect, having regard to the relative proportions of the welding load and the general load supplied by the power or sub-station affected. The provision of condensers or other corrective devices on the lagging-current phase may be worth while in large lay-outs. (Here the author drew attention to Prof. Miles Walker's paper; see p. 585 of our last issue.)

At the present stage it seems premature to make definite regulations. Supply undertakers would be sufficiently protected by the provision that for welding plant above a certain capacity, varying with local conditions, the method of converting the supply shall be subject to their approval, which shall not be unreasonably withheld.

In both D.C. and A.C. welding the striking of the arc is potentially the short-circuiting of the leads. It is on a par with the starting up of a motor, but somewhat more favourable, inasmuch as when welding there must be a resistance in circuit, and the current can be limited by providing some minimum resistance or choker which the operator's regulating switch does not cut out. Similar regulations to those limiting starting currents on motors will therefore suffice, with the simplification that where a number of welders are in use a single limiting device in the mains is all that is necessary to protect the supply.

DISCUSSION.

Mr. C. H. WORDINGHAM, in calling upon Major Caldwell to open the discussion, explained the object of the paper, which was to obtain the views of the industry on the question of protection, and to afford an opportunity for members of the Institution to express an opinion as to the formulation of regulations for the protection of welders and other workers in the vicinity during welding operations.

Major JAMES CALDWELL, R.E., gave an indication of the position of electric welding development in the United States of America. He said that last year investigations were carried out by the Standards Committee of the A.I.E.E. in order to standardise spot welders and the apparatus connected therewith.* That Committee was later transferred to the General Engineering Committee of the Council of National Defence, formed to deal with engineering aspects for war preparation. Part of its activity was devoted to considering the possibilities of electric spot-welding, and also the successful production of cast-steel anchor chains, which last spring obtained the approval of the classification societies under test specifications 40 per cent. more severe than those for wrought-iron chain.† The first order—a trial order—for cast-steel chain saved the U.S. Shipping Board £10,000.

Whilst attending meetings of the Standards Committees in London in November, last year, the American representative, Mr. H. M. Hobart, interested himself in electric welding development here, and submitted a full report on the subject to the U.S. authorities. Subsequently, on the invitation of the U.S. Shipping Board, he (Major Caldwell) was privileged to visit America to explain the procedure adopted by the Admiralty relative to the application and use of electric welding at factories and in the dockyards where the arc process had been applied successfully.

He stated that Prof. Comfort A. Adams, at that time president-elect of the Institute, was granted four months' leave of absence from his work at Harvard University and the Massachusetts Institute of Technology, in order that he might devote himself entirely to electric welding investigations. Furthermore, a regular session of the Mid-Winter Convention of the A.I.E.E. had been assigned to electric welding. Meantime the Council of National Defence had abolished its Advisory Committees, but within a fortnight of his (Major Caldwell's) arrival in New York the Emergency Fleet Corporation of the U.S. Shipping Board decided to adopt the Electric Welding Committee as formerly constituted, including representatives covering broadly the whole field of welding activities in America.

Along with Prof. Adams, Mr. Hobart, and one or other of the Committee, he visited as many shipyards as it was possible to include in the itinerary of the trip, and attended meetings of shipbuilders and local representatives of the Emergency Fleet Corporation and the classification societies held at New York, Boston, Philadelphia, and Baltimore. On all such occasions it was explained how the demand for oxy-acetylene welding gases had so enormously increased in this country during the war that electric arc welding was taken up as a substitute, with the result that it was found in many cases superior to the former method.

He cited many applications of electric welding at munitions factories, shipyards, and naval dockyards in this country, followed by a description of the cross-channel barge which was then in course of construction entirely by means of electric welding.‡ He also assisted in the early work of the Electric Welding Committee, which proceeded to collect data and suggestions as to the methods of applying electric

*Elec. Rev., December 6th and 13th, 1918.
†Elec. Rev., August 2nd, 1918.
‡Elec. Rev., August 9th, 1918.

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welding with the intention of ascertaining the best processes, standardising the apparatus, and considering how welding should be used to advantage in ship construction and repair. In that way much useful work had been accomplished and important facts established.

As regarded the extent to which electric welding had been utilised in the several services in America, the resistance system, including butt, spot, and line welding had already been used to a much more considerable degree than in this country, even for heavy parts. Interesting operations were viewed by him at the Schenectady works of the General Electric Co., where three-ply of 1-in. steel plates were satisfactorily welded together, and again at the Metropolitan Engineering Works, Brookland, N.Y., where shells, 9¼ in. diameter, were formed in two parts out of 2-in. steel plate blanked in presses, with the longitudinal seam butt-welded in one operation. The electric welding machines used at the latter works were of special interest, as the necessary pressure was effected with electromagnets, and although an accurate estimate of the maximum current could not be ascertained, the circuit-breaker at each machine was set for 15,000 KW.

It was noted that considerable use of arc welding by means of bare and gaseous flux-covered metal electrodes was limited to railroad shops and the manufacture of transformer tanks, besides the usual repair services. Arc welding by means of carbon electrodes was employed for minor structural work at some of the earlier shipyards, but the liquid flux-covered electrode as manufactured by the Quasi-Arc Weltrode Co. in America was not at the time of his visit appreciated to the extent it deserved; in fact, the method of applying that process did not appear to be understood by the firms who had installed equipments. The bare-metal system of arc welding had achieved much success in America, particularly in the railroad shops, where a high degree of proficiency prevailed. There were, however, certain conditions which seemed to preclude the universal adoption of any one of those methods, dependent upon the conditions of electricity supply, the equipment available, and the strains to which the welded part would be exposed whilst in service.

To attain satisfactory results with electric arc welding, it was his opinion that current regulation provided by specially-constructed machines was of almost negligible importance as compared with: Skill of the operator; choice of proper electrodes for the work in hand; current adjustment to suit the size and type of electrode employed.

Both in this country and America there had been an utter absence of any agreement as to the electrode material and the voltage conditions for obtaining the best results. He maintained that there was no notable difference in the mechanical characteristics of welds made with direct current and alternating current, although certain electrodes were much more suitable for direct-current work, whilst others gave undoubtedly better results when used with alternating current. The quality of welding work performed by alternating current was of the highest grade, and, moreover, some American authorities maintained that there were certain characteristics of the alternating-current arc which made it more difficult to do poor work than in the case of direct current.

The quantity of current employed in making the weld was of great importance. Considerable skill was required to secure a satisfactory weld with current of sufficient amount to permit penetration and fusion at the welded joint. Improved results were attained with increased current when the speed of working was greater, although more expert manipulation was required on the part of the operator.

Lower current densities were preferable with flux-covered than with bare-metal electrodes, although it was a matter for consideration whether the present figure of from 4,000 up to 6,000 amps. per sq. in. should not be considerably increased, in view of the satisfactory results obtained in America with bare-metal electrodes designed for 6,000 to 14,000 amps. per sq. in. There was a definite current at which most efficient welding could be achieved on any work. That current was determined by the heat conductive capacity of the work being welded, and was the current at which, with the operator working at his maximum speed, the metal in proximity to the arc was pre-heated to very nearly the correct fusion temperature. Below that current the operator would have to reduce his speed to get proper penetration of the deposited metal, and above it he was wasting energy heating up the work, and would run risks of burning holes right through the metal. Heat dissipating qualities were proportionate to the thickness of plate; therefore, the thicker the plate the higher the current that could be employed.

In putting forward recommendations relating to the most suitable voltage for use at the arc, Mr. H. M. Sayers had raised a point on which there were still many divergent views. One argument in favour of limiting the available voltage was to compel the operator to use more care in keeping the arc short and of nearly constant length, which was a fundamental requirement for a good weld. But he had seen good results obtained with both 40, 110, and intermediate voltages, in the same way as with the usual positive and negative connections reversed.

In the old days it was thought that anyone would serve as an electrician, and now it appeared to be the belief that any unskilled labourer would pass as an efficient welding operator. On the contrary, electric welding was a craft requiring skill which was not always obtained after long practice, although with extended training some men and women became so proficient that they were able to do the most difficult work within three months. That point should be appreciated, particularly where other than repetition work was being done. Those who had been responsible for welding undertakings realised how much successful results depended on the operator who was entrusted with the work.

Prof. C. R. DARLING suggested that the Committee should endeavour to secure uniformity as regards welding operations; there should be some definition laid down as to what constituted a good or a bad weld. It was also desirable that there should be more uniformity as to the fluxes, current, and voltage that should be used. In America spot-welding had furnished some very good results; it was not understood in this country to the same extent as it was over there, and there was still much pioneer work to be done here.

Mr. G. SCOTT RAM said that it would be extremely difficult to limit the voltage as a means of protection against shock, because no two persons were alike as to the voltage they could stand without dangerous results. He had made some experiments himself on these lines, and he had found that even with only 40 volts it was not possible to let go once contact had been made. The electrode handle was a source of danger. He had seen such handles in use to which brass ferrules and set-screws were attached; that was obviously dangerous. It would be said that the operator always wore gloves, but why should gloves be necessary if the holder was properly designed? He maintained that danger could be limited to the electrode holder as other parts could be earthed, and especially the object that was being welded should always be earthed. He had once investigated the death of a boy who had come in contact with a tank that was being welded. The tank was not earthed, and when the boy made contact he was quite unable to let go again, with fatal results, and yet the voltage between the tank and earth was only 60 volts. He thought face protection, while necessary, was a disadvantage, because the operator was not able to see properly what he was doing.

Dr. W. ROSENHAIN said that electric welding was a growing industry, and regulations were undoubtedly necessary. Regulations should be framed not only as to how to weld, but also as to what to weld and what not to weld. Referring to Mr. Sayers's suggestion that stained gelatine films could be used in place of glass as a protection for the eyes, he thought that such films would not be found practicable, because they would have a very short life; they would deteriorate very quickly. During the last 10 years or so much research work had been carried out, and glass possessing good absorptive properties was now obtainable. Sir Wm. Crookes had done some important research work in connection with glass, and there was a considerable range of glass now available that would absorb both red and ultra-violet light. In connection with protective goggles or masks, he suggested that two sheets of glass should be used, the outer sheet to dilute, and the inner one, next to the eyes, to absorb.

Prof. E. W. MARCHANT said that the question of eye protection was a difficult one, because the eyes of no two persons were alike. As an illustration, he mentioned that most people would be temporarily blinded if they looked at a bare arc even for a very short space of time, whereas he himself could look at an arc for as long as one minute without any ill-effects whatever. The same argument applied to the question of shock. He had once made some experiments on some of his students, and he found one man—a black man—upon whom an electric shock had no effect whatever. Referring to tests he had carried out with a motor-generator for electric welding, he said he had been extremely interested to watch the metal at the point of welding. The process was almost exactly similar to that of bricklaying. He also exhibited lantern slides of current and voltage curves showing the rise in pressure when the arc was broken, and the effect of putting reactance in the circuit.

Mr. W. STEEL did not think that glass was a suitable eye protection; its disadvantage lay in the fact that the operator could not see through it sufficiently clearly. He suggested the use of a V-shaped screen made up of strips of different glass, so that the operator could look through either strip as desired. It was desirable that the welder should always have one hand free, and therefore any protective device should be so designed that it was not necessary for the operator to hold it in his hand. It was necessary to have one hand free so that the operator might be able to steady himself, especially when standing on a staging. He further called attention to the defective methods of attaching leads to the electrode holder; such leads should have a long enough life to make it worth while soldering them to the holder.

Mr. A. HENDERSON agreed with the remarks made by the previous speaker; it was important to protect the eyes of not only the welder, but also workmen in the vicinity. He did not think that alternating current was suitable for use on ship work because of the difficulty of guarding against shock, especially as most workmen engaged on such work stood upon staging, and there was danger of a fall following the shock. He thought that direct current was more suitable for overhead work on ships.

Mr. T. A. SEDGWICK said that his firm were prepared to spend £20,000 to make a good start on electric welding. They had committed themselves to a pressure of 60 volts with reactance in series, but they would welcome all and

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any information that could be given on the subject. At Barrow they had succeeded in welding brass to steel quite satisfactorily, also watertight joints could be made very much more easily by means of welding. Certain jobs which formerly took 10 minutes to do were now being done in one, or even one-half a minute by welding.

Mr. A. Collie preferred the use of direct current; he thought that dangerous results from a shock at 100 volts were quite out of the question. The shielding of adjacent workmen was very important, but he doubted whether a screen could be devised that would fit into all the cramped positions on a ship where a welder was required to work.

Mr. Swift described the E. and E. magnetic arc system of electric welding; he showed lantern slides of the "Daysohms" patent automatic magnetic clutch,* and explained the advantages to be derived by the use of the same.

Mr. Markham thought that no hard and fast rules or regulations could be made. He did not think the real danger had anything to do with electric shock; it was more likely to result from the surprise at receiving a shock which would cause the operator to fall. The real difficulty lay in shielding workmen in the vicinity as a welder who understood what he was doing would also realise the danger, and would take necessary precautions. He suggested the use of reactance to keep down peaks and to steady the arc.

Another speaker took strong exception to the remarks made by the last speaker. In his experience he had found that the British workman required to be watched and nursed like a child. He did not trouble himself in the least about taking precautionary measures against any form of danger; on the other hand, he lost no time in claiming compensation when any accident did occur. Most firms insured their welders, and if they did not draw up some sort of protective regulations the insurance companies would very soon compel them to do so.

The Author, in reply to some of the points raised, said that it was most important to shield onlookers and adjacent workmen, as it was quite possible for such persons to receive serious injury without their being aware of it. It was possible, but he did not think probable, that fatal results would follow a shock of 100 volts; however, all regulations were framed to protect the weakest, and not the strongest. Referring to the use of gelatine films, his suggestion was that they should be protected with glass, and not used alone. He did not think that the short life of such films would prevent their being used, as they could very easily be renewed. He said it was not possible to procure glass through which the welder could see clearly and which at the same time would afford sufficient protection. With regard to the best colour of protective glass, in his opinion an apple green was the most effective for the human eye.

ELECTRICITY SUPPLY PROGRESS IN WAR TIME.

(*Continued from page* 585.)

SWINDON.

During 1916 the Corporation of Swindon (Mr. F. Newey, acting borough electrical engineer) installed one 300-kw. and one 500-kw. rotary converter, together with suitable switchgear, and high-pressure mains—overhead and underground—to supply a Government factory in the neighbourhood. Early this year it was found that there would be large additional requirements of power at the factory, and it was decided early in January that if the Corporation could have a new turbine running at the works by the end of April, additional plant would be installed. The Corporation agreed to get the work executed by the time mentioned. Accordingly about the third week in January the work of dismantling one of the reciprocating sets was begun, and new foundations for a turbine were prepared. The new plant installed this year consists of two 1,000-kw. Ljungström turbines, and three 12,000-lb. Babcock boilers, together with coal-handling plant, economisers, feed pumps, &c.; an additional 0.2 sq. in. high-pressure main was also laid to the factory, where transformers and additional switchgear were installed. The total rated output of the generating plant has thus been raised from 1,400 kw. to 3,400 kw.

WOKING.

Prior to the war practically all the energy sold by the Woking Electric Supply Co., Ltd. (Mr. F. Woods, resident engineer) was for lighting purposes, but soon after hostilities began munition works commenced to appear for the making of aeroplanes and engines, and practically the whole of these factories have taken their supply from the company, whose output rapidly advanced until nearly 75 per cent. consisted of power units. These are being supplied to very important works on the mains, which cover an extremely wide area, and take in many villages and small towns.

To meet the load it was necessary to install a new turbine, so one of the Brush Co.'s Ljungström type of 1,000-kw. capacity was added. The plant capacity was thus raised from 1,100 to 2,100 kw. Several large mains extensions were made, and the company supplies power to all classes of aeroplane manufacture, including the planes, engines, and the Admiralty Park where the completed machines are tested, passed, and sent abroad. Other classes of consumers include Army and Navy barracks, sponge and timber factories, &c.

* Elec. Rev., January 25th, 1918.

IPSWICH.

At the outbreak of hostilities the undertaking of the Corporation (Mr. F. Ayton, chief engineer and manager) was arranged for the generation of direct-current supply only. Orders had, however, been placed prior to the war for plant for a three-phase high-pressure supply at 3,300 volts and 50 periods, including a rotary-converter sub-station containing two 250-kw. rotary converters with their transformers. Duplicate feeders were laid to this sub-station, and thence to a couple of static transformer sub-stations, which fed a low-pressure 4-wire 3-phase network. A total of 5.45 miles of low-pressure 4-core main has been laid.

The supply was commenced by transforming from d.c. through the medium of a 312-k.v.a. rotary converter and transformer working inverted. As a stand-by, the 220-kw. d.c. generator was removed from one of the Reavell engines, the engine was altered to give the required frequency, and a Westinghouse alternator of 240 k.v.a. was fitted. The whole of the rotary-converter plant was supplied by the British Westinghouse Co.

The power station high-pressure switchboard and the sub-station switchgear had been ordered before the war broke out from the firm of Voight & Haeffner (England), Ltd. This firm was subsequently taken over by the Switchgear Construction Co., who completed the contract.

The high- and low-pressure three-phase cables were ordered before the war from the Ateliers de Constructions Electriques du Nord & de l'Est. They were manufactured at their Jeumont (France) works, and the first batch of cables was got away safely. This place, however, being close to Mons, and on the borders of Belgium, was shortly after the outbreak of war taken possession of by the Germans, and the last heard of the second batch of cables intended for Ipswich was that the drums containing them were being used for barricading roads by the German army. The cables needed for completing the scheme were obtained from Messrs. Johnson & Phillips, Ltd.

The three-phase supply was commenced at the end of March, 1915, and very shortly after Messrs. Ransomes, Sims and Jefferies began taking a supply they found it necessary to apply for a much greater amount of power. Consequently a 500-kw. rotary converter and transformer were ordered from the British Thomson-Houston Co. for the sub-station, and a 500-kw. rotary converter and transformer, arranged to run inverted, from the General Electric Co. for the power station. The switchgear was provided by the British Thomson-Houston Co. This additional plant has been running fully loaded for the last 18 months of the war.

The power station was soon taxed to its utmost. The total available capacity for meeting the outside demand was about 3,300 kw. Last winter the maximum demand was well over 2,800 kw. Considerable trouble has, however, been experienced with the plant due to frequent breakdowns of turbines and their dynamos, and the failure of the reciprocating plant, due to wear and tear and the impossibility of executing repairs by the time needed. This undertaking has also suffered each winter from shortage of boiler power and the deterioration in the quality of the coal. In November, 1917, a new boiler with a normal rating of 18,000 lb. of steam per hour was ordered from Messrs. Babcock & Wilcox; this boiler, which was promised for completion by the end of July, was only got into commission the last week in November. Owing to the overloaded condition of the plant, the five dry-back marine-type boilers have not been properly cleaned and overhauled for over a year, while the large marine-type Babcock boiler has not been properly cleaned and overhauled since Easter. The consequence is that efficiency has seriously fallen off, and the staff has had a most anxious time. While the output of the power station for the year ending March 31st, 1914, was 2,829,000 units sold, that for the year ending March 31st last was no less than 6,797,400 units.

The Corporation has placed orders for extension plant totalling £43,000, the scheme including the installation of a 3,750-k.v.a., Brush-Ljungström, three-phase turbo-alternator. An order has also been placed with the British Thomson-Houston Co. for a 1,500-kw. rotary converter to work inverted and provided with an automatic control induction regulator. The British Thomson-Houston Co. has also received the order for the extension to the power station switchgear. The installation of the new turbine plant necessitates an extensive scheme of new circulating water supply and discharge pipes. Provision is also being made for eventually dealing with three turbine sets, each having an output of 3,750 k.v.a. A vertical-spindle turbine type pump driven by a 120-b.h.p. Laurence, Scott motor has been ordered from Messrs. Gwynnes, Ltd., and a rotating disk screening gear from Messrs. F. W. Brackett & Co., of Colchester.

TWICKENHAM AND TEDDINGTON.

Prior to the war the Twickenham and Teddington Electric Supply Co. (Mr. M. Farrer, engineer and manager) gave a d.c. supply only, with the exception of a small three-phase lighting load in one or two outlying districts. The plant

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capacity was then 1,180 KW. in reciprocating sets. During the war the company installed two 100-KW. turbines, and is now completing a further 2,000-KW. turbine extension. Some 24,000 yds. of H.T. and E.H.T. mains have been laid to supply the new factories which have sprung up in the district, and which include a shell factory taking a maximum of 900 KW. and an aircraft factory taking a maximum of 300 KW. The supply given before the war to the National Physical Laboratory has also been greatly extended.

A special feature at Twickenham has been the number of small factories and workshops started in any sort of building which could be found, and employing from 16 to 20 men. Most of these small firms are Belgian.

The company's output has increased very largely; in 1913 2¼ million units were generated, which increased in 1917 to 8 million units.

It is difficult at present to estimate the future prospects. The use of electricity for power purposes has been given an impetus during the war, which is bound to have a permanent effect; on the other hand, the war industries are shutting down, and it remains to be seen whether a residential district with few industrial advantages will be able to obtain a share of the engineering work of the future in competition with the recognised industrial areas. Up to last spring the heating load was developing satisfactorily, but for the time being it has been crippled by the Household Fuel and Lighting Order.

STOCKPORT.

The Corporation of Stockport (Mr. R. Lomax, borough and tramway electrical engineer) inaugurated its A.C. supply in 1913, when the first 2,000-KW. turbine was installed. A second 2,000-KW. turbine was installed in 1914, and one of 5,000 KW. in 1916. An additional 5,000-KW. turbine is now about to be delivered. This should have been installed 12 to 18 months ago. Also two additional boilers were installed in 1914, two more in 1915, and a fifth in 1917. The annual output has risen as follows:—

Year ended March 31st, 1913	... ...	6,241,063 units.
,, ,, 1914	... ...	7,493,204 units.
,, ,, 1915	... ...	9,179,595 units.
,, ,, 1916	... ...	15,134,461 units.
,, ,, 1917	... ...	20,002,983 units.
,, ,, 1918	... ...	24,500,598 units.

Applications for textile industries have been refused to the extent of 6,000 to 7,000 KW., and owing to the lateness of delivery of boilers and generating plant on order supplies have had to be considerably curtailed to less important industries than those engaged on work of the highest national importance.

(To be continued.)

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sexton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

19,844. "Device for electrical illumination for theatrical effect, &c." T. H. Rochford. December 2nd.

19,846. "Lamp locking nut." F. W. Gardiner. December 2nd.

19,853. "Electric cookers." G. Wilkinson. December 2nd.

19,873. "Electrical apparatus." C. H. Plyton. December 2nd.

19,877. "Telegraph pole mortising and boring machines." E. Tuckett. December 2nd.

19,896. "Method of selecting and intensifying sound waves." L. Barlow. December 2nd.

19,906. "Control of electric supply plant." W. J. Branson & H. J. Read. December 2nd.

19,913. "Electrical control apparatus." A. J. Roberts. December 2nd.

19,955. "Electrical equipment of motor vehicles, boats, &c." W. A. Cocking & W. E. Hean. December 3rd.

19,957. "Sparking plugs for internal-combustion engines." B. Carter, J. Suckling & W. Suckling. December 3rd.

19,995. "Electro-vaporisers and heaters." Electric Steam Radiator Co. December 3rd. (U.S.A., November 30th, 1917.)

20,004. "Wireless receiving gear." British Thomson-Houston Co. and R. C. Clinker. December 3rd.

20,027. "Dynamo-electric machinery." V. Mallalieu. December 4th.

20,044. "Washer for sparking plugs, &c." J. E. Barrows. December 4th.

20,068. "Overhead electric trolleys." J. Ford & E. H. Jackson. December 4th.

20,069. "Sparking plugs." A. E. Lamkin. December 4th.

20,090. "Continuous feed for arc lamps." A. D. Standeford. December 4th.

20,109. "Electric relays." G. McAlpine. December 4th.

20,110. "Electromagnet wave signalling systems." J. Erskine-Murray. December 4th.

20,122 "Electromagnetic measuring instruments." F. J. Green. December 5th.

20,131. "Sparking plugs." W. H. Harris. December 5th.

20,135. "Means for obviating risks due to failure of insulated joints, &c." A. R. Angus. December 5th. (Sweden, December 5th, 1917.)

20,168. "Electromagnetic apparatus." E. S. Carey. December 5th.

20,170. "Automatic switches, circuit systems, and operating methods." D. S. Hulfish. December 5th. (U.S.A., December 8th, 1917.)

20,177. "Brakes for electrically-propelled vehicles." P. A. H. Mossay. December 5th.

20,178. "Electrically-propelled trucks, tractors, &c." P. A. H. Mossay. December 5th.

20,184. "Screw-nut for securing shade, &c., on electric lamp fitting." L. G. Flory. December 5th.

20,187. "Appliance for progressive heating of liquid by electric resistance." H. Wintle. December 5th.

20,189. "Ignition systems for internal-combustion engines." A. H. Midgley & C. A. Vandervell & Co. December 5th.

20,209. "Lamp telephone relays." M. Latour. December 5th. (France, December 5th, 1917.)

20,226. "Electric motor controllers." W. Rogers. December 6th.

20,235. "Giving constant number of revolutions to a dynamo for giving steady electric light on vehicles." N. Olechnovitch. December 6th.

20,241. "Metal work for assembling and fixing conduits of non-circular section in electrical installations." L. Joubert. December 6th.

20,254. "Manufacture of electric dynamos and motors." T. L. R. Cooper, A. Lyon & Wrench, and J. C. Todman. December 6th.

20,255. "Electric apparatus." A. Lyon & Wrench & A. Willmott. December 6th.

20,258. "Electric magnetic apparatus for protecting pneumatic tires." G. Odierno. December 6th.

20,266. "Thermostatic circuit-controlling devices." American Fire Prevention Bureau Inc. December 6th. (U.S.A., February 8th.)

20,267. "Ignition systems." Dayton Engineering Laboratories Co. December 6th. (U.S.A., December 15th, 1917.)

20,279. "Circuit arrangement for reduction of static interference in radio-receiving stations." Western Electric Co. (Western Electric Co., U.S.A.) December 6th.

20,285. "Means for supporting overhead conductors on railways, tramways, &c." E. H. Whittall. December 6th.

20,289. "Electric switches." C. A. W. Hultman. December 6th. (Sweden, December 11th, 1917.)

20,312. "Locking out disengaged levels on electrical signalling systems." M. O. Myers & R. C. Robson. December 7th.

20,330. "Electrical ceiling roses, &c." W. Holt. December 7th.

20,335. "Turbine electric driving-gear." F. Foster. December 7th.

20,374. "Apparatus for hardening and tempering metal wire by electricity." A. Imbery. December 7th.

20,375. "Electric muffle furnaces." A. Imbery. December 7th.

20,378. "Electric metallurgical furnaces." W. E. Moore. December 7th.

20,379. "Armatures and pole shoes of magnets." L. de M. G. Ferreira. December 7th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

14,561. Magnet coil windings, specially applicable to field coil windings for dynamo-electric machines, transformers, and the like. Lancashire Dynamo & Motor Co. and H. B. Whitmore. October 8th, 1917. (120,593.)

15,076. Electrodes of secondary batteries. E. F. Ablitt, B. de Q. Quincey & A. J. Adams. October 17th, 1917. (120,598.)

16,238. Electric fuses. V. Hope. November 7th, 1917. (120,600.)

16,317. Means for controlling the electric lighting of motor vehicles. W. Curtis. November 8th, 1917. (120,602.)

16,361. Supports for telephone receivers. M. Weil. November 8th, 1917. (120,436.)

16,394 Galvanic batteries. G. Oldham & J. Oldham. November 8th, 1917. (120,439.)

16,425. Railway signalling and high-frequency selective devices for use in connection therewith. McKenzie, Holland & Westinghouse Power Signal Co. (Union Switch & Signal Co., U.S.A.) November 9th, 1917. (120,441.)

16,434. Cooling arrangements for dynamo-electric machinery. Lo-Thermo Patents, Ltd., B. Longbottom & E. Greenhalgh. November 9th, 1917. (120,605.)

16,507. Electric furnace. C. H. von Baur. November 10th, 1917. (120,444.)

16,645. Electrolytic gas generators. I. H. Levin. November 18th, 1916. (111,483.)

16,763. Magnetic apparatus for indicating verticality and orientation in inclined bodies subjected to centrifugal force. J. T. Clarke. November 15th, 1917. (Cognate application 7,244/18.) (120,625.)

17,014. Construction of electric collectors. Soc. Anon. des Etablissements L. Bleriot. November 20th, 1916. (111,847.)

17,364. Electric switches. G. Tua. November 24th, 1916. (111,851.)

17,450. Electric switches. G. Tua. April 4th, 1917. (Addition to 17,364/17.) (114,615.)

17,470. Engine starters. V. Bendix. November 26th, 1917. (120,465.)

17,699. Electrically-operated riveting, pressing stamping, and the like machines. E. Adamson. November 30th, 1917. (120,651.)

17,775. Rotors for dynamo-electric machines. Vickers, Ltd., & S. F. Barclay. November 30th, 1917. (120,653.)

19,063. Spring terminals for electric accumulators. Fuller Accumulator Co. & A. P. Welch. December 24th, 1917. (120,479.)

1918.

480. Telephone systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co. U.S.A.) January 8th, 1918. (120,483.)

600. Manufacture of electric cables. C. J. Beaver & E. A. Claremont. January 10th, 1918. (Addition to 4,808/17.) (120,485.)

1,804. Sparking plugs for ignition purposes. A. E. Heath. January 31st, 1918. (120,492.)

2,089. Systems of electrical distribution. British Thomson-Houston Co. (General Electric Co., U.S.A.) February 5th, 1918. (120,677.)

2,164. Controllers for electric motors. J. C Kelso. February 6th, 1918. (120,495.)

2,208. Removable electrical fuse-carriers or connecting devices. British Insulated & Helsby Cables and L. B. Wilson. February 7th, 1918. (120,678.)

2,384. Electric cells. C. Fery. February 9th 1918. (120,681.)

3,840. Electric cells and batteries. R. S. Baxter. March 5th, 1918. (120,689.)

4,120. Heating conductors of thermic telephones. P. de Lange and Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. March 8th, 1918. (Patent of addition not granted.) (120,507.)

8,084. Sparking plugs. J. M. E. Franc. May 14th 1918. (120,519.)

8,242. Protection means for terminals of electric batteries. A. H. Sheppard & British Ever-Ready Co. May 16th, 1918. (120,521.)

Electric Welding on Concrete Ships.—Electric welding has recently been introduced in British concrete ship-yards with satisfactory results for connecting various members of the reinforcement as an alternative to the use of wire ties. The welds are very quickly made and hold the bars so firmly in their final positions that the blocks, wedges and distance pieces otherwise necessary can be entirely eliminated.—*Steamship.*

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THE

ELECTRICAL REVIEW.

VOL. LXXXIII. DECEMBER 27, 1918. No. 2,144.

ELECTRICAL REVIEW.

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TO "ELECTRICAL REVIEW" READERS.

Owing to the continued increase in the circulation of the ELECTRICAL REVIEW in recent months, an increase which has become accelerated since the signing of the Armistice, we cannot guarantee that casual copies will be available. The only way to make sure of securing a copy regularly as issued, is to place a definite order with a newsagent, or else to subscribe direct to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

GREATER LONDON'S ELECTRICITY SUPPLY.

THE habit of reporting on the Board of Trade Committee's Report on National Electricity Supply seems to be infectious; to-day we publish an abstract of a report drawn up by the Conference of Local Authorities in Greater London. This Report is addressed to no specified quarter, but presumably is intended for the edification of the local authorities and others concerned in this great question, and of the Government. Like the report of the I.M.E.A., on which we commented last week, but unlike the memorandum of the N.E. Coast municipalities, it endorses the broad principles laid down by the Board of Trade Committee, especially that which urges the necessity of immediate action, upon which we have repeatedly laid stress.

The Conference, it is true, declines to take the Committee's condemnation of the existing system of parochial administration without a protest, advancing the extraordinary contention that but for the nursing of the infant "Electricity Supply" by the large number of separate authorities which shared the duties of its foster-mother, the babe would never have attained to its present "perfected" methods! The Report says:—"It behoves the nation to-day to review the mistakes of the past not in the light of wasted capital, but of experience purchased at a cost from which ample profit will accrue in the future." We are then, to understand that it is to the multiplicity of the errors thus admitted by implication that the industry owes its present state of grace; the more the errors, the quicker the progress. This is an obviously fallacious theory, more especially when it is remembered that of all authorities, the municipality is the most timorous and the least inclined to adventure on any departure from the stereotyped pattern. We speak with knowledge when we say that, as a rule, with rare exceptions, such progress as has been made by municipal suppliers has been due to the large undertakings, and in very many cases could not possibly have been contemplated by the smaller ones which make up the vast majority. Take, for instance, the adoption of three-phase transmission and distribution, an essential feature of the "perfected methods" of to-day; was this developed by a small undertaking? Was it developed by any municipality before it had been developed by companies? Or was it even of British origin? The reply is in the negative in each case. Again, take the adoption of high pressure, such as the 30,000 volts which Manchester is standardising; what aid could this derive from a multiplicity of small undertakings? As a matter of fact, it was the great North-East Coast combination that led the way in this direction by adopting 20,000 volts. Or take the question of steam turbines—were these tried out by small municipalities? Not a bit of it. The claim is a preposterous one; on the contrary, the excessive subdivision of supply areas not only immensely retarded technical progress by damping initiative and enterprise, but also handicapped our manufacturers for long years by depriving them of the opportunity to develop

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large schemes and plant, so that they lost the long lead which they at first possessed over all other nations, and it also throttled the infant industry by the low salaries paid—and *paid to this day*—to the station staffs in municipal employ. Whoever penned that astonishing claim displayed colossal ignorance of the history of the electricity supply industry in this country and abroad. The biggest of all the "mistakes" was the excessive sub-division of supply undertakings.

The scheme put forward by the Conference is to establish a purely Municipal Board for Greater London, armed with the powers with which other District Boards would be endowed in accordance with the B. of T. Report. That is the gist of the matter; the remainder of the Report consists mainly of argumentation in support of the proposal, and in opposition to any scheme which may contemplate a measure of compromise with the companies which have borne the burden of pioneering electricity supply, and are guaranteed by Parliament in the retention of their concessions for periods laid down by statute. Clearly, therefore, this Report is intended to undermine the plan which was favoured by the London County Council just before the war, and we may take it that the Conference, on which the L.C.C. has no representation, has thrown down a challenge to the L.C.C and the companies alike. It is rightly agreed that electricity supply, to be economically carried on, must be dealt with as a monopoly; and the Conference means to have the control of that monopoly. There is the usual dig at the North-East Coast companies, and a cry of alarm at the suggested threat of the establishment of one of those "trusts" which, it is admitted, are as yet "*foreign to British industry.*" The recommendation of the B. of T. Committee that large consumers should have representation on the District Boards proportional to their payments is represented as a temptation to the large manufacturing groups to acquire control of the District Boards and put up the prices against themselves—surely a puerile suggestion.

The statement that the B. of T. Committee proposes to scrap the existing machinery wholesale is a groundless allegation, as the I,M.E.A. pointed out; it is utilised to support a scheme for public heat supply with electricity as a by-product, and this leads the Conference into an entanglement with the housing schemes of the Reconstruction Committee, into which we need not follow it; neither need we discuss the Conference's competence to deal with agricultural requirements. Had its Report been confined to the statement of its *conclusions*, we should have found little to criticise in it, for we are in agreement with most of them. It is an undeniable fact that company supply in London has made a very poor showing in comparison with municipal supply as regards the cost to consumers; we have not now space to inquire into the reasons for this condition—there is no doubt that there is a good deal to be said in mitigation of the fact—but fact it is, nevertheless. The estimated requirements of Greater London at a date only indicated as "ultimate," which amount to about ten times the present consumption, deserve attention which we cannot now give them, and we must conclude with the remark that the Conference's conclusions, sound in the main, would have been much stronger if most of the long-winded preamble and fallacious arguments had been omitted.

Nationalisation of Industrial Works in Germany.

Dr. Walter Rathenau, of the A.E.G., who has had much to say about Germany as well as Great Britain and her Allies during the war, has been exceptionally reticent concerning the international situation, or even that of Germany, since the so-called revolution in that country and the conclusion of the armistice. He has now appeared in print again, as reference to our "Notes" pages to-day will show. He is also appearing in a new *rôle* as one of the members of the Commission appointed by the "National Commissioners" to prepare an expert report as soon as possible on the question as to which industrial works should be first expropriated by the State. The other members of the Commission are Prof. Ballod, Prof. Ernst Francke, Dr. Lederer (private coach), Dr. Vogelstein, Dr. Rudolf Hilferding, Karl Kautsky, Heinrich Cunow, and Otto Hué, the last of whom appears to be one of the coalminers' leaders. It is not quite obvious why one of the champions of private enterprise, as represented by Walter Rathenau, should have been chosen to report against private ownership. This is, however, not very material for the moment. What is of importance is the scheme of nationalisation in itself, and on this point we cannot do better than quote from a statement made towards the end of November by Hugo Simon, then Prussian Minister of Finance.

Hugo Simon states that the fact that the "Government" have appointed a Special Commission, in which are prominent national economists who are men of practical economic life and science, proves that experiments as made in Russia are to be avoided in Germany. The object is to examine which undertakings are ripe for nationalisation, and the Commission will then submit proposals to the Government, who will presumably act accordingly. Special importance is attached to the fact that no interruption in activity is to take place through transfer to the State, and the highest aim will be to substitute a well-considered system for the existing unrational method of working. As a personal opinion, Herr Simon remarks that only works which are ripe for nationalisation will be acquired. No clearness exists for the time being as to whether the properties will be vested in the State and the actual working entrusted to the former owners, or whether special syndicates will be formed which will be under State supervision; and it is also possible that entirely new forms may be found. The scheme of nationalisation would apply to the arms and munitions industry, and the supply of electricity, whilst all monopoly products—such as coal, potash, &c., would belong to the general community under any circumstances, together with the cement and brick industries. Even in the case of the merchant trade, certain forms are considered to be of utility to the community, whether in the shape of merchant monopolies or of special State and distribution departments; and in this connection the chemical industry is quoted as an example. It is only intended to nationalise those undertakings which have the certain prospect of yielding profits.

The question of the purchase price of the industrial undertakings is also raised by Herr Simon, who, as will have been gathered from the preceding extracts, is himself a Socialist. But preparatory to expressing himself on the matter of expropriation, he mentions that an accompaniment of nationalisation will be a just distribution of payment. "The large salaries of leading persons," he says, "will be able to fall without danger for the efficiency of the undertakings, in favour of workmen and officials being better paid." The undertakings are not to be confiscated, merely expropriated; although no plans exist at present as to how this will take place. It is thought, however, that compensation will have to be fixed in each individual case; neither the book value nor the Stock Exchange quotation can come into consideration, but solely the value which the undertakings would possess as State property. It is suggested that when the values have been fixed, a nationalisation loan should be floated, so as to provide the means for carrying out the programme, and the shareholders would receive certificates of this loan in exchange for their shares on the basis of the price value of the latter to the State. It is further suggested that the certificates, instead of being handed to the shareholders, might, perhaps, be deposited at an official depôt, in order to prevent a flooding of the market and a depression of the loan quotations, and the migration of the loan to other countries. On the other hand, it would be possible for holders to realise their certificates on making application to the official depository.

The internal situation in Germany is so chaotic that it is impossible to foresee whether the nationalisation scheme has any prospect of being actually carried into effect. At any rate, if the scheme should come to maturity, the leading industrial interests in Germany will only have to thank themselves for the disaster they have brought upon themselves by fomenting the war.

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RUHLEBEN—A FINAL SURVEY.

By W. E. SWALE.

Ruhleben Camp is—for Englishmen at least—a thing of the past. Amidst the joys of home-coming, and the blessed charms of a re-discovered civilisation, the memories of those four long years are rapidly fading away, and will soon be but a nightmare fancy. Before forgetfulness finally draws the veil over this most painful period of our lives, it may be worth while to record—for the first time uncensored and unrepressed—some of the work achieved by British Engineers at Ruhleben.

Of the "Technical Circle" mention has already been made in the Review. This very active body of engineering enthusiasts kept its colours flying until the very end, being dissolved only a few days before our repatriation commenced. Ninety-four meetings had been held in all, and a whole host of technical subjects, ranging from wireless telegraphy to electric heaters, from the metric system to scientific workshop organisation, had been exhaustively discussed. A very useful asset to our fund of knowledge was made by the advent of the last Chairman (a director of one of our leading electrical firms), who was captured in the Channel as late as August, 1916, and who was the only one—barring a few recent arrivals from Russia and Australia—who could give us first-hand information about the wonderful work of our colleagues at home. The "Technical Circle," having well fulfilled its object, was disbanded; but many of the members will keep in close touch with one another. The late secretary has a list of the names and addresses of the 120 odd members of the "Circle."

The contemporaries of the T.C.—the local branch of the Marine Engineers' Association—numbering about as many members, were likewise very active, and their work has often been mentioned in the *Journal* of the M.E.A. Several chief engineers—some possessing extra-chief certificates—assisted by trained scientists, organised classes to prepare younger colleagues for the B.O.T. examinations, and a number of junior engineers did excellent work in many technical classes. Not only have the studies pursued in the Camp given them a thorough grounding in the theory of their work, but the B.O.T. officially recognises the value of this study by dispensing with three months of the necessary period of sea-going experience. A large number of marine engineers further pursued the fascinating hobby of model-making.

Apart from such "circles," engineers did a considerable amount of systematic study in the Camp School. A number of professional men and scientists co-operated in running an "Engineering Section," and classes were held, of which many worked progressively upwards from elementary to Intermediate and B.Sc. standards. The subjects taught included mathematics, physics and chemistry, theory of electrical machinery, heat engines, efficiency of prime movers, electrical testing, practical surveying, ferro-concrete structures, &c. As time went on we gradually built and equipped biological, physical, and chemical laboratories. A typical piece of work may be cited as an example of the ingenuity of some of our experts. The "Woollen and Worsted Circle" had for many months been weaving little carpets on an automatic loom of original design, built from scrap material found in the camp, and fed by wool which was laboriously collected from the dustbins in the form of old socks, mufflers, &c. Before use the wool was washed and combed, and, where necessary, dyed with dyes made in their own laboratory by dye experts.

It may not be generally known that the work of the School was officially recognised by many educational authorities at home, who, in a commendable spirit of enterprise, allowed public examinations to be held in the camp. At three different examinations some two dozen students passed the Matriculation Examination of the University of London; and five science students, pursuing their studies further, subsequently sat for the Inter. B.Sc. Examination of London. The writer thinks that this case of students passing University examinations whilst interned in an enemy country is unique,

As a branch of the engineering section, practical classes (with actual working machinery) were held in motor-car driving and kinema operation. Of less importance, perhaps, from the scientific point of view, but certainly of greater general interest, were the many examples of work classed under "Handicrafts." The school had a special section where organised instruction was given in bookbinding, leather and silver work, boat building, and cabinet making. Many beautiful examples of such work will shortly be on view at the Ruhleben Exhibition in London.

But the most amusing examples of resourcefulness, and sometimes almost perverted ingenuity, were to be found among the people—often unorganised and untaught—who "made" things, usually with the meagrest of appliances, simply for the joy of making. The construction of "fat-stoves" offered the first outlet for really inventive genius. In the early days it was impossible to obtain a hot meal otherwise than by cooking it illicitly in one's own box (a procedure which was, of course, "strengstens verboten," and for that reason, universally adopted). The original "Tommies' Cookers" we received in parcels were quickly modified to burn sardine oil, &c., and from these rude beginnings innumerable "patent" cookers developed. Some of the elaborate cooking ranges we built, with multiple-wick burners and using oil, candle-ends, or rancid margarine were really triumphs of the amateur tinsmith's art. Constant fear of raids on cookers—detection resulted in severe punishment—led many inventors to elaborate what one would nowadays call "mystery" designs, in which a complete cooker was disguised as a peaceable "billy-can."

The cooking question solved, the attention of experts was turned to lighting problems. The totally insufficient lighting of most parts of the camp was one of our greatest hardships, and as no representation on our part would induce the authorities to alleviate our situation, we took the law into our own hands. The daylight supply was first tampered with. Men living for months in the lofts, in semi-darkness, grew desperate, and fitted glazed skylights into various roofs—with dire results to the unfortunate man who first got caught. But the precedent had been established, and henceforth "day-light" stealing was indulged in in many dark corners. At night conditions were still worse, and in consequence, as soon as we had extended our "underground" communications to such an extent that contraband, like copper wire and insulating tape, could be smuggled in, wire-tapping from the barrack mains became a common procedure. Little transformers—220/8 volts—were designed and built in large numbers, and many men in the lofts soon had their private lighting installations, using the 2- or 4-c.p., 4-volt lamps, which fitted the standard accumulators we were allowed to buy.

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Needless to say, these installations were likewise most carefully "camouflaged." The effects of this rapidly increasing "secret" load were of course felt in a general drop of pressure all over the camp, which did not tend to improve the illumination of public space; and when it was discovered that the "perverted" genius referred to above had evinced itself in the shape of an electric toaster and an electric bed-warmer, public opinion rose loud in protest, and cut off the undesirable consumer.

The theatre and kinema, of course, afforded work for electricians, and ingenious devices, such as illuminating switchboards, "dimmers," &c., were constructed there. But the finest example of perseverance and ingenuity in the use of the unpromising material available was shown by the work of electrical and marine engineers in the school compound, foremost among them a man whose name, before the war, was well known to Review readers. The first thing to be built was a 50-watt, 220/16-volt transformer, which was run on the three-wire system, to illuminate the workshops. Several little rotary-converters and D.C. motors were then constructed. For charging up the accumulators used in the laboratories, a simple rotary switch gave excellent results. The climax was reached in a ½-H.P. motor-converter, which was designed to be ultimately used in a lighting set for a car. At a science exhibition recently held in the School laboratories, a complete cycle of transformation, demonstrated with home-made machines, excited great interest. The A.C. supplied to the camp from Spandau Works at 220 volts and 50 cycles was transformed down to 16 volts and converted, by means of a 2-pole synchronous switch, into a hybrid direct-current. This current actuated the motor-converter, which, in its turn, fed a bank of lamps from its A.C. side. Every link in this chain was made in the camp, even down to the end-shields of the big motor, which were cast from an alloy of brass and aluminium scrap, and zinc that had been "obtained" from neighbouring roofs. Many pounds of meat and biscuit tins, as a matter of fact, were converted into dynamo-plates in this department.

Prisoners—like schoolboys—delight in things that are forbidden. Many and wonderful were the methods by which materials and implements necessary for our work were smuggled in. The writer well remembers the pleasure expressed by electrical men on first seeing the Electrical Review in camp, just before Christmas, 1915. In response to repeated, carefully-worded hints, the first copy had essayed the perilous journey, and had safely arrived —cunningly concealed in the false-bottom of a food parcel. For 12 months it continued to arrive in this manner, and only then did we succeed in getting technical papers through the ordinary post. Our thanks are very largely due to the columns of the Review for what we could do to keep abreast of matters electrical.

These brief remarks give but a sketch of the activities of engineers in the camp, but they indicate the nature of the work we tried to carry on. The difficulties in the early days were great, for our captors deliberately hampered our attempts at organisation for purposes of self-improvement. *All* that we eventually possessed we procured, and paid for, ourselves. Then indeed, when the work had been done, our captors would, almost daily, bring round visitors and try to impress them with what Germany had done for the welfare of its prisoners. But we knew better. Even we—who lived so long, on that little island, as it seemed, of Ruhleben—cut off from the world, and isolated by the sea of strife and bloodshed that raged around us—learned lessons from the war. Not the least valuable of these is that we gained a fuller appreciation of one of the secrets of our national strength. The versatility and resourcefulness of the Britisher, left to himself, is in truth amazing.

THE COMING OF OIL FUEL.

By C. M. BENNETT.

It is more than probable that had it not been for the great war, the utilisation of liquid fuel in conjunction with solid fuel would have made as great a step forward in boiler-house practice as did the adoption of mechanically-fired grates over the somewhat crude method of hand firing.

Every branch of science has its milestones of progress, and although some of these are indistinctly marked, green with age, and too often seem more in the nature of resting places than witnesses of progress, the oft-times tedious distance between the last left and the one ahead is eventually overcome.

Hand firing and the use of Welsh coal was the rule, the mechanically-fired grate and bituminous coal the exception. The reason for this was largely due to the fact that boiler-house conditions were not sufficiently studied, the science of combustion did not really interest the electrical engineer, and the use of Welsh coal made the top of the chimney stack appear as if that science was thoroughly understood, and being given the necessary attention.

The great difference in price between the Welsh coal and the bituminous coals was undoubtedly the cause of the examination into the problems of combustion, the conception of properly designed combustion chambers, and the use of mechanical stokers. And with this great advance, for it certainly was such, the general conditions of the boiler house greatly improved, and it can be said that a considerable amount of thought was transferred from the engine house to the boiler house, to the benefit of electrical power production and economy.

The time had arrived then, when things began to settle down with the general use of bituminous coal, and mechanically fired grates.

Although the production of smoke had by no means been overcome, the required conditions were being more and more understood and studied. The demand for small bituminous coals had its effect upon the price of such coal, for whereas in the early days of mechanical stoking in electrical power houses, small coal was abundant, the greater use of such devices brought about a scarcity of coal, and a large increase in price.

This increase in price more than ever brought about a careful study of conditions with a view to further improving the economy of the boiler house, and the saving of fuel.

To those who carefully studied the boiler house conditions, both during a steady demand for steam and a sudden demand for steam during fog periods, it was apparent that there was still something wanting, some addition to the mechanical stokers, to make the whole system of steam raising more elastic.

There are many conditions which make a mechanically-fired boiler sluggish at the very time when its best results are required of it. There are times, owing to the furnace condition as regards temperature, when nothing can be done to get that ready response to steam requirements out of the mechanically-fired boiler.

It is at such times as these that some simple apparatus is felt to be wanting to establish those conditions which will at once make the mechanically-fired boiler the perfect piece of apparatus that it is desired it should be.

This wanting auxiliary to the mechanically-fired boiler can be at once found in the oil-fuel burner, but although this simple piece of apparatus has long been known, it is only quite recently that power station engineers have looked into its possibilities as an auxiliary to mechanical apparatus for the burning of solid fuel.

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Just before the war many experiments were being made along the lines of employing oil fuel burners in conjunction with mechanically-fired boilers, and it was noted that not only lower grades of fuel could be burnt, which were otherwise considered useless, but that even with the higher grades better and more perfect conditions were at once established.

If a boiler was hard pressed, due to conditions of combustion not easily corrected at the time, the putting into operation of the oil fuel burners almost immediately rectified matters, and during sudden demands for steam, and even peak loads, the use of oil fuel burners prevented other boiler units being put into operation, just the little extra meeting the demand. In cases where the boiler setting does not give the advantage of adequate combustion chambers, the auxiliary oil fuel burners are of great value, improving as they do the conditions for perfect combustion, and igniting the volatile gases which would otherwise be wasted.

The above remarks show promise that the efficiency of steam-raising plant can be improved by some auxiliary apparatus in the form of oil fuel burners, especially when the furnace conditions are bad, or when the fuel delivered to the hoppers is of an inferior grade. But there are many instances in the best operated boiler-houses when the addition of oil fuel burners would add greatly to the general economy of the plant, and vastly assist in getting the utmost out of the plant, reducing the quantity of combustible matter dumped into the ash pits and enabling a cheaper class of fuel to be used.

Auxiliary oil fuel burners for mechanically-fired boilers can be of a very simple nature, and the whole apparatus requires little or no attention. It is there to be used if the conditions warrant its use, and when these conditions do exist those who have had the advantage of the use of this simple auxiliary apparatus can appreciate its value to the utmost degree.

This milestone of progress has now been reached, and it will not be long before this very necessary and simple supplementary apparatus to coal-fired boilers will be found in every modern boiler house.

It is to be hoped that progress along these lines will now be made, and that the work stopped by the war will again be taken up. The combustion of oil fuel and coal may even mean a great reduction in the weight of mechanical chain-grates, for small grates can be used if the boiler is provided with liquid fuel burners.

The saving of coal and its more perfect combustion is the goal towards which the attention of power house engineers should be directed.

LOOKING AHEAD.

By "SWITCHGEAR."

Now that the war is over, or, at any rate, the armistice signed, it would be wise for electrical manufacturers to consider their post-war programmes, if they have not already done so, with a view to securing trade on a grand scale for this country.

There are many large and reputable firms in the country who manufacture electrical gear; there are also many small firms who turn out good-class work, and it is up to all of them to get their shoulder to the wheel and secure the big trade which undoubtedly will come very soon.

About 20 years or so ago, electrical engineering was more or less in its infancy, for the simple reason that very little was known about it; but as each year has passed, those who have been continuously connected with the business have noticed that rapid advancement, both in designs and manufacture, has been effected.

There is no doubt that "British manufactured" electrical gear is "real stuff," and it is the object of this article to impress upon manufacturers the necessity of still continuing to manufacture good and substantial gear. By their so doing, the users of the goods will be induced to "come again," and it is the repeat orders which pay.

One thing in particular must be borne in mind. When electrical gear is installed, be it generators, motors, switchgear, cables, &c., the customer expects it, and has every right to expect it, to work with little or no trouble, and to attain this end manufacturers should see to it that their wares are perfect and substantial in every respect, and absolutely "it."

With regard to manufacture—"specialisation" and "standardisation" are the words which the manufacturer should bear in mind for his post-war work; for if we Britishers are to have our share, we shall have to look after production on an extensive scale.

During the war—to take one example only, viz., aeroplanes complete with their engines—as everyone should agree, this country has excelled in production and supply. The huge number of machines could not have been completed had it not been for standardisation, specialisation, and mass production. The manner in which hundreds of small firms have specialised on small parts has been simply amazing. With electrical gear it is equally essential, if we are to secure the trade, to specialise and standardise, for by so doing manufacturers can turn out large quantities of what may be termed "units," such as a range of generators and motors (up to a certain size), a range of motor starters, panels, knife switches, various ranges of cable fittings, connectors, &c. In this way they can utilise a good share of the female labour which, during the war, has been employed on munitions; also, it will be possible to buy large quantities of raw material at reduced prices, and thus place on the market large quantities of goods which can be delivered from stock.

In pre-war days consulting engineers and users of electrical gear were sometimes hampered very considerably by having to wait many months for their orders to be completed; this could be obviated to a very great extent if specialisation and standardisation were to be adopted.

With regard to foreign trade, in the past this country has supplied a fair amount of electrical gear to places abroad, but not on the scale that it might have done. Without doubt, in the near future, the electrical business, both at home and abroad, will develop very rapidly, and manufacturers will be wise to look after their interests in this respect. Their representatives abroad should be well educated in the business. In far too many cases, it is to be feared, representatives and agents abroad, although they may be good commercial men, lack knowledge of the design and requirements of electrical gear, and are thus at the great disadvantage of not being in a position to advise clients as to the most suitable type of machine or fitting for any particular job.

Another point to remember is that under the above conditions of working, a great deal of time is inevitably wasted in correspondence.

In the matter of advertising electrical gear we are very much behind, as will be observed by comparing the advertisements in our electrical papers with those in our mechanical papers, to say nothing of the American journals. It is feared that British firms are not quite so go-ahead as they might be, or they would advertise more—and better.

Let it not be overlooked that if we are to secure the electrical trade, we must look ahead.

Electric Vehicle Progress.—A company has been established at Dixon Street, Capetown, under the style of Electric Vehicles, Ltd., to handle a number of leading agencies for electric battery vehicles, which will be sold under adequate guarantees with regard to load-carrying capacity and reliability, together with the provision of an efficient maintenance service. A new idea in connection with petrol vehicles is also being inaugurated, viz., for a fee of 2s. per month the company is undertaking to make fortnightly inspections of the starting and lighting batteries of cars and make minor adjustments, besides replenishing the cells with distilled water where necessary.

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TESTING D.C. METERS OF THE AMPERE-HOUR TYPE.

By W. HALL.

THE demands of the military authorities have reduced the staffs of most of the electricity generating concerns, and, in a great many cases, the aid of unskilled labour has had to be called upon. Many girls are now employed with the larger corporations and companies, and employment is also being found for discharged soldiers. There is no more suitable sphere for the energies of the foregoing than in the meter department. It has been amply proved that wounded soldiers, with both arms, make most diligent and painstaking meter repairers. The girls at the test benches also soon get to know their apparatus, and carry out the usual tests to the satisfaction of all concerned. These notes, therefore, may be of interest to many who may only recently have taken up meter work, or intend doing so.

Most of the meters at present in use by supply companies are of the ampere-hour type—that is to say, the meter takes account of the current taken by the circuit only, and is independent of the supply voltage. In consideration of the fact that few companies generate much more than their declared voltage, this system works quite well in practice. The mercury meter holds the field at present, and with the type now on the market the error curve is practically a straight line. This meter depends for its action on the passage of the current to be metered through a mercury bath, acted on by the field of a permanent magnet, in which an armature is caused to rotate. A compensating coil to counteract the effect of the friction of the mercury on the armature is added, through which the current also passes. The speed of rotation varies directly as the strength of the current, and this rotation is conveyed to the counting train by a pinion on the top of the armature spindle.

Another meter still in wide use is the commutator type. The principle of action is somewhat similar, only most of the current is shunted off and the remainder passed by means of a commutator round coils of wire on a drum or disk arranged so that at any instant there is current flowing in the coils between the poles of the permanent magnet.

After the meter has been properly cleaned and overhauled by the workman, it requires to be tested for accuracy. Meter testers should strive, as far as possible, to bring their meters within the Board of Trade limits (2½ per cent.) on all loads from full to $\frac{1}{10}$th, since, by careful testing, faults may be discovered, and this will save trouble when the meter is erected. For measuring the current, good ammeters or a good milli-voltmeter and set of shunts are required. These should be tested periodically against standard instruments, and the corrections always applied.

Except in certain circumstances, where a small concern is in question, it is not advisable to test meters by putting them in series with a load on the ordinary circuit. A good battery of 10 or 12 cells should be used, or a low-voltage dynamo. The latter is preferable where a separate room for the cells is not available. The dynamo is separately excited and is driven by a small motor, and the current output is regulated by means of a rheostat in series with the dynamo field, fine adjustments being got by means of a small sliding-contact resistance.

Where only about half a dozen meters are being tested at the same time, these should be connected in series and given a dial run at full load. One ampere-hour will be found sufficient for all meters up to 50 amperes capacity.

$$\text{Time (hours)} = \text{amp.-hours/full-load amps.} \quad \ldots \quad (1)$$

$$\text{Units per hour} = \text{amps.} \times \text{volts}/1{,}000 \quad \ldots \quad (2)$$

E.g., say, 10-amp. meter, 240 volts.

Time of run = 1/10 hour = 6 minutes.

Units per hour = $10 \times 240/1{,}000 = 2{\cdot}4$.

∴ Meter should record $2{\cdot}4/10 = 0{\cdot}24$ unit in 6 minutes.

Say, meter records 0·244 unit.

Error = 4 in 240 = plus 1·67 per cent.

The meter should now be tested on at least two other loads, ½ or ¼, and $\frac{1}{10}$. A stop-watch test is more satisfactory in this case. All Ferranti and Chamberlain & Hookham meters are provided with what is called a "testing constant"—

$$\text{Const.} = \text{amps.} \times \text{secs./revs.} \quad \ldots \quad (3)$$

Assuming this testing constant to be correct, we have a convenient way of testing. By re-arranging the formula, we get—

$$\text{Amps.} = \text{const.} \times \text{revs./secs.} \quad \ldots \quad (4)$$

Now, say the ammeter indicates that 5 amperes are passing through the meter, and we get 30 revolutions of the armature in 32·9 seconds by stop-watch—

Const. = 5·6

Amps. = $5{\cdot}6 \times 30/32{\cdot}9 = 5{\cdot}1$

In this case the meter is 2 per cent. fast. The other tests are conducted in a similar manner, the amperes from the formula being compared with the reading of the ammeter.

Meters of larger capacity than 200 amperes can be checked at full load by timing one unit on the counter—

$$\text{KW.} = 3{,}600/\text{time of one unit in secs.} \quad \ldots \quad (5)$$

The KW. are got by multiplying the amperes by a thousandth of the supply voltage. By a combination of these two stop-watch tests, a dial run is rendered unnecessary altogether.

Some of the commutator type of meters give, on the counter, the number of revolutions of the disk corresponding to one watt-hour or KW.-hour. These meters can, therefore, also be tested by stop-watch.

$$\text{Units} = \text{amps.} \times \text{volts} \times \text{secs.}/1{,}000 \times 3{,}600 \quad (6)$$

$$\text{Revs. per unit} = \text{number of revs. taken/units} \quad \ldots \quad (7)$$

This figure can now be compared with that given on the meter. If greater, the meter is fast, and *vice versâ*.

E.g., 8 revs. per watt-hour. By stop-watch 126 revs. in 48 sec.

Amps. = 5·0. Volts = 240.

Watt-hours = $5 \times 240 \times 48/3{,}600 = 16{\cdot}0$.

Revs. per watt-hour = $126/16 = 7{\cdot}9$.

Error = minus 1·25 per cent.

This meter is therefore slow, and should be adjusted slightly to make it read correctly.

After the first series of tests it will be found that the meter is in one of the following classes:—

1. All loads from full to $\frac{1}{10}$th within plus or minus 2½ per cent.
2. All loads *uniformly* high or low.
3. Difference of more than 5 per cent. between full and $\frac{1}{10}$th loads.
4. Meters that are sticking on 1 per cent. of their rated full-load current capacity.

1. This case is easily disposed of, since the meter is within B. of T. limits, and can be passed for stock.

2. To illustrate the term *uniformly*, we will imagine the following test results:—Full load, plus 12 per cent.; ¼-load, plus 10 per cent.; $\frac{1}{10}$th load, plus 9 per cent. Here we have a difference between full and $\frac{1}{10}$th loads of *less* than 5 per cent., and we see that if, by some means, we can alter the speed the meter will be a good "pass."

In the case of the modern mercury meter, the best way to adjust it is that of "wheeling." This means that one of the wheels in the dial train known as the change wheel is removed, and another substituted in its place, with more or fewer teeth, as the case may be. The speed of registration varies inversely as the numbers of teeth in the change wheels.

$$\text{New wheel} = \text{old wheel} \times \text{average test result/required result.} \quad \ldots \quad (8)$$

So in the foregoing test, if the old wheel had, say, 74 teeth,

New wheel = $74 \times 110{\cdot}5/100 = 81{\cdot}8$.

Where decimals are involved, as above, the lower number of teeth is taken, to be on the safe side for the department.

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After changing the wheel, a new constant must be calculated, or ascertained from the constant cards supplied by the makers.

New constant = old const. × old wheel/new wheel. (9)

On retesting, this meter should pass all right.

With the commutator type of meter, adjustment is got by altering the resistance of the shunt circuit. By increasing the resistance of the shunt circuit, more current is forced through the fine wire of the rotating coils, and so greater speed is got, the speed depending on the strength of the current in the coils. After a little practice, the meter tester can tell exactly how much to move the sliding contacts on the shunt for any required result.

3. Often on testing a meter we get results somewhat as follows:—Full load + 2 per cent.: ½ load + 7 per cent.; $\frac{1}{10}$ load + 8 per cent. Here there is a difference of 6 per cent. between top and bottom loads, and it is obviously useless to "wheel" this meter straight away, since, on retesting, one load would not be within the B. of T. limits. In the mercury meters it is sometimes possible to lessen this difference between top and bottom-load results, accord-

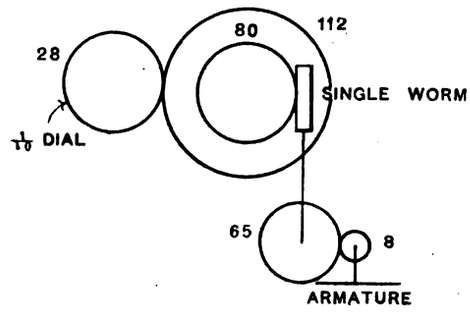

Fig. 1.

ing to the construction of the meter. Thus we have magnets acting on brake disks which, if lowered, slow up the meter at all loads, but *more especially* the bottom load. There are other devices, such as shunt magnet bars, &c., which have much the same effect. Instructions are issued by the makers. So it is possible to "close up the error curve" to the extent that will allow of "wheeling." If there is a pronounced slowing up of the meter from full to $\frac{1}{10}$th load, there is probably a mechanical fault, and the meter should be examined to make sure that everything is free.

4. This class also includes those meters which may not have moved at all during the test, which is possible where a large number of meters are being tested at the same time. Make sure that the locking device for the mercury bath has been freed, and also that the change wheel is not too deeply in gear. No difficulty should be met with in getting all meters to start with 1 per cent. of their full-load current, and no meter should be passed which fails in this test. Cracked jewels are a not infrequent cause of "sticking."

It is most important that the correct constant of the meter should be entered on the test-card, and where the meter has been tested by dial run only, the constant should be checked by putting a known current through the meter and taking a stop-watch test, when the constant can be found from formula (3). A convenient test is to take the same number of revolutions as there are amperes passing, when the seconds will give the numerical value of the constant. This should be compared with the value for the given wheel in the constants-book, and, if within 2 per cent. of it, *the value in the book* should be entered. In any given case the meter constant can be calculated from examination of the gearing. The figures represent the numbers of teeth on the wheels, and the 28 wheel records one unit with every revolution, being connected to the 1/10 unit dial. Say the meter is of 100 amperes capacity, voltage 240—

Units per hour = 100 × 240/1,000 = 24·0
Units per sec. = 24/3,600 = revs. per sec. of 28 wheel
Armature speed = (24/3,600) × (28/112) × (80/1) × (65/8)
= 1·08 revs. per sec.

Const. = amps. × sec./revs. = 100 × 1/1·08 = 92·32.

Stop-watch tests should always be made when testing on site, since they are speedier and more accurate. A test-card should be enclosed with every meter, giving number, date of test, and constant, &c. Besides this, the results of every meter test should be properly recorded, and kept in the test room for reference. Every meter should be given a department number, which in itself will show the capacity of the meter—

Meter No. = 173/25·240.

Here the real reference number is 173, but we are also told it is a 25-amp. 240-volt meter.

TAUNTON'S NATIONAL KITCHEN.

We described a fortnight ago the electrically-equipped canteen that has been put down for the benefit of the workpeople in a rolling mill near Birmingham, and we now have pleasure in giving some details and illustrations, for which we are indebted to Mr. A. J. Howard, borough electrical engineer, regarding a similar enterprise at Taunton. This time it is a National Kitchen and Restaurant which, on Tuesday, December 12th, was formally opened by Mr. W. Bateson, the deputy director of National Kitchens. With regard to National Kitchens, Mr. Bateson explained in his speech, certain things were essential in order to make them a success. The first essential was that the kitchen should be conveniently situated, the premises must be light and airy, and there must be cheerfulness, as they saw there that day. The whole equipment must be of the best possible kind, and such as would enable them to exercise economy. The staff must be properly attired, and the duties must not be performed in a perfunctory way. They must also see that the portions of food which were given were ample, well cooked, and of a nourishing kind. With those factors there was no reason why a National Kitchen should not be a success.

At the invitation of the Mayor (Alderman H. J. Van Trump), about 65 persons sat down to an excellently cooked

Fig. 1.—Dining Room.

four-course luncheon, served by the kitchen staff, which did credit to Miss Robertson, the supervisor, and the staff.

The whole of the cooking apparatus, including the boiler for heating water for all purposes, is electric, and comprises the following:—Two standard roasting ovens, each capable of cooking 100 lb. of meat, and one grill, by Messrs. Belling and Co. One steaming oven, one 20-gallon boiling pan for vegetables, one 14-gallon boiling pan for milk puddings, one 12-gallon boiling pan for soups, &c., and one hot cupboard, by the Jackson Electric Stove Co. There are also three "Arora" boiling rings and a "Tricity" oven, which is used as a hot cupboard in the restaurant.

Fig. 1 is a view of the dining room, showing the hot cupboard to the right. Fig. 2 shows the steaming oven.

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together with the vegetable-boiling pan, to the left, and a grill in the extreme right-hand corner; while in fig. 3 are seen one of the roasting ovens and two of the boiling rings.

The water boiler was designed by Mr. A. J. Howard, borough electrical engineer, and was built by the staff of the electricity department. The heating elements are composed of spirals of chrome-nickel alloy immersed directly in the water in an ordinary 40-gallon galvanised tank, which is covered with non-conducting material, and for which a high efficiency is claimed, "practically 100 per cent." The elements are easily replaced. It has been in

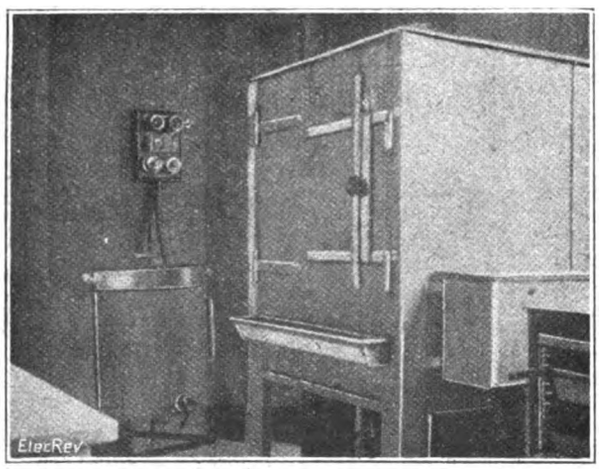

Fig. 2.—Steaming Oven and Boiling Pans.

use since October 4th, and not a single element has failed; it has given entire satisfaction. There are six spirals, the total loading being 10 kw.

Each piece of electrical apparatus is fitted with pilot lamps, and it is proposed to fit ammeters as well. In the week ending December 15th, 3,000 portions of food were served, the consumption of electricity for the week being as follows:—Hot cupboard, ovens, and boiling rings, 385 units; vegetable and soup boilers, including the hot cupboard in the restaurant, 122 units; milk boiler, steaming

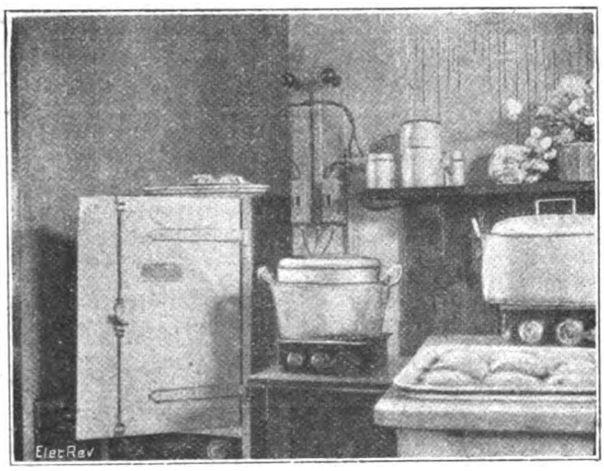

Fig. 3.—Roasting Oven and Boiling Rings.

oven, and grills, 146 units; and the water boiler, 358 units. Since the kitchen was opened for public use on October 4th last it has been a complete success, and we are glad to learn that the number of patrons is steadily increasing.

In the opinion of the Food Controller the National Kitchens have filled a public need. There are now in London between 50 and 60, and throughout the provinces from 700 to 800. The Food Department contemplates their becoming a permanent system, and is prepared to make a grant of 25 per cent., and a loan of 75 per cent. free of interest for 10 years, of money required by local authorities desiring to set up new or additional kitchens.

THE USE OF HIGH-PRESSURE AND HIGH-TEMPERATURE STEAM IN LARGE POWER STATIONS.

On Monday, December 9th, Mr. J. H. Shaw, A.M.I.E.E., read his paper (an abstract of which appeared in our issue of July 19th, 1918) at Newcastle-upon-Tyne, before the North-Eastern Centre of the Institution of Electrical Engineers.

Mr. J. W. Jackson opened the discussion, saying the subject was a difficult one to discuss, for they had so little experience to go upon. He raised a point as to Schedule II, which gave a steam pressure at the turbine of 215 per sq. in, and the steam consumption as 9.46 per kw.-hour. This appeared too optimistic. At the same time, he thought the figures for 500 lb. pressure appeared reasonable; but the difference between the two columns was less than they might have expected. As to the steam consumption shown in Schedule III, which gave 11.1 lb. of steam per kw.-hour on the busbars, so far as he had seen that was about the consumption that they expected. As to maintenance charges, it appeared to him they were going through the pioneer work through which they went when they passed from 150 to 200 lb. pressure. He instanced pipe-covering, when they got to a temperature of 650 or so it was difficult to keep the pipe covering on; it seemed to disintegrate, and to require renewing in three or four years' time. The question of temperature also raised the point as to whether they had found the best materials for the construction of valves, &c. As to the presence of oxygen in feed water, he did not quite see why there should be more difficulty in that regard with high pressure than in low pressure. He criticised the suggested use of lap-welded pipes. He mentioned that his firm was constructing a large power station on the North-East Coast of 70,000 kw. capacity with a pressure of 450 lb.

Mr. A. H. Law said that in 1899 his firm anticipated the possibility of the use of high pressure, so far as putting down a boiler to generate at 350, and a superheater for 700 or 800 deg., although they never used those high temperatures except on one experimental turbine, a tandem turbine, but the results were not of any practical interest.

Mr. Dowsing thought that in actual practice steam was more efficient than gas; a way might be found out of the difficulty raised by the author as to the loss in converting water into vapour by re heating the steam. That might prove a very good solution.

Mr. Shaw, replying to some of the points raised, said the figures given in Schedule II as to the steam consumption of 9.46 lb. per kw.-hour, at 215 lb. pressure, were given by two or three turbine manufacturers as possible and reasonable if purchasers were willing to pay the price. As to 500 lb. pressure, he had got no information at all, and had worked the results out. He did not think any of them need fear the question of maintenance costs so far as pressure was concerned; if there were any trouble it would be due to temperature; with the two combined they might have some difficulty. He did not mean to suggest there was any more air in the condensate at the higher pressure than at the lower, but they had to remember that chemicals were more easily formed at the higher temperatures; furthermore, an absolutely pure water condensate had a greater affinity for air than a condensate perhaps mixed with town water. With regard to the piping, before 1914 he did not think cold-drawn pipes could be bought over 10 in. Now, he thought, they could get 12- or 14-in., but not cold-drawn, so that they had to accept the lap-welded piping.

DIESEL ENGINE USERS' ASSOCIATION.

At a meeting of the Association on November 28th, a discussion took place on a paper read at the previous meeting by Mr. James Richardson on "The Semi-Diesel Oil Engine." (See Elec. Rev., p. 443, November 8th, 1918.)

Mr. George E. Windeler took exception to the title of the paper, as he failed to see why the engine particularly referred to was called a "Semi-Diesel" engine. In the matter of friction, he failed to see why so many piston rings were considered necessary. The design of piston rings was most important, and experience in aero-engine design had proved that the friction due to the piston rings absorbed the major portion of the engine friction. A narrow ring with only a small amount of spring was the best. In the matter of fuel economy, this was higher in the Diesel than in the semi-Diesel, and there was less "blowing down" of the gases, with less wear and tear in the parts of the engine. He could not see the reason for Mr. Richardson's statement that the mechanical efficiency of the semi-Diesel was greater than that of the Diesel, particularly as it had a fixed ratio to the fuel consumption. The great advantage of the Diesel engine was its high economy down to half-load and its capacity for burning heavy fuel oils. In the matter of lubrication there were difficulties with the use of tar-oil fuel, as it was an enemy to lubricating oils. Hot bulbs did not appeal to him for high powers. Good results had been obtained from the use of aluminium alloy pistons.

Mr. T. C. Thomsen considered the question of clearance

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with aluminium pistons to be of great importance; he thought that a very viscous lubricating oil was necessary, and remarked that he could not understand how the spray could be too fine. He expressed the opinion that much useful research work could still be carried out in the direction of standardisation of qualities of fuel oil for various types of engines, and with this end in view he thought that more co-operation between the engine builders, users, and fuel-oil manufacturers would be useful. He pointed out that the use of a suitable lubricating oil would considerably assist in clearing away the carbon deposit inside the engine due to excessive temperature of the hot bulb, and he stated reasons in support of his preference for a compound lubricating oil for such purposes.

Mr. Guy B. Petter looked forward to a great future for the semi-Diesel engine, and referred to the rapid progress which had been made, particularly in America, in connection with the use of such types of engine. He referred to the small difference in fuel economy between the Diesel and the semi-Diesel engine, and to the greater simplicity of the latter type.

Lieut. A. J. Mackay gave particulars of experiments which he had carried out with a special form of cylinder head with which he obtained a higher mean effective pressure. He considered that the spray could certainly be too fine; he had experimented with sprays of all degrees of fineness. He spoke very favourably of his experience with pistons of an aluminium alloy.

Lieut. J. L. Chaloner, R.E., considered that pressure was the governing factor in distinguishing between the Diesel and the semi-Diesel type of engine. In the matter of design, the semi-Diesel type was tending towards the Diesel type of engine. He considered the water injection device to be bad practice; it had now been to a great extent eliminated. In regard to fuel consumption he thought that to a great extent this was a question of the class of fuel used. He did not agree with the author's statement that the satisfactory fuel economy attained in the semi-Diesel type of engine was due to the fact that the cycle of operation was nearer to the explosion cycle than to the constant-pressure Diesel cycle.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Simulation of Daylight.

The accompanying illustration (fig. 1) shows a very interesting example of illumination employing concealed source of light, and giving an excellent reproduction of daylight window-lighting effect at the Café Cairo, Dublin. It should be noted that the room shown is entirely underground with entire absence of daylight. For the lighting 100-watt half-watt type Mazda lamps are used, equipped with X-ray reflectors placed outside the windows.

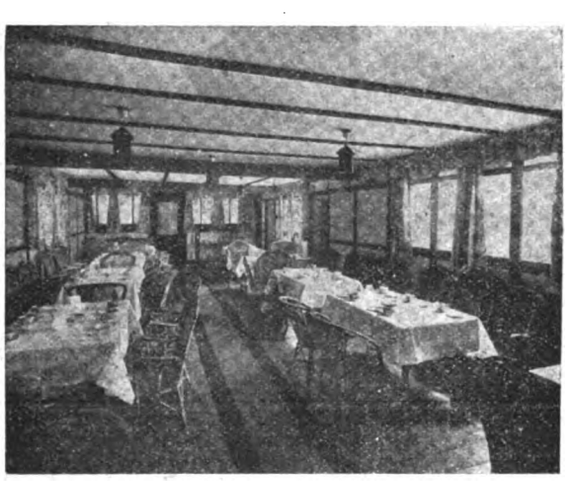

Fig. 1.—Daylight Lighting Effect at Café Cairo, Dublin.

The light is thrown upon white millboard, from which it is reflected through the arctic glass of the dummy windows, producing the effect of morning sunshine which is very pleasing. The hanging lanterns shown are for use at midnight in the event of dances, when the daylight effect is not desired.

The whole installation is an excellent example of effective illuminating engineering work, producing unusual results in a very natural way, and giving a most artistic and attractive effect in interior illuminaton. The installation was designed by the illuminating engineering department of the British Thomson-Houston Co., Ltd.

B.T.H. "Efracta" Lanterns.

The important requisite for the effective use of half-watt type lamps is scientifically designed lighting equipment. The British Thomson-Houston Co., Ltd., of Mazda House, 77, Upper Thames Street, E.C. 4, is therefore very timely in its announcement of its new types of street lighting lanterns—the "Efracta" and "Diffracta"—both scientifically designed for use with half-watt type lamps.

The illustration (fig. 2) shows the "Efracta" lantern in its open position. This lantern is of substantial cast-iron construction, thoroughly weather and storm proof, and is adjustable so that varying sizes of lamps can be fitted and adjusted in focus in the refractor. The lantern is equipped with the latest type of holophane prismatic bowl (or band) refractor, which provides the most effective combination for securing the wide angle light distribution required in street lighting service. Fig. 3 shows the characteristic light distribution given by this lantern with holophane bowl refractor.

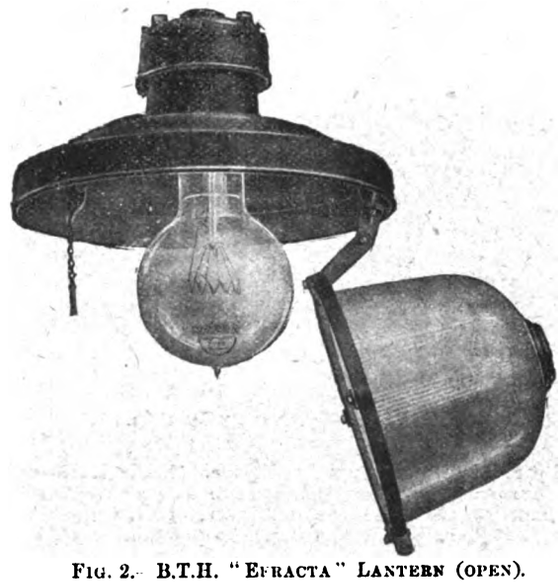

Fig. 2.—B.T.H. "Efracta" Lantern (open).

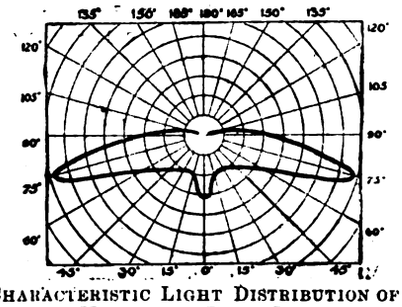

Fig. 3.—Characteristic Light Distribution of Lantern, with Holophane Bowl Refractor.

The illuminating engineering department of the B.T.H. Co. has given special attention to the problems of street lighting, and is willing to assist all public authorities and engineers in the preparation of up-to-date plans, data, &c., for street or other lighting installations.

Copies of the new list, No. 10401-10A/B, will be furnished on request.

A Novel Arc Lamp.

We learn from the *Daily Telegraph* that a further development in arc projection was recently exhibited in this country. It is the invention of a Frenchman, M. Garbarini, and has in small sizes found considerable application in kinematographic projection. But it appears to have a much wider scope of utility. In the new lamp, the end of the positive carbon is centrally disposed within a concentric annular copper ring, which constitutes the negative pole. This ring is water cooled. The arc is struck by a simple automatic adjustment between the positive carbon and the ring. It is then not concentrated at a single point on the ring, but rotates, thus producing a central small crater in the positive carbon, and at the same time distributing the heat over the circumference of the water-cooled ring. No obstruction to the beam of light projected from the small intensely illuminated crater thus occurs, and the light may be projected by any of the ordinary methods. In a lamp of standard size, with a voltage of 55 and a current of 43 amp. or 2,365 watts, a positive crater of 17.6 sq. mm. is formed, with a light intensity of 12,280 decimal candles, or 700 c.p. per sq. mm. The cooling of the annular ring which constitutes the negative pole is automatic by the convection currents of quite a small quantity of water. The feed of the positive carbon is automatic, and is actuated by a mechanism controlled by the current of a thermo-couple; the overall weight is of the order of 20 kilograms or 45 lb.

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"Easifix" Shade Carrier.

The accompanying illustrations show the "Easifix Lamlok" shade carrier, by the use of which the removal of a shade for cleaning and other purposes is the work of a second or two, and it is re-attached to the holder in the same small amount of time, a mere twist or untwist of the two little milled-head screws being all that is necessary. The screws are not visible from the distance at which holders are usually seen, and therefore no unsightly

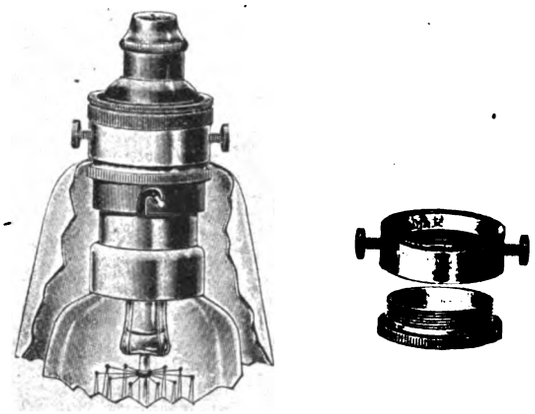

FIG. 4.—G.E.C. SHADE CARRIER.

metal part is introduced by their adoption. The device should find ready acceptance in hotels, offices, factories, &c. We understand that THE GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, E.C. 4, have secured the sole manufacturing and selling rights of this device. Samples of the carrier, together with fuller particulars, can be obtained from the company.

LEGAL.

THE LIGHTING OF A REFUGE.

IN the Court of Appeal last week in the case of Baldock *v.* Westminster City Council, the appeal of the defendants from the decision, as already reported here, of the Divisional Court, was dismissed. The action, it will be remembered, arose out of a charge of negligence on the part of the City Council in not having a street refuge in Cockspur Street properly lighted. The jury in the County Court found that the defendants were negligent in failing to maintain a danger lamp on the refuge; they appealed to the Divisional Court, and failed, as they have now done, in the Court of Appeal.

MOTOR ASSESSMENT QUESTION.

IN the Valuation Appeal Court, Edinburgh, on Thursday, last week, an appeal of interest to the electrical trade was heard.

Included in the amount of £1,151, which was agreed upon as the valuation of the iron and steel works at Craigneuk, near Motherwell, in the event of the assessor being right, was a sum of £9 fixed by the assessor as the annual value of two electric motors installed in the works. The motors are driven by current purchased by the appellants, the Etna Iron & Steel Co., from the Clyde Valley Electrical Power Co. The assessor submitted that the motors fell to be included in the valuation in respect that they were machines for producing or transmitting first motive power. The appellants contended that the motors neither produced nor transmitted first motive power, and that the first motive power was the electric power supplied by the Clyde Valley Power Co. The Valuation Committee for the Middle Ward of Lanark adopted the assessor's view.

The Court refused the appeal on the ground that the electric motors were machines or plant for producing or transmitting first motive power. Lord Salvesen said that it was not motive power at all until the current had passed through these motors.

Transmission at 140,000 Volts.—The Consumers Power Co. has recently completed a hydroelectric plant in the State of Michigan, which, though rated at only 16,500 KW., is being operated with a transmission voltage of 140,000 over a 100-mile line to Grand Rapids, says the *Electrical News*. Generation is at 7,500 volts, and the 7,500/140,000-volt transformers of 5,000 K.V.A. capacity are of Westinghouse manufacture. On each transformer are 120,000-volt to 140,000-volt taps arranged in 5,000-volt steps. The 140,000-volt oil switches, which are type G.2, 300-amp. units, are non-automatic, solenoid-operated, and set on concrete foundations. The 140,000-volt electrolytic lightning arresters, with their horn-gap structure, are also on concrete foundations and are served by a cone-stack derrick.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Motor Problems.

The ELECTRICAL REVIEW regularly reaches the small West-Country town where I am at present, and I was glad to read Mr. Pickett's contribution on the above subject in the issue of December 6th. I am unable for the moment to refer to the Patent Office records, but I thank him for drawing my attention to the fact that the problem has been attacked.

His statement that my solution does not overcome the difficulty is correct to the extent that the gear is not "fool proof." If I remember aright, the editorial mentioned, or implied, the use of a controller of the barrel type, fitted with shunt-resistance notches. If it is necessary to stop suddenly the quick movement of the controller handle to the off position will first of all cut the shunt resistance out, and give rise to the troubles mentioned. Now a barrel controller implies careful or intelligent operation; given that, the arrangement I suggested will be satisfactory, especially as the controller handle is likely to be the more conveniently placed of the two.

I gather that Mr. Pickett can confirm that some forms of the fluttering relay give trouble, and am glad to note that one form at least is free from criticism. I am still more glad that it is an English production.

Ernest F. Butler.

Bridport, *December 16th*, 1918.

Smooth versus Undercut Commutators.

I have read with very great appreciation your readers' remarks *re* "undercutting of commutator micas." A certain set of rotary-converters with undercut micas gave no trouble whatever as regards commutators when running on a fair load or overload, but when by any chance they were giving no output, or when a neighbouring station began to motor them, they at once commenced violent chattering at the brushes. In fact, we always regarded this as a warning to look out for the reverse-current relay of the circuit-breaker operating. Can anyone suggest the cause of this?

D. F. B.

December 18th, 1918.

NATIONAL ELECTRICITY SUPPLY (GREATER LONDON).

LAST week a "Report on Public Control of Electricity Supply" was issued by the Conference of Local Authorities owning Electricity Undertakings in Greater London, of which Ald. Duncan Watson, M.I.E.E., is chairman, and Mr. Fred. Tait, of Poplar electricity works, hon. secretary. The conference embraces 16 Metropolitan borough councils, two county borough councils, four borough councils, and 13 urban district councils in the Metropolitan area. It is not indicated to whom the report is addressed. As it is a lengthy document, we give below an abstract of its contents:—

The report first quotes the speech made by the Prime Minister on November 16th to emphasise the importance of the subject, and the conclusions arrived at by the Board of Trade Committee on Electricity Supply. Of the latter, the first two, pointing out the necessity of adopting the most efficient methods and machinery, and of largely increasing the amount of power used in industry are unreservedly accepted; the third, stating that the supply to small areas by separate authorities is incompatible with a technically sound system, is criticised on the ground that had not the large number of separate authorities undertaken the supply of electricity when it was in its infancy, the present perfected methods of supply would never have been attained, and the United Kingdom would have been unplaced in the race for industrial supremacy. The fourth conclusion, stating that interconnection alone cannot meet the requirements of the situation, is characterised as "meaningless to the public at large," but it is pointed out that the Board of Trade, having recommended linking-up, did nothing to enforce it, and the report adds that interconnection will go a long way towards meeting the requirements if evolutionary methods are adopted to obtain the cheapest possible supply. The fifth conclusion—that a comprehensive system for the generation of electricity on a reorganised basis should be established as soon as possible—is emphatically endorsed as the solution of the vital problems enunciated by the Prime Minister.

The report states that the municipal authorities of Greater London have recognised the necessity of linking-up their generating stations, and of erecting large super-stations instead of extending existing stations, and it is proposed that a central authority, to be known as the "Greater London Electricity Board," shall be set up to control these super-

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stations. The Board will be empowered to raise capital upon the security of the assessable value of the whole area of supply, and all local authorities within the area will have representation on the Board. It is proposed to transfer to the Board the compulsory powers of purchase now vested in the London County Council and other local authorities, and to supply electrical energy to authorised undertakers in and adjoining the area, and to railways, tramways, &c. The policy of the Conference is to secure complete public control with the least expenditure of capital, and at the minimum cost for the promotion of the scheme. It is not proposed at the outset to scrap existing economical stations, but others would be shut down, the future demands of all existing stations taken over, and the remaining loads taken over when the existing plant became obsolescent. It is the desire of the Conference to establish a Board untrammelled by the burdens of capital expenditure in respect of private interests acquired by private enterprise, and to avoid financial pitfalls such as the Metropolitan Water Board and the Marylebone Borough Council fell into. Attempts have been made to obtain private control of electricity supply in Greater London at the cost of compromising with existing private undertakers before the terms of their provisional orders have expired; "*compromises of this nature can only be made either by a huge expenditure of public money or by excessive charges for supply over a term of years,*" and care should be taken that no such compromises are allowed by legislation. The Conference desires that legislation shall be set up to ensure the economic use of coal now and for all time by controlling its use both by private individuals and by public utility undertakings; should the individual be restricted in the use of fuel, the demand for electricity would be enormously increased, and therefore the producers of electricity should also be restricted in the use of fuel in order to obtain maximum economy. Electricity supply is essentially a monopoly; competition merely leads to increased charges through the duplication of capital expenditure. It has been suggested in recent reports that mixed boards, representing public ownership and company control, are preferable to absolute public control, because profits can, by legislation, be limited to moderate rates, but no legislation can limit capital expenditure entered into upon expert advice on which such profits would be allowable. Capital can be multiplied to an appalling extent in numerous ways, as exemplified in "the revelations recently published of the financial operations of certain companies which have hitherto been taken as a model electricity supply combination." Records of the cost of production show that municipal management is decidedly superior to company control, and the public will benefit if private interests are entirely eliminated from the supply of electricity.

Estimates prepared by the conference on the ultimate requirements of Greater London show that over 5,000,000,000 units of energy per annum will be needed, on which a variation of one-tenth of a penny per unit means a sum of £2,000,000 per annum. The primary object of companies is to maintain profits, whereas that of municipalities is to reduce prices to the lowest possible degree. The average prices per unit sold by companies and municipalities of London in the decade prior to the outbreak of war show differences in favour of public control amounting in later years to more than 30 per cent. (1913-14: Municipal 1.77d., company 2.38d.; difference 0.61d.) The minimum rate for a municipal undertaking in 1913-14 was 0.99d. per unit, and for a company 1.09d., the difference being 0.1d.; in the latter case the supply was largely for traction, which was not included in the former. The average price charged in London, which has been maintained at high rates by private companies, has been held up for comparison with those of the principal cities of the world, much to the detriment of London, but in all such comparisons the London traction supply has been left out, rendering the figures valueless for comparative purposes. The operating costs in three East London boroughs in 1913-14, corrected for the price of coal, and compared with those of Berlin in 1911-12, and Chicago in 1911, corrected for "municipal participation," are given as: East London 0.447d. per unit, Berlin 0.454d., Chicago 0.51d. Traction supply is cheaper than general supply, and in Chicago 69 per cent. of the whole output is used for traction, whereas in East London 10 per cent. only is so used. "These figures should dispose finally of the argument that electricity can be produced cheaper abroad than at home."

It is held that although little exception can be taken to the principles of the conclusions arrived at in the Board of Trade Committee's Report, the whole tendency of the report seems to be in favour of company operation in preference to public control, and "the legislation recommended would have the effect of fostering the growth of huge industrial trusts of a nature happily yet foreign to British industry"; the report of the committee recommends that large consumers be represented on the District Boards, with one vote for each £200 paid for electricity, and it is suggested that any one of the great manufacturing groups recently formed could control the operations of a District Board, and as the number of votes would be increased in proportion to the price charged, "the public would suffer at the hands of the trust."

The cost of machinery at present in use by municipal undertakers in Greater London is estimated at 4½ millions sterling, and "the Board of Trade Committee recommends that this plant be taken over by the proposed district board and placed upon the scrap heap, the cost of this manipulation to be charged to capital account, and paid for by money raised at certainly not less than 5 per cent., but probably 5½ per cent. or 6 per cent., whereas on an average the original loans were raised at 3½ per cent." Whilst in some instances an increase in capital charges would be more than repaid by decrease in operating costs, many undertakings could continue to generate under existing conditions at a cheaper rate than could possibly be adopted by the proposed district boards; therefore it is essential that these stations should be utilised during their economic life. Schemes "in embryo" for the utilisation of existing steam-raising plant and buildings as central-heat supply stations, with a certain amount of electricity generated as a by-product, are referred to, and it is urged that the generation of electricity with steam produced by refuse destruction should be continued, whereas the Board of Trade Committee has deliberately ignored this, in spite of expert advice. Under the new housing schemes under consideration of the Reconstruction Committee, the supply of hot water to private users is considered essential to public health.

The question of coal conservation is next dealt with, and it is suggested that if a combined system of power, light, and heat distribution were adopted through the medium of electricity and water on the lines indicated, and restriction placed on the use of coal, the reserves of the country would last another 2,000 years.

The conference concludes:—That agricultural prosperity, improved transportation, industrial power, increased wages, improved conditions of labour, and the health of the people are inseparably bound up in the development of electricity supply under public control. Greater London and its immediate neighbourhood must be recognised as a "district," and provided with a district board appointed by the people, financed on public security, and operated for the benefit of the people only. The cheapest possible supply of electricity is absolutely essential to the development of Greater London as an industrial area, and cheapness can be obtained under public control only, unhampered by watered capital. Each clause of the Board of Trade report should be weighed carefully before acceptance. Regard should be had to the distribution of heat from a central source. The problem should not be considered as a party question. Compromise means inordinate capital expenditure, and consequently excessive charges for supply. Coal should be conserved by restricting its use. Electricity supply is essentially a monopoly, and should not be exploited for gain. Some of the most important recommendations of the Board of Trade Committee leave the door open for financial trusts of foreign origin. Under public control in London production has invariably been at a lower average charge than under company control, and in parts of London the rates have been lower than in Chicago. Existing plant should not be scrapped because inefficient, but retained where possible for central-heat production, and the generation of electricity as a by-product. Public control of electricity supply in Greater London would do much towards conserving the coal of the country.

A PHŒNIX DYNAMO CELEBRATION.

A great social and reunion of employés and ex-employés of the Phœnix Dynamo Manufacturing Co., Ltd., Bradford, took place on Friday evening at the works. The various buildings of the large establishment, as well as the entrances and the passages through the yards to the different places of entertainment were lavishly decorated by cordons of coloured electric lights and masses of bunting, flags, holly, and flowers. The whole place was transformed to a degree beyond the imagination of all except those who had had the supervision of the entire work. The affair was organised by the firm, of which Mr. P. J. Pybus, O.B.E., is the managing director, and the staff. The attendance numbered somewhere about 4,000, many of the guests being in fancy dress, in connection with which prizes were ultimately given. One of the most noteworthy features of the occasion was the way in which plant and productions had been cleared out of the way to allow unhampered freedom of movement of the great crowd of pleasure-makers. The 9.2-in. shell shop, which was the hall of assembly, and the centre of games and music, and the A.V. metal shop, which became a spacious ballroom, presented wonderful kaliedoscopic pictures, what with the massed decorative effect and the happy throng.

The event, which commenced at 6.30 and continued until 2 a.m.—when there was a special service of tramcars to various part of the city—was held for the purpose of celebrating the end of hostilities and of the need for further production of shells. The aircraft work of the firm, it should be mentioned, is being continued. Refreshments were available without charge in the aerodrome women's canteen, which has seating accommodation for about 900 persons at a time, and is run by the firm and the Young Women's Christian Association jointly. The men's canteens, which are under similar control, were not in use. In the A.V. erection shop a concert and kinema entertainment took place, the films shown being partly comedy and partly pic-

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tures of the firm's work and productions, a picture of the Prime Minister being received with warm applause. The bands engaged for the evening were the Bradford Police Military, and Mr Brown's Band from Morecambe Tower and Casino, Mr Brown himself, one of the best-known North of England experts, being the master of ceremonies in the ballroom.

Mr. P. J. Pybus, welcoming the vast party of guests in the assembly hall, expressed the great pleasure which it gave the directors and himself to entertain their workers who had collaborated during the great war to help in the production of the munitions needed by the Allied troops. He thought he was correct in saying this was the most wonderful Christmas in history. The war had overshadowed everything during the past four years, but it was now over, and over in the right way. Mr. Pybus spoke of the wonderful way in which all departments of the undertaking, along with similar workers throughout the country, had worked together to bring about the triumph of right. He thought he could fairly say, "Well done," and he believed that when the soldiers all returned they would say the same. After referring to the work and productions of the Phœnix establishment, Mr. Pybus said when the idea of a victory celebration was made it was taken up with enthusiasm, and it was resolved to have a "do." He thought it would now be agreed that it was going to be "some do." Mr. Pybus expressed the firm's regret that a good many of the employés would now have to go back to their ordinary peace-time occupations, but they would leave a great tradition behind them which would live for many years. Though the firm were sorry they could not find employment for them all just now, perhaps many of them might ultimately return.

In connection with the celebration a special issue of the *Phœnix Bulletin* was issued to mark the gathering. The issue was profusely illustrated with photographs of the works, of the productions, of the visit of the King and Queen in May, 1918, and of the welfare arrangements, and with cartoons, with letterpress describing the various operations.

The transformation of the great workshops had been accomplished in just over a week, the clearance being necessary in connection with the future operations of the undertaking. Arrangements had been made with the Ministry of Munitions by which, as shell-making was not now necessary, the firm should go on to something more useful. Arrangements for the demobilisation, at a gradual rate, of many of the war-time hands had already been made. The people no longer needed in the shell departments were got to work on the clearance of certain of the buildings, so that the needs of work and the requirements of the reunion synchronised, there being no hall anywhere in the district which could accommodate between 4,000 and 5,000 people at a social. All this big space now provided will be required for post-war work in the new operations of the English Electric Co., comprising the Phœnix Co., Dick, Kerr & Co., Ltd., and the Coventry Ordnance Works, and the associated companies of these concerns, a fusion which will employ 20,000 hands. After the whole of the great assembly had marched in marshalled order before a kinematograph operator, taking half-an-hour over the operation, the ball, concert, games, and kinema exhibition proceeded. In the kinema show the first film was that taken at the works in connection with Mr. Pybus's propaganda campaign earlier in the war, when he toured the country on the question of the dilution of women labour. Another film showed the visit of the King and Queen to the works, and the opening of the women's canteen by Her Majesty.

The Phœnix undertaking has made upwards of 2,000,000 shells, ranging from a six-pounder anti-Zeppelin shell to the 12-in. gun shell, which is the largest in general use in the British Army. As other people got more accustomed to making the smaller shells the Phœnix works turned to bigger types, and have been engaged on the big shells mostly for some time past. The building of the shops in which the festivities took place was a wonderful achievement. The 9.2 shell shop, which was the hall of assembly, after work on the erection night and day, was in such a condition that the first tool was run exactly three weeks after the laying of the first brick. This was in February, 1915. The aircraft shop, which was the ballroom on Friday, was built similarly in six weeks. At the end of 1915 the firm started the aircraft work, making scouting seaplanes of two designs supplied by the Admiralty. Later they got out improved types of their own, and a flying boat of their own design and construction, which they named the Phœnix-Cork, and which was, at the declaration of the armistice, Mr. Pybus claims, the fastest big machine in existence. The Phœnix boats have all been named after some Irish town. The firm have employed about 1,500 people on aircraft continuously. Later, in 1916, it was decided that instead of receiving billets from Sheffield, they should put up a factory and pierce their own, and that was why the works at Dick Lane—forges on the most modern lines—were built on the Great Northern Railway sidings, and linked to the Thornbury works by an electric railway. The firm have all along specialised in the employment of women labour, and have found it a great success. In fact, Mr. Pybus pays the highest tribute to the women in all branches of work. Their operations in female labour have been photographed and kinematographed officially for Government circulation both in this country and in India and the Colonies, and since America came into the war a staff of kinema photographers have visited the place for similar propaganda in the U.S.A. Mr. Pybus is an enthusiast in the work of the firm and in the welfare of the people, and this spirit, along with the welfare arrangements at the premises, has made the output at Phœnix amongst the best in the country. The works are five times their pre-war size, the bulk of the erections having been put up by the firm's own contracting staff. It is expected that the space will be fully utilised by the work under the fusion of companies.

WAGES OF EMPLOYÉS IN ELECTRICITY UNDERTAKINGS, LONDON DISTRICT.

As stated in our abstract of the Committee on Production's Award No. 2,772, in our issue of November 22nd, "pending the setting-up of District Boards under the proposed Joint Industrial Council for the Electric Supply Industry, it is proposed that if any questions arise with regard to:—

1. The intent and application of any award of the Committee on Production.
2. Rates for addition grades;
3. Regrading;
4. General questions;

the parties shall confer after requisite notice has been given and endeavour to arrive at a mutual settlement. Failing such settlement, any matters of difference to be referred to the Committee on Production.

The Committee are of opinion that the proposal is likely to be of benefit, and they will be prepared to co-operate in its adoption so far as it is in their power to do so."

In accordance with this provision, a joint meeting between the employer and union representatives was held at the County Hall on November 27th, when the following were nominated to give effect to the above award:—

Employer Representatives (10).

The 14 London Companies.—Mr. Charles P. Sparks (chairman), Mr. F. Bailey.

The Incorporated Association of Power Companies.—Mr. E. T. Ruthven-Murray.

The Tramways Association.—Mr. C. J. Spencer.

The Suburban Undertakings.—Mr. K. A. Scott-Moncrieff.

I.M.E.A.—Mr. A. C. Cramb.

Conference of Local Authorities on Wages.—Ald. A. G. Beaumont, Mr. A. J. Fuller.

L.C.C.—Mr. A. L. C. Fell, Mr. P. L. Riviere.

Union Representatives (14).

Electrical Trades Union.—Mr. J. Rowan (vice-chairman), Mr. J. Membery, Mr. H. H. Morton, Mr. Westfallen, Mr. T. Goode, Mr. V. Needham.

Workers' Union.—Mr. Small, Mr. J. G. Greenwood, Mr. A. Smith.

National Union of General Workers.—Mr. C. L. Skinner, Mr. Boyne.

National Amalgamated Union of Enginemen, &c.—Mr. J. Meakins, Mr. J. Allen, Mr. W. G. Chapman.

Mr. W. J. Webb, Secretary of the four Unions.

THE FARADAY SOCIETY.

The Occlusion of Gases by Metals.

A most instructive discussion on the above subject was held by the Faraday Society at its November meeting. The meeting, which opened at 5 p.m., was largely attended, and the 30 or more speakers, who kept up a sustained interest in a very attractive subject until long past 10 o'clock, envisaged the points under discussion from every possible point of view. Such a discussion cannot fail to be fruitful in its results.

The President, Sir Robert Hadfield, F.R.S., in his opening remarks, gave a brief historical survey of occlusion, more particularly from the point of view of the ferrous metals. It is noteworthy that the great English chemist Graham, the father of colloidal chemistry, was also the author, so long ago as 1866, of the first scientific contribution on "Occlusion," although previously Bessemer had recognised the importance of removing gases from fluid steel. To this day one of the most important practical bearings of the subject concerns the production of sound steel castings, while other aspects of it range from the passivity of metals and the embrittling of iron to catalysis and the production of high vacua in X-ray tubes.

On the theoretical side the symposium was opened by Prof. Alfred W. Porter, F.R.S., who grouped the phenomena of occlusion under the following heads:—

1. Chemical combination of gas with metal.
2. Simple solid solution of gases.
3. Immiscible solid solution of gases in equilibrium with each other.
4. Solution accompanied by surface adsorption.

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5. Surface condensation under molecular forces unaccompanied by solution.
6. Inclusion.

In practice it is often difficult to distinguish between these various types of occlusion. A case in point is the familiar occlusion by palladium of hydrogen, which was discussed at some length by Dr. Porter. The theory of the subject was further developed in a suggestive contribution by Capt. J. W. McBain, who showed how the different types of occlusion varied in the time-relationships and in their dependence upon temperature. Thus true *adsorption, i.e.*, surface condensation, is nearly instantaneous, while *absorption*, or solid solution, obeys Fick's law, commencing with a very high velocity and then rapidly falling off with time.

Several speakers spoke on the temperature relationships. Dr. W. Rosenhain, F.R.S., contrasted the absorption of gases by liquid metals with their solution in ordinary liquids, where solubility decreased with rising temperature. This pointed, he thought, to the formation of compounds of gases with metals which were more stable at higher temperatures. Gases remaining occluded after the solidification of the metals were probably in solid solution, and perhaps held in the amorphous undercooled liquid films bounding the metal crystals. Dr. N. T. M. Wilson, however, pointed out that the decrease of gas solubility in ordinary solutions with rise of temperature was only true of water. Other solvents behaved as did molten metals in this respect.

The important theories of Langmuir were referred to by Capt. McBain and others. Langmuir pictures every atom within a solid as tied to an equilibrium point in a space lattice, but it is attached to all neighbouring atoms by primary or secondary chemical valency. On the surface, therefore, the layer of atoms would present unbalanced valencies on their outer side, and in these are to be found the origin of all surface phenomena. Thus adsorption is the attachment of outside molecules or atoms to the exposed free valencies of the surface atoms. It is therefore due to purely chemical forces.

Prof. H. E. Armstrong, F.R.S., in a characteristically incisive speech, strongly supported the chemical view of dissolution, and hence of occlusion of gases by molten metals. By way of illustration, he referred to an example put forward by Sir T. Kirke Rose in his speech, namely, the occlusion of oxygen in silver. In this case the higher the temperature the more oxygen was absorbed. As the temperature fell, however, the oxygen was not expelled until solidification, and then it all went off at once, and a shower of metallic globules was thrown out. Hydrogen occluded by molten copper behaved similarly. In Prof. Armstrong's view a definite oxide of silver was formed at a high temperature, when both elements must be regarded as being in different molecular forms from those obtaining normally, and having great affinity for one another. Similarly in the case of iron, carbonic oxide had a high affinity for it at some high temperature; hence the ease with which this gas passes through iron. This view, by the way, was ably controverted by Capt. L. Aitchison.

Space will permit of a bare reference only to the many miscellaneous bearings of the subject of occlusion referred to by the various speakers. Thus Sir Charles Parsons, F.R.S., regarded the formation of diamonds as being connected with occluded gases. Dr. H. A. Bumstead, a distinguished visitor from America, spoke on the elimination of the last traces of absorbed gases in metals in a liquid air vacuum. Dr. R. S. Willows similarly touched on the subject as it concerned X-ray apparatus, and indicated points where information was needed before the highest possible vacua could be obtained. Sir George Beilby, F.R.S., illustrated an effect of occluded gases by reference to the dependence of the recrystallisation temperature of cold-worked gold on the presence of minute quantities of hydrogen. Mr. C. R. Darling spoke of the effect of the absorption of gases on electric welding. The pickling of the iron rod used as negative in an acid produced a defective weld, in an alkali a sound weld. Dr. A. G. P. Gwyer spoke on occlusion by aluminium and its alloys. Some blisters in cast metal which developed when it was rolled into sheet contained from one-tenth to one-third of their volume of occluded gas, principally hydrogen.

It was noteworthy that hydrogen was the chief gas occluded by the non-ferrous metals. The matter called for further study. In this connection Dr. J. A. Harker, F.R.S., made the interesting observation that nearly all metals which absorbed oxygen gave at the moment of melting a large emission of gas, accompanied by a greatly increased electric emission.

The embrittling of iron by occluded gases raised the interesting question, what constituted brittleness. It was difficult to associate this quality with cobbler's wax, and yet to a sudden fracture this material would break like glass. The question of time was obviously involved, but Prof. Porter, who raised the question, confessed that it baffled him, as it baffled Prof. C. V. Boys, F.R.S.

Dr. Rosenhain's generalisation that all liquids were brittle, and cobbler's wax was a liquid, did not seem to give satisfaction, and Prof. Porter promised an explanation of his own at a later stage.

A considerable portion of the discussion was naturally taken up with the consideration of occlusion by the most important, technically speaking, of all metals, namely, iron and steel. The President, in his historical survey, drew attention to the interesting researches recently undertaken in Swarthouse, U.S.A., by Allemann and Darlington. These investigators, by means of a well-designed gas-tight vacuum furnace, capable of working at 1,900 deg. C., studied the gases occluded in ferrous alloys, and concluded that metals like aluminium, manganese, and silicon, which are commonly used to remove gas from steel, acted as catalytic agents in so doing. This theory was indirectly supported by a curious observation stated by Capt. L. Aitchison to the effect that the addition of a very small amount of ammonia increased the rapidity of absorption of carbon monoxide in the case-hardening of steel. Dr. W. H. Hatfield thought that the above-mentioned metals did not prevent the occlusion of gases, but caused them to be *retained* on freezing.

So far as iron and steel are concerned, Mr. Cosmo Johns very much clarified an involved group of phenomena by distinguishing between "primary" or true occlusion, and "secondary" occlusion, where gases were formed as the products of reactions occurring during the cooling of the metal. The occlusion of hydrogen was an example of the former, and as it was more soluble in molten than in solid iron, the result of cooling was to concentrate the gas in the amorphous intercrystalline cement. This would explain why a comparatively small amount of gas had often a profound effect on the physical properties of the metal. The gaseous oxygen compounds, CO and CO_2, so often present in iron and steel, were probably actually formed *in situ* as the metal cooled.

Dr. Thomas Baker, who dealt quantitatively with the gases—hydrogen and carbon-monoxide—occluded in steel, did not follow Mr. Johns in his views, and considered the origin of these gases a problem still unsolved. A very carefully-thought-out paper by Dr. Andrew McCance discussed the reactions, with the gaseous products resulting therefrom, that took place in the melting furnace from the point of view of chemical dynamics. He concluded that blow-holes were formed in steel when there was a high CO_2 content, and this was dependent on the amount of FeO present. Deoxidants, such as silicon, removed the FeO, and at the same time converted CO_2 into the far more soluble CO, which was therefore merely taken up by the metal.

Perhaps the most important outcome of the discussion was the clear and general recognition of a negative truth: *We have no knowledge whatever of the true physical properties of pure metals*, for all experiments that have been made so far have been made on industrial metals which contain quite unknown quantities of gases. What a field for the happy investigator!

BUSINESS NOTES.

The "Electrical Review" Index.—As it is still necessary to effect every possible economy in paper consumption, the index to Vol. 83 of the Electrical Review, which will shortly be printed, will be supplied only to those who, through the post, specially apply for it. To such it will be supplied for 3d. post free. Any reader or advertiser at Home or Abroad who requires a copy for binding, or for other purposes, is asked to make early application therefor to the Publisher, Electrical Review, 4, Ludgate Hill, London, E.C. 4.

Tasmanian Carbon Factory.—The Hydro-Electric Power and Metallurgical Co. has set up a factory at Electrona, near Hobart, for the manufacture of carbon electrodes for its own use in the manufacture of carbides and also for general supply.—*Industrial Australian.*

Juvenile Employment after the War.—The Ministry of Reconstruction has issued (6d. net) a paper-covered book of 114 pages, in which the most important subject of "Juvenile Employment During the War and After" is very fully covered. The contents are really a long report, based upon reports by a large body of investigators who undertook an extensive inquiry for the Ministry of Labour during the closing months of last year and the beginning of this. All who are interested in the welfare of juvenile workers, whether independently or as industrial employers or managers, will no doubt feel it their duty to secure a copy of the book, and study its facts and conclusions carefully.

Export Restrictions Removed.—The *London Gazette* for December 20th contains a further list of export restrictions which have now been removed.

Calendar.—The British Ebonite Co., Ltd., Hanwell, W. 7, has issued a wall calendar for 1919, with monthly date sheets, each sheet having a complete year in miniature.

Trading with the Enemy.—Further names of bodies and persons in the following countries with whom trading is prohibited, appear in the *London Gazette* for December 20th:—Argentina, Bolivia, Cuba, Mexico, Spain.

Platinum Order Suspended.—The Minister of Munitions has suspended until further notice the Platinum Order, 1915, and the Platinum Metal Order, 1916, which prohibited purchases, sales, or dealings without a permit.

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Engineering Trade Co-operation during Transition.—During the period of transition from the manufacture of war material to ordinary trade, some difficulty may be experienced by firms having more orders on their books than they can readily deal with, whilst there will be other firms having manufacturing facilities without orders to execute. It is considered essential in the national interests that firms in these two categories should be brought into intimate touch as rapidly as possible. With this object in view, manufacturers in the engineering and allied trades who need the assistance of sub-contractors, and who meet with difficulty in finding suitable firms to undertake their sub-contracts, are requested to communicate with the Superintendent Engineer of the Ministry of Munitions in the area concerned. Similarly, manufacturers having capacity available with the necessary labour should notify the Superintendent Engineer of their area. The Superintendent Engineers will give every possible assistance to manufacturers in overcoming difficulties which may arise during the transition from war to peace manufacture. A list of the Superintendent Engineers, and addresses of the area offices, is appended :—

DEPARTMENT OF ENGINEERING.

LIST OF SUPERINTENDENT ENGINEERS.

Area No.	Name.	Address.	Telegraphic address.	Telephone No.
1	Mr. G. H. Clay.	Pearl Buildings, Northumberland Street, Newcastle-on-Tyne.	Munarea, Newcastle.	3814 Central.
2	Mr. H. C. Buckmaster.	70, Spring Gardens, Manchester.	Munarea, Manchester.	8740/8 City.
3	Mr. H. C. M. Austen.	Quebec Chambers, Quebec St., Leeds.	Munarea, Leeds.	5500 Leeds.
4	Mr. A. A. Rowse.	111, New Street, Birmingham.	Munarea, Birmingham.	2700 Midland.
4 E	Mr. G. S. Knocker.	91, Queen's Walk, Nottingham.	Munarea, Nottingham.	5578/9 Nottingham.
5 & 6	Mr. Selwyn Grant.	3, Unity St., College Green, Bristol.	Munarea, Bristol.	6090 Bristol.
7	Lieut. Moberly.	Room 114, Charing Cross B'ldgs., Embankment, W.C. 2.	Mundepeng, Phone London.	Gerrard 540, Ext. 712.
8	Mr. G. Davidson.	90, Princes Street, Edinburgh.	Munarea, Edinburgh.	9040 Central.
9	Mr. W. D. Kirkwood.	39, Elmbank Crescent, Glasgow.	Munitions, Glasgow.	9880 Central.
10	Capt. C. Ablett.	32, Nassau Street, Dublin.	Munarea, Dublin.	4894/6 Dublin.
11	Mr. A. W. Brown.	Coates Buildings, Castle St., Belfast.	Munarea, Belfast.	57 8 Belfast.

The Fraser & Chalmers Sale.—In the course of his speech at the annual meeting of MESSRS. FRASER & CHALMERS, LTD., last week, Mr. A. W. Tait said that for some time the directors had appreciated that, in order to secure the full development of their manufacturing business, particularly in connection with turbines and turbo-blowers, they should seek an alliance with some company or group in the electrical industry which would be sufficiently strong to quote for and obtain contracts and orders for large electrical installations both at home and abroad. The arrangement with the General Electric Co., Ltd., of which particulars have been given in these pages, followed in due course. Mr. Tait later referred to the steps taken in disposing of the purely merchanting business in South Africa, where Mr. Haig, the manager, and others, had purchased the business, and in Canada, where Mr. Sancton (the manager) had taken over the assets. Negotiations were also proceeding with the General Electric Co., Ltd., with regard to the business in Australia and in Singapore, and it was hoped that before long these negotiations would be satisfactorily concluded. The speaker suggested the voluntary liquidation of the company, and this idea received the meeting's approval.

British Magnetos.—As a proof of the great strides the British manufacturers are making in the production of magnetos, we are informed that Messrs. C. A. Vandervell & Co.'s output for October alone was no less than 3,500. The C.A.V. magneto figured largely on the motor cycles of our dispatch riders on all fronts during the war, and we understand that it met with their highest commendation.

New Trust for Development of Electrical Undertakings.—Following upon our recent reference to the Aabada Trust, Ltd., we observe in the daily papers that this concern has been holding a general meeting in London, under the chairmanship of the Earl of Kintore. He said that the trust had been in existence since 1912, though for the past few years its operations had been restricted by the war. Its current business was almost entirely confined to the development of electrical undertakings and to allied interests. The managing director, Mr. C. S. Colton, and the engineers had long been associated with the electrical industry. Mr. J. W. Towle, M.I.E.E., who was formerly superintendent of power for the Metropolitan District Railway and for the London Electric Railways and chief engineer to the Ebro Irrigation Power Co., Barcelona, had been appointed chief of the trust's engineering staff. The trust would, therefore, have at its disposal the highest technical knowledge, both for the selection of its undertakings and for the supervision of its execution. The financial resources of the trust were sufficient for all the requirements of the current business, and should further working capital be required for extensions the trust had an unissued capital of £44,000. It had large and important business on hand, and in regard to some of its undertakings, several of the best-known engineering and chemical firms in the country were jointly interested with it.

After-war Trade.—We have received a copy of the fourth report of the London Chamber of Commerce Special Committee on Trade During and After the War, which was adopted on December 12th. This report completes the series issued by the Committee, and indicates the changed situation and altered possibilities as well as new economic problems which have arisen since the issue of the first three reports, with special reference to (*a*) matters of common interest to the business community as a whole : (*b*) commercial organisation ; (*c*) industrial organisation ; (*d*) finance.

Holidays.—The London office and works of MESSRS. JAMES KEITH & BLACKMAN CO., LTD., are closed as from last Saturday until Monday next, while the works at Arbroath, N.B., are closing from Saturday next until January 6th, for the Christmas and New Year holidays and to mark the cessation of hostilities.

Fiat Cars in the War.—With the Armistice, not a little information to which the Censor formerly objected now becomes available for publication. While the war was in progress, for instance, it was forbidden to give the actual output of the motor-car factories supplying material to the Armies. This restriction having been removed, the Fiat Co. has made a statement of the actual number of cars and lorries it has supplied for Army use. In 1914, Italy then being neutral, not more than 500 motor vehicles were supplied for Army use. Between January 1st, 1915, and October 30th, 1918, the number of cars and lorries built for the Allied Armies totalled 50,000. Of this number 30,000 went to the Italian Army, 15,000 to the French Army, and 5,000 were divided among the American, British, and Portuguese Armies. The record monthly output was 2,023 during October, 1917, this being an average of 75 motor vehicles per working day. This daily record was considerably exceeded later when, the Italian Government having requested the factories to speed up to their utmost limits, in order to make good the material lost in the Caporetto disaster, the Fiat factory succeeded in attaining the wonderful record of 176 motor vehicles (the majority of these were lorries) produced during the working hours of December 31st, 1917. It is believed that this is the largest number of vehicles produced by any European factory in one day. It has to be taken into consideration, too, that the Fiat cars and lorries are produced entirely in the company's works, only the tires being procured from outside. This record output was attained without interfering with the normal production of aeroplanes and aeroplane engines.

Our Letters from the Forces.—A correspondent in France writes :—"Please accept my very best thanks for your continued kindness in sending the REVIEW so regularly. It has been a source of entertainment and profit to me out here, and during the whole time you have been sending (nearly two years) it has never failed to turn up. I sincerely hope that in a very few months we shall be back to our jobs again, and able to follow the REVIEW every Friday in more congenial surroundings. I shall never forget, however, how much I, and numerous friends here, owe to you for your weekly REVIEW in France."

Loans to Local Bodies.—The Local Government Board is now prepared, in conjunction with the Treasury, to consider applications from local authorities for permission to raise loans in order to enable them to put into operation schemes of public utility, such as housing, water supply, gas and electricity, and construction and improvement of roads, which are of urgent importance. It is essential that the necessary loans should be raised locally by the authorities concerned, except in the case of the smaller authorities who, requiring money for very urgent services, may be able to secure advances from the Local Loans Fund.

Catalogues and Lists.—MESSRS. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—Publicity card giving price, &c., of one of their weather-proof reflector fittings.

AUTOMATIC AND ELECTRIC FURNACES, LTD., 6, Old Queen Street, London, S.W. 1.—Bulletin No. 6, relating to the use of molten salt baths in hardening operations.

THE COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD., has issued a telephone card, the pictorial feature of which shows Armistice celebration beneath the electric lights of Home.

Training Disabled Soldiers.—In connection with the scheme for the restoration of disabled service men to industrial life, large training centres have been established in various East Lancashire towns, those for electrical engineering being formed at Bootle, and for motor mechanics at Bolton.

Changing Over at Vickers's.—According to a note in the *Times*, 30,000 munition workers employed at Vickers's stopped work on Saturday until January, the suspension being arranged to enable the firm to take stock and to prepare for peace industries.

Building Work May Now Proceed.—The National Service Ministry has cancelled the Order of February last which prohibited the beginning or proceeding with building or construction works exceeding £500 in value, without licence.

The 47-hour Week.—Though the total figures are not yet known, the returns of several fairly large Unions not having been received, it is stated that the result of the engineers' ballot on the acceptance or rejection of a 47-hour week without any reduction of wages is strongly in favour of the proposal.

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Book Notice.—"B.E.A.M.A. *Journal*" (Spanish Edition). Vol. II, No. 4. December, 1918. London: Oakley House, Bloomsbury, W.C.

Liquidation.—Switchgear Construction Co., Ltd., Park Street, Southwark. Application for release of trustee, Mr. J. H. Stephens. Last day for objections, December 28th.

LIGHTING AND POWER NOTES.

Argentina.—Strike.—The employés of the German Trans-Atlantic Electricity Co., who had been on strike for about two months, returned to work at the end of October, on the terms of settlement offered by the company.

E.L. Scheme.—The Municipality of Federacion (Entre Rios) is considering the question of installing an E.L. scheme in the town.—*Review of the River Plate.*

Aylesbury.—Proposed Extensions.—The U.D.C. has decided to apply to the Ministry of Munitions for permission to extend the electricity works, and to offer a supply to Nestlé's and Anglo-Swiss Milk Co. as a stand-by, at 6·6d. per unit for lighting and 2d. per unit for power, with a minimum payment of £120 a year.

Bristol.—Proposed Loan.—The T.C. has decided to apply for a loan of £88,000 for extensions in connection with the electricity department during the next three years; the sum includes £50,000 for mains, £9,000 for house services, and £29,000 for sub-stations.

National Electricity Supply.—On the recommendation of the general manager, Mr. H. Faraday Proctor, on Friday last, the Electricity Committee resolved that the report of the Incorporated Municipal Association on the question of Electric Power Supply, should be approved, with the exception of that portion of Paragraph 2 which dealt with the constitution of the District Boards; the Committee expressed the opinion that where companies were now operating, and continued to operate as either generating or distributing authorities, they should not be excluded from representation on such Boards.

Continental.—Sweden.—Among the new companies formed to establish electric generating or distributing stations, are the Gammelsbyns Kraft Aktiebolag, Langviksmon; the Ostavalls Elektriska Aktiebolag, Ostavall; and the Langeds Elektriska Aktiebolag, Nordmaling.

Spain.—The Government has granted a concession for the establishment of a plant to utilise the water power of the River Restabal, near the town of that name, in the Province of Granada, for the generation of electricity.

Don José Cardona Palos has been authorised to utilise 7,600 litres of water per second from the River Mijares, Province of Castellon, for the generation of electricity.

Don Alfredo Velasco y Sotillo has been authorised to utilise 700 litres of water per second from the River Durcal, Province of Castellon, for the production of electricity.

With the title of Energia e Industrias Aragonesas, S.A., a company has been formed in Barcelona with the object of developing several waterfalls in the Valley of Tena, Province of Huesca, and the construction of a factory for chemical products and their derivatives is to be undertaken. The capital of the concern is 3,000,000 pesetas.—*La Energia Electrica.*

Austria.—The first installation to use the water power of the Danube for generating electrical energy on a large scale is to be erected 15 km. below the junction with the Enns, to the north-east of Mitterskirchen. The fall will be 7·6 to 13·45 m., and 17 units will be installed with an output of 52,000 to 125,000 kw., according to the level of the water. A company, in which the Austrian Siemens-Schuckert Works will have the most important interest, is to be formed to erect and run the generating station. Part of the output will be taken by Vienna.—*Elektrotechnische Zeitschrift.*

Dublin.—Coal Shortage.—At a meeting of the Corporation last week, Alderman Farrell called attention to the serious position of the coal supply in Dublin. The Coal Controller had done his best in the matter, but had failed to get coal. The engineer had been instructed to purchase coal at £3 per ton whenever he could get it, but it would eventually work out at nearly £10 per ton.

Edinburgh.—E.L. Charges.—The T.C. has decided not to adopt the increased charges for electricity recommended by the E.L. Committee. Members in favour of the increase argued that it would be improper to meet the increased charge, with which the department is faced, out of the reserve fund, which now stands at over £99,000, while the objectors contended that users of power should have some consideration when changing over from munitions to ordinary work. The charges proposed were 4d. per unit for lighting and 1½d. per unit for power, increases of ½d. and ½d. respectively.

Hebburn.—Street Lighting.—The U.D.C. has provisionally agreed to a scheme of the Northern Counties E.S. Co. for renewing the public lighting system; the company is to bear the cost of relaying the mains and renewing the lamps, estimated at £3,986, and the Council is to supply new posts, estimated at £5,832.

Isle of Wight.—Street Lighting.—The Isle of Wight E.L. Co. is to light half the street lamps at Sandown, at £110 per quarter, and half the lamps at Ventnor, at £420 per annum.

London.—Kensington.—Price Increase.—The B.C. is opposing the application of the Brompton and Kensington E.S. Co. for powers to increase its charges from 13s. 4d. for any quantity up to 20 units per quarter, and 8d. per unit over 20, to 16s. 8d. up to 20 units, and 10d. per unit beyond that amount.

Shoreditch.—Year's Working.—There was a net profit of £6,006 on the working of the B.C. electricity department for the year ended March 31st, 1918.

St. Pancras.—The Electricity Committee has applied to the Ministry of Munitions for permission to complete the extensions to the boiler house and generating plant at the King's Road station.

East London.—The Poplar and West Ham Borough Councils have decided to obtain an independent report on the question of an electricity supply scheme for the eastern districts, in view of the proposed centralisation of supply.

Lynn.—Proposed Extensions.—At a meeting of the T.C., the engineer reported that in order to supply electricity to the two shipyards which were being built at West Lynn, extensions costing £7,500 would be required at the electricity works, and the cost of the necessary mains was estimated at £3,000. Subject to consent to the extensions being obtained, energy is to be offered to the firms in question at £4 10s. per kw. of maximum demand per annum, plus 1¼d. per unit, with a variation of ·03d. for every 1s. increase or decrease in the price of coal.

Morocco.—A company, with a capital of 2,500,000 pesetas, has obtained a concession to erect two generating stations for the supply of electricity to Fez. An installation has already been established in the district for the driving of flour mills, and the Sultan possesses workshops equipped with four turbines, which derive energy from the Fez River. There are many rivers in Morocco capable of yielding 30,000 h.p. each.—*La Energia Electrica.*

Slaithwaite.—Prov. Order.—The U.D.C. has appointed a deputation to meet the Huddersfield T.C., which is applying for an E.L. prov. order for the district.

South Africa.—Cape Town.—Price Increase.—The Electricity Committee has recommended that the 10 per cent. war charge authorised by the Council on November 29th, 1917, for supplies of electricity be extended to cover all tariffs, with the exception of those under contract, which it is proposed to deal with on their merits as the contracts mature.

Owing to the defective condition of the boiler at the air-compressing station, it is intended to drive the compressor by electric power, and the City Council has authorised the expenditure of £1,400 for this purpose.

Southend-on-Sea.—Proposed Extensions.—The T.C. has decided to lay additional mains to the Thorpe Bay area, instead of proceeding with the scheme for the erection of a new sub-station.

The electrical engineer has been authorised to negotiate with the firms from which the additional plant for the central station and the Leigh-on-Sea sub-station was ordered, with a view to obtaining the same.

South Shields.—Year's Working.—There was a net deficit of £3,849 on the working of the Corporation electricity department for the year ended March 31st, 1918, compared with £2,941 in the preceding year. The income amounted to £35,185, against £32,370, and the working expenses increased from £18,829 to £21,874. Capital charges increased from £15,236 to £16,108. 5,413,980 units were sold, against 4,921,944, and included—lighting, 900,650, against 858,619; heating, 232,263, against 184,265; power, 2,855,394, against 2,616,713; public lighting, 30,168, against 13,769; traction, 1,385,505, against 1,248,578. The works cost per unit was ·954d., against ·909d., and the total cost, 1·559d., against 1·578d. Up to the end of the financial year the pre-war charges for electricity had not been increased. The electrical engineer estimates that had permission been obtained to install a new water-tube boiler in March, 1917, a saving of £1,000 in fuel and labour could have been effected during the year. The maximum demand was 2,684 kw., and the load factor 23 per cent.

Stoke-on-Trent.—Fire.—A fire, causing considerable damage, occurred on Thursday, last week, in a storeroom at the Hanley electricity works, but was extinguished in about an hour.

Twickenham.—Fire.—Damage was done to the stores at the electricity works last week by a fire, which was fortunately extinguished before it reached the engine room.

Uruguay.—E.L. Scheme.—The Municipality of Cruz del Eje (Cordoba) is installing an E.L. scheme, and supply is to commence in January next.—*Review of the River Plate.*

Walton-on-Thames.—Mains Extension.—The U.D.C. is considering an application by the Urban E.S. Co. for permission to lay a H.T. cable from Esher to Thistlecroft, Hersham.

Whitby.—Price Increase.—The U.D.C. has adopted the following revised charges for electricity:—Lighting, flat rate, first 500 units per quarter, 6d. per unit; second 500, 5d.; beyond, 4d.; outside lighting, flat rate, 4d.; long-hour consumers, maximum demand rate, exceeding 150 units per quarter, first 1½ hours in winter and first half-hour in summer, 6d.; remainder, 4d.—discount of 5 per cent.; contract demand system, £3 15s. per quarter per kw. demand, plus 1¼d. per unit; heating and cooking, first 60 units per quarter, 2½d.; beyond, 1½d.; contract demand system, 5s. per quarter per kw. demand, plus 1½d. per unit; flat rate for power, 25 per cent. added to existing rates.

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Wimbledon.—Year's Working.—For the year ended March 31st last, the income of the B.C. electricity department was £50,211, against £41,988 in the previous year. The working expenses amounted to £31,306, against £27,587, and after paying capital charges amounting to £18,524, the net profit was £380. The generation cost was 1·509d. per unit, against 1·269d., and the total cost, excluding capital charges, 2·015d., against 1·783d. 5,181,030 units, against 5,079,485, were generated, and 3,727,097, against 3,712,749, were sold; 288,068, against 315,208, were sold for public lighting: 1,347,744, against 1,396,358, for private lighting; and 2,091,285, against 2,001,183, for power and heating. The average price obtained per unit was 3·144d., against 2·647d. The total capacity of the undertaking is 4,825 kw., and the maximum demand, 2,219 kw. The capital expenditure was £272,490, and the reserve fund £12,500.

Wolverhampton.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to borrow £1,000, for the provision of sub-station equipment.

The scheme for providing an overhead runway with tubes for the removal of ashes from the old boiler house at the electricity works, at a cost of £423, has been approved.

Woking.—E.L. Charges.—The E.S. Co. has withdrawn its application for powers to increase the maximum price of electricity.

TRAMWAY AND RAILWAY NOTES.

Australia.—A delegation of three officials of the Victorian Railway Department has been appointed to visit America "to secure the information necessary to enable an electric furnace to be installed at the Newport workshops for the production of high-grade castings." They will also study the application of electricity to portable tools, and electric welding.

Continental.—Electrification of Dutch Railways.—An important lecture was delivered recently by Geesteramus in the Koninkijk Instituut van Ingenieur on the advantages of the electrification of railways, and containing a description of the operation of the South Dutch electric railway between Rotterdam, Haag, and Scheveningen, which is intended to act as an example in future Dutch plans for the electrification of the railway system of the country. A change to the electrical system is planned on the sections Amsterdam—Haag—Rotterdam, Amsterdam—Hilversum, Amsterdam—Zaanstreek—Beverwijk—Haarlem (Ymuiden), Rotterdam—Maassluis.

Sweden.—Railway Electrification.—The Administration of the Swedish Railways has issued a report, which states that the plan for the electrification of the whole railway system is nearing completion; the work is estimated to take ten years to complete. It is also proposed to lay cables along the track for the supply of power for agricultural purposes.—*Financier.*

Spain.—The Empresa de los Tranvias de Granada, which has just inaugurated extensions from Atarfe to Elvira and Pinos Puente, proposes to construct other lines in the Provinces of Granada and Cadiz, the first to be taken in hand being that from San Fernando to Chiclana.

Don Carlos Lezcano y Fernandez, president of the Sindicato de Iniciativas de Guadarrama, has applied for a concession to construct an electric railway from Cercedilla to the port of Navacerrada.

Don Bibiano Gonzalez Saez has applied for concessions from the Ministry of Public Works for the extension of the Santander tramway system.

Leeds.—Track Renewals.—The Tramways Committee has obtained B. of T. sanction for 2,000 tons of rails for tramway track renewals; the tramway manager stated that about 10 miles of permanent way required renewing.

London.—Development Committee.—It is reported in the daily Press that tramway managers of Greater London propose forming themselves into a Committee to develop tramway services and to co-ordinate joint services.

Taunton.—Electric Vehicles.—The T.C. has decided to apply for L.G.B. sanction to a loan of £1,500 for the purchase of three electric vehicles.

United States.—Railway Electrification Recommended.—Electrification of the mountain divisions of the California railroads has been recommended to Director-General of Railways McAdoo by Mr. D. M. Folsom, director of the Pacific Coast section of the Oil Division of the Fuel Administration, as a means of conserving the use of fuel oil and reducing the total operating expenses of sections of the railroads involved by $4,923,300 a year. The investigations on which the report was based were made by Mr. W. F. Dietrich, engineer for the Pacific Coast Section of the Oil Division of the Fuel Administration, working under the direction of Mr. Folsom.

TELEGRAPH AND TELEPHONE NOTES.

Radio-Telephony.—The *Derby Despatch* states that American aeroplanes fighting in France up to the moment of the Armistice were manœuvered under the vocal orders of the squadron commander that reached each pilot by radio-telephone. News of the successful development of this device (hitherto a military secret) has been allowed to become public by Mr. John E. Ryan, Director of Aircraft Production. "I have myself," he declared in a statement, "standing on the ground, given orders to a squadron flying in the air, and watched them manœuvre accordingly. The transmission of the voice is clear enough to be heard distinctly through the sound of the aeroplane motor." The President of the Institution of Civil Engineers, in his presidential address a few weeks ago, hinted at important developments in this direction during the war.

South America.—The *Review of the River Plate* states that the Brazilian Government has authorised Mr. Frank Carney, representing the Central Telegraph Co., to form a company for the purpose of constructing and working a direct cable between Rio de Janeiro and Cuba.

Wireless and the Air Service.—As soon as the relaxation of restrictions allows of the free flight of aeroplanes, the air service will be greatly developed. A system of wireless, and a complete organisation for its effective use, will be features of the scheme making for increased safety. Mr. Godfrey Isaacs has made a statement to the daily Press that the Marconi Co. will be prepared to supply every aeroplane with a combined wireless and telegraph installation, under the management of a thoroughly qualified operator, adopting the system that is now in force with regard to ships. There will be charts and direction finders which will give the operator the exact position of the aeroplane wherever it may be. Wireless stations are to be erected on the frontier of Cashmere and the Chinese side of Siberia. Mr. Isaacs has arranged with Mr. Handley Page for the transport of the apparatus to the sites by big aeroplanes.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Sydney.—April 28th. City Council. Supply and erection of power house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.

Victorian Railways Department.—January 15th. Supply of battery cells. Particulars from Agent-General for Victoria, London, S.W.

Liverpool.—December 30th. B. of G. Electrical supplies for three months, for the Toxteth Park B. of G. Mr. R. A. James, Clerk, 15, High-Park Street.

Sheffield.—January 7th. Corporation Tramways and Motor Committee. 50 double-decked, top-covered, vestibule tramcar bodies with trucks. Mr. A. R. Fearnley, General Manager Division Street.

CLOSED.

Edinburgh.—Corporation E.L. Committee:—

New plant at Dewar Place Station, £28,700.—British Thomson-Houston Co., Ltd.

Government Contracts.—The undermentioned contracts were placed during November, 1918:—

War Office.

Chatterton's compound.—India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.
Dynamos.—Austin Motor Co.
Electric lighting sets.—Petters, Ltd.
Generating sets.—Aster Engineering Co.; R. A. Lister & Co., Ltd.
Motors, &c.—H. T. Boothroyd, Ltd.; Brown Bros.; City Electrical Co.; Crompton & Co., Ltd.; Electric Construction Co., Ltd.; Phœnix Dynamo Manufacturing Co., Ltd.
Alterations and additions to turbo-alternator plant.—General Electric Co., Ltd.
Insulating tape.—Chemical Engineering Corporation, Ltd.; J. G. Ingram and Son.
Transformers.—British Electric Transformer Co.; Foster Engineering Co., Ltd.
Electric trucks.—Electromobile (Leeds), Ltd.
Iron and steel wire.—F. A. Power & Sons.

General Post Office.

Telegraph apparatus.—India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.
Telephone apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.; Peel-Conner Telephone Works, Ltd.; Western Electric Co., Ltd.
Telegraph and telephone cable.—London Electric Wire Co. & Smiths, Ltd.; C. Macintosh & Co., Ltd.; Union cable Co., Ltd.
Telephone cords.—British Insulated & Helsby Cable, Ltd.; Peel-Conner Telephone Works, Ltd.
Rearrangement of motors, gears, &c., on electric lifts at Money Order Office, Holloway.—Medway's Safety Lift Co.
Cable between Grimsby and Immingham Telephone Exchanges.—W. T. Henley's Telegraph Works Co., Ltd.
Bronze wire.—British Insulated & Helsby Cables, Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.).
Bronze insulated wire.—British Insulated & Helsby Cables, Ltd.
Copper wire.—Elliott's Metal Co., Ltd.
Enamelled and silk-covered copper wire.—London Electric Wire Co. and Smiths, Ltd
Galvanised iron wire.—R. Johnson & Nephew, Ltd.

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H.M. OFFICE OF WORKS.

Electric wiring, H.M. Fuel Research Station, East Greenwich.—Malcolm and Allan, Ltd.

Installation of goods' lift G E Co.'s building, Kingsway.—Medway's Safety Lift Co.

INDIA OFFICE.

Cables.—W. T Glover & Co.
Cells.—General Electric Co., Ltd.; Chloride Electrical Storage Co.
Copper tubing.—Yorkshire Copper Works Co.
Dynamos.—J. Stone & Co.
Phantophones.—Automatic Telephone Manufacturing Co., Ltd.
Telephone sets.—Peel-Conner Telephone Works.

Luton.—Electricity Committee. Recommended :—

One 300-KW. rotary converter, £1,831.—British Thomson-Houston Co., Ltd.

Switzerland.—Messrs. Piccard-Pictet & Co., of Geneva, have recently secured a contract for the supply of a Francis vertical-shaft turbine, of 10,000 H.P. capacity, for the hydro-electric station of the Société d'Electricité de Fribourg.

NOTES.

The Compliments of the Season.—The ELECTRICAL REVIEW wishes all of its readers and other friends a Prosperous New Year. We trust that the period of transition, with all its difficult problems, will be safely passed through, and that in the course of a few months all connected with the industry will have satisfactorily changed over to their former pursuits, and will have reason to feel, long before 1919 closes, that they are on the high road to a prolonged period of unprecedented success.

British Oil.—According to the daily Press, Lord Cowdray's drillers at Hardstoft, Derbyshire, have already sunk about 1,000 ft. of the first bore by which oil for the Navy is expected to be obtained. The drills are now working in the coal strata, and another 2,000 ft. will have to be bored before it will be definitely known whether oil exists there. The work goes on smoothly at 40 ft. to 70 ft. a day. Drilling at two other sites near Chesterfield will soon be in full swing.

"An English company is being formed, with £100,000 capital, to test low-temperature processes of obtaining oil from minerals," Dr. F. Mollwo Perkin is reported to have said, and "a great deal of experimental work is being carried out, and several large schemes are under consideration."

Insulated Wire and Cable Conservation.—In order to prevent the manufacture of many unnecessary types and grades of wire and cable in the United States, at a meeting of the rubber-insulated wire and cable industry, called by the War Service Committee of that industry, it was voted to submit to the War Industries Board the following programme for the conservation of rubber-covered wire and cables :—

I.—Manufacturers to carry in stock but one grade of any given type and size of wire.

II.—Stop the manufacture and sale of rubber-insulated national electrical code double-braided wire No. 8 B. & S. gauge and smaller, and national electrical code twin wire No. 8 and smaller. Substitute therefor single-conductor single-braid wire.

III.—Limit the number of colours to be used on outer braids of flexible cords, silk, cotton, or mercerised thread to four—namely, black, green, yellow, and red (white not counted as a colour).

IV.—No cartons to be used in packing flexible cords or other wires. However, present stock of cartons may be utilised.

V.—Reduce the number of standard types of national electrical code flexible cords and portables.

VI.—Conserve tin in stranded conductors of seven wires or more; wires not coming in contact with the insulating compound (*i.e.*, wire strands) not to be tinned.

VII.—Eliminate wires of special diameter in manufacture of stranded conductors and conform to a table given.

Educational.—The Leeds Education Committee has decided to continue the wireless instruction department of the Technical School, which was established in September, 1917, on a fee-paying basis.

A Blackburn Dinner.—The closing of the Munitions Department at Blackburn Electricity Works was celebrated on December 18th, by a dinner attended by the whole staff. Mr. P. P. Wheelwright, electrical engineer, said that since the works were established three-and-a-half years ago, they had handled 350,000 shells, of which 95,000 were 6-in. shells. This was the third largest output of any factory in N.E. Lancs. Blackburn was one of the few electricity works in the country where munitions had been manufactured, and he was justified in saying it was the largest shell factory controlled by any corporation.

Tungsten Output.—In an interesting article on this metal in the current issue of *Salvage*, it is pointed out that out of a total of 19,000 metric tons of tungsten concentrates (60 per cent. WO_3) produced in 1913, England controlled and acquired 13,000 tons, or over two-thirds of the world's supply.

Appointments Vacant. — Power-house superintendent (£350) for the Stoke-on-Trent Corporation electricity works; instructors in electrical engineering for the Leeds Education Committee Technical School; charge engineers (57s. 6d. + 12 per cent.) for the R.E. Camps under the Ripon Command; instructor in electrical work for the North Wales Joint (Disablement) Committee of the Ministry of Pensions, Bangor Centre. See our advertisement pages to-day.

The Channel Tunnel.—The *Railway Gazette* states that the Paris Municipal Council on November 22nd adopted a resolution in favour of the resumption of work on the construction of the Channel Tunnel, as sanctioned by the Law of August 2nd, 1875.

Rathenau on "Innocence and Justice."—In reproducing the following in parallel columns we do not think that any comment is necessary :—

London evening paper, December 20th, 1918.

MAGNATE'S WHINE.

CHIEF OF THE GREAT A.E.G. CRIES FOR MERCY.

The Dutch paper *Handelsblad* publishes a rhetorical appeal from Dr. Walter Rathenau, the head of the Allgemeine Elektricitaets-Gesellschaft, in which he declares that the German nation is innocent, and committed whatever wrong was done in innocence, and from a childish dependence on its masters.

"If the Entente Powers kill Germany in the name of justice," he says, "then justice will never again be what it now is.

"If a decision is now taken against us, we will bear our lot and perish upon the earth. You will hear no complaint, but our complaint will be heard where never yet has a complaint from human hearts arisen in vain.—*Reuter.*"

(Extract from an article in the Berlin "Lokal Anzeiger," from the pen of Dr. Rathenau. See ELEC. REV., *January 26th, 1917, p. 97, for fuller reference to this matter.)*

"We began the war a year too soon. When we have secured a German peace we must begin at once a reorganisation upon a broader and firmer basis than ever before. Establishments that produce raw materials essential to the Army must not only continue their work, but enter into it upon lines of increased energy, forming thus the kernel of economic Germany in preparing in the economic sense for the next war. We must carefully calculate in advance, in view of lessons learned in this war, what our country lacks in raw material, or essentials of raw material, and secure immense reserves to remain unused until a day in the future. We must organise as genuine an industrial mobilisation as we had a military mobilisation. Every technician, or semi-technician, enrolled or not in the list of mobilised, must be empowered through official credentials to take charge and direction of a given establishment upon the second day following a new declaration of war. Every establishment manufacturing for commercial purposes must be mobilised also, and understand officially that upon the third day after declaration of war its entire abilities are to be devoted to serving the Army upon demand.

"It must also be determined in advance just what quantities and sort of essentials such establishment can furnish the Army in a given time. Each establishment also should be required to furnish a detailed list of workmen who can be dispensed with, these alone to be mobilised in the military sense."

Institution and Lecture Notes.—Royal Society.—At the meeting of the Society held on the 5th inst., Mr. C. Chree, Sc.D., F.R.S., submitted a paper on "Electric Potential Gradient and Atmospheric Opacity," at Kew Observatory. The author states that it has been the practice for many years at Kew Observatory at the ordinary hours of meteorological observation to record the most distant of a selected series of objects which is visible at the time. Separate notes are also made of the presence of mist or fog. Thus a large amount of information has been accumulated as to the greater or less opacity of the atmosphere. The present paper utilises the data for a comparison of atmospheric opacity and the potential gradient of atmospheric electricity. It is found that even for the smallest amount of opacity which the observation scheme is able to disclose, the value of the potential gradient increases with the opacity. The effect of mist or fog on the potential gradients recorded in winter is large, and there being a large diurnal variation in the incidence of mist or fog, there is consequently a noteworthy influence on the character of the diurnal variation of potential gradient.

Institution of Electrical Engineers.—Mr. C. H. Wordingham, president of the Institution, addressing a meeting of the Scottish Centre at Glasgow, on December 16th, said it was proposed to apply for a charter for the Institution. As at present constituted, the Institution could not look after the interests of every branch of the industry. Separate Associations must be formed to deal with separate interests, and all these Associations should be linked together in one main body, so that when occasion arose there would be one organisation to act and speak for the industry.

Illuminating Engineering Society.—At the meeting on the 19th inst., papers were read and discussed on photometric tests of parachute lights and flares, self-luminous paints used for naval and military purposes, and on integrating photometers.

The president (Mr. A. P. Trotter), in opening the session, said that before it was brought to a close he hoped a Treaty of Peace would have been made. But it was difficult to treat with a people who had lost all sense of honour. German men of science had made, unasked, two deliberate pronouncements of hostility to scientific men of the Allied nations.

If among German and Austrian scientific men there had been one who was ashamed of the dishonourable and bestial conduct of their countrymen in the war, not one had had the courage to admit it. In these circumstances, what could they be but outcasts from

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intercourse with nations like our own, in which the individuals would rather perish than prostitute their consciences as the Germans had done, to the lusts of a brutal and unscrupulous Government? While Labour, materials, and Capital were in a confusion undreamed of in the postulates of the academic economist, Science could detach herself and press steadily on.

Junior Institution of Engineers.—The new president, Colonel R. E. B. Crompton, C.B., delivered his inaugural address on "What the War has Done for Engineers, and the Part Engineers have to Play in Reconstruction," on Friday last. He said that ever since mankind divided itself into the two groups of those who *worked* and those who *talked*, the talkers had had the upper hand, and had always attempted to be the governing body. But the war changed all that. One year of war showed that nine-tenths of the work was essentially the work of the engineer, and in every department of Government, engineers found themselves forced to the top. The status of engineers in regard to the body politic had reached a point which it would have taken many years to reach if it had not been for the war.

With regard to the problems of reconstruction, he drew attention to various branches of engineering work which would demand their earnest consideration. Referring especially to road transport, he said that when road vehicles could be driven by power derived from a side wire by a trolley-pole, very great economy in tare weight of the propelling vehicles could be obtained, as the weight of the electric motor and its gearing was much less than that of the petrol motor or the steam unit. His most advanced idea was that it would be wise to develop the use of electrically-driven road trains, each train consisting of four three-axle vehicles; it would be possible to load each of these axles to eight tons, or a total moving weight of train close on 100 tons, without the road crust being stressed in excess of what was now the case when a motor-wagon, with back axles loaded to eight tons, passed over it at the same speed. He estimated the working cost of a train consisting of four such vehicles, carrying a maximum fuel load of 32 tons, and, therefore, probably weighing under 60 tons, at 1·51d. per net ton per mile, of which the wages charge was only ·22d. per ton mile. This subject of road trains, combined with electric driving, merited careful consideration. On the subject of railway reconstruction he dealt with the proposals of Gattie to establish clearing-houses at large railway centres, so as to reduce the number of goods wagons required for the transport of goods by loading their contents into containers. He agreed that if Gattie could only carry out a part of what he promised, he would have done well. Looking at it from the road user's point of view, he was not wholly satisfied that Gattie's large containers would greatly facilitate the distribution of goods, whenever these had to be carried partly by rail, partly by road.

Col. Crompton proposed to reduce the huge cost of the terminal transfers by his own transfer system; he gave the name of transfer to a motor-box or frame, of a size that could be placed transversely on railway wagons, could be pushed on to them from the side, and unloaded by being pushed sideways on to the road wagon. At suitable points on the main line which carried goods traffic, instead of the usual roadside station, with its sidings, goods sheds, and the like, it would only be necessary to provide platforms of a suitable height, by which the road wagon could approach the railway wagon sufficiently close to allow the loads to be moved from railway to road wagon, or *vice versâ*.

The transfers might either be the property of the railway company or of the road-carrying companies. The 3-ton motor-wagons which would be returned from France when the war was over would be, for a long time to come, largely used for road transport.

Touching the future of manufacturing by machinery in quantity, he said that in the past our inland and export demand had rarely allowed our manufacturers to put in orders in large numbers, exceeding one thousand, at a time. The bulk of the output from our engineering works, however, since it had been standardised, had been in orders up to many thousands at a time.

At this parting of the ways, it became of paramount importance to carry on the manufacture of goods on the same scale as we had carried out the manufacture of munitions during the war. The workers in America undoubtedly had been able to secure for themselves good wages, reasonable hours, and a degree of comfort, without the price of the article made by them being high; but the American workman had undoubtedly lost individuality and interest in his work. The question was whether the same high wages as had been earned in America on these automatic performances could be received here without such soul-destroying results.

Electrical Engineering in Italy.—Mr. E. Morelli recently discussed this question at length before the Italian Association of Electrical Engineers. According to *L'Elettrotechnica*, he mentioned the directions in which foreign competition had been most active, and advocated Government action to assist the development of native industry. It was expected that the development of water-power stations in Italy would proceed rapidly when the industry returned to normal conditions, and in this connection the manufacture of machinery and accessories on a large scale should proceed *pari passu*. As regarded the general measures for encouraging the electrical engineering industry in Italy, he recommended that increased attention should be given to the design of generators and motors and to improving the mechanical, magnetic, and electrical properties of materials of construction and methods of commutation and compensation, as well as cooling. Attention should also be paid to the special requirements of cotton-spinning mills, sawmills, paper mills, printing works, &c.: and the principle of separate motors for machines or groups of machines should be followed as far as possible, instead of having a main driving motor for the various workrooms.

The question of the best system to adopt for electric railways was considered at some length. Owing to the special conditions of working, single-phase current was not suitable, in spite of its advantages. Many engineers were inclined to favour the low-frequency three-phase system which had been successfully applied on some mountain railways. Some of the disadvantages of this system might be partly obviated by building experimental locomotives of the three-phase type with ordinary frequency and higher working voltage than was usual (as there were many systems of speed reduction applicable at the present time). If this were successful, one of the gravest objections to the present system in Italy would be removed—viz., the special frequency used (50/3 cycles per second).

As regarded the general question, standardisation should be the key-note of the future, and greater attention should be paid to specialisation of design and mass-production. As regarded some insulating materials and alloy sheets for dynamo stampings, much yet remained to be done in Italy to render her independent of foreign supplies, but the author believed that Italian metallurgists and insulating material manufacturers would be able to solve the problems set them.

The Romance of Electricity.—On Sunday evening, Dec. 8th, at Coventry, Mr. A. P. Young delivered an interesting lecture, entitled "The Romance of Electricity." The chair was occupied by Mr. H. J. White, and there was a record audience. With the aid of numerous slides, films, and experments, the lecturer traced the development of electricity and magnetism. The various purposes to which electricity had been applied were demonstrated, and at the conclusion, Mr. Young explained what was meant by the all-electrical scheme put forward by the Coal Conservation Committee some 12 months ago.

On December 16th, Mr. W. M. Selvey, of Sheffield, addressed the Bradford Engineering Society on the reports on Electric Power Supply.

Financial Facilities for Trade.—The Report of the Committee that sat to investigate this matter has just been issued. We hope to refer to it more fully later.

The Ford War Output.—Sir Percival Perry, chief director of the Ford Motor Works at Trafford Park, is reported to have stated to a meeting of employés last week that the war work of the company consisted of 38,296 cars, 6,366,000 explosive container tubes, 3,700 plough conversions, 3,928 master gauges and jigs, 48,341 car bodies, and 6,000 Fordson tractors. A 40-hour week will begin at the works with the New Year, as against the present 48. Wages are to be advanced from 1s. 3d., the present minimum, to 1s. 10d. per hour. Women are to participate in the profit-sharing scheme.

Volunteer Notes.—The Headquarters of the Royal Engineers' Volunteers, London Army Troops Companies, will be closed from December 30th to January 4th, and no parades will be held.

Football.—The second of the series of football matches between the Magnet F.C. and the remainder of the G.E.C. was played at Dulwich, on Saturday last. In the first match the "Old Crocks" were victorious, but this time the Juniors gained a creditable victory, scoring two goals to their opponents' one. Whitford scored for the G.E.C. after about a quarter of an hour's play, but although the Magnets did a lot of pressing, they could not score, owing to Maddams's fine display in goal. Soon after half-time, however, Joseph equalised, and a few minutes before time Brown scored the winning goal, amidst great applause. The feature of the afternoon was the play of Maddams in goal, but for whom many more goals would certainly have been scored against the G.E.C.

Inquiries.—Makers of the "Simplex-Coventry" lighting set are asked for.

Industrial Committees.—The activities of the Ministry of Reconstruction in the formation of Interim Industrial Reconstruction Committees—or temporary Whitley Councils, as they are sometimes called—will be resumed after the holiday period. Full Trade Conferences have been arranged for the tubes and paper-making industries. They will be held in January, under the presidency of Mr. E. J. P. Benn, Chief Trade Organisation Commissioner of the Minister of Reconstruction and Chairman of the Industrial Reconstruction Council.

German Protective Devices Against Surges.—German patent No. 291,498 of E. Nytborck describes a fuse, the operation of which depends on electrostatic attraction. A U-shaped filament is connected in the circuit and suspended in a tube containing oil. At the lower bend the filament lies between two plates, one earthed and the other connected to the line. If the line to be protected rises in voltage beyond a safe limit, the filament is attracted so as to touch the earthed plate, and fuses in consequence. The rupture takes place under the oil. Another patent, No. 288,373, of the Siemens-Schuckert works shows an ingenious construction of subdivided cables, so that they may afford an obstruction to incoming surges. The cores of the cables are crossed at certain points, so that outer strands proceed into the interior of the cable and *vice versâ*. Rapid oscillations tend to remain on the surface of the cable, and, when they reach the cross-over and are led into the centre, they have to find a path to the outer strands again. Only a part of the surge finds this passage, and the remainder is reflected back along the outer strand. The action is assisted by including choking coils at the points where the strands pass from the inside to the outside of the cable, or in the reverse direction, and also by providing resistance bridges from an outer to an inner conductor, where the interchanges of position take place.

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Mr. Winston Churchill on the Change-Over.—On Saturday last Mr. Winston Churchill, Minister of Munitions, addressed a joint conference of employers and trade union representatives on the measures taken by his department to turn over to peace industry. The first task was the liquidation of contracts; the second was the rendering of assistance of various kinds to firms to turn over from war industry to peace industry; and the third was the disposal of stocks of materials, properties, and stores of all kinds, amounting to nearly 1,000 millions in value. They had to get the best prices for the Exchequer without discouraging and dislocating the normal industries of the country and delaying their revival through throwing great masses of new or part-worn surplus products upon the market. This seemed to him to be one of the most intricate business problems that had ever been set. He hoped that by the end of January the staff of his Department would have been reduced by at least 4,000 persons. The diminution of staffs would be followed by the disgorging of hotels. But during the greater part of 1919 the liquidation of contracts and the sale of stores, apart altogether from the normal business of the Ministry of National Supply, would require the maintenance of a very large staff at headquarters. The inspection staff of 70,000 persons had been effectively reduced during the past six weeks, and by the end of this week 20,000 to 25,000 would have been released. But the inspection staff had now to inspect and schedule the stocks of finished and unfinished munitions, so as to assist in the rapid settlement of accounts between contractors and the Ministry of Munitions. In the course of his reference to the output of shells, Mr. Churchill said that nearly 230,000 persons would have left munitions production by the end of this week. As far as the engineering shops were concerned, we were bound to have a period of dislocation extending over several months. Not only had new projects got to be undertaken, but the shops had to be cleared for new arrangement of machinery. It was inevitable that there should be a period of more or less severe dislocation throughout the great engineering trades by the transition from war to peace, but the difficulty would have been seriously aggravated if a similar disturbance and arrest of production had extended to the basic trade, the great steel trade, upon which, as a foundation, all our engineering activities stood. The arrangements which had been made to turn the steel trade on to peace production appeared to be working extremely well. Orders were being booked for export, and so far as home production was concerned the steel works were already fully occupied. That was a very satisfactory step on our anxious and lengthy journey from war to peace. After alluding to orders for the release of tools and metals, the speaker referred to the efforts of the Government in placing orders to develop alternative industrial productions as a stop-gap pending the transition. The superintending engineers of the Ministry of Munitions distributed all over the country were advising and assisting firms in their areas. The local boards of management were also co-operating in every way. They were making special efforts to obtain orders from Government Departments, from the Colonies, and the Dominions, and from public bodies, with a view to placing them to the greatest advantage. When necessary he was prepared, in connection with Government schemes, to place covering orders for commodities which would clearly be required in considerable quantities if private orders were not forthcoming. For instance, he had arranged with the Railway Executive Committee and with the Board of Trade to place orders, if necessary, for 1,000 locomotives and 30,000 or 40,000 wagons in the shops of the country.

Arrangements were being made with the Local Government Board for the Ministry to place large orders for articles required in connection with the Government's housing schemes; such articles as fittings for gas and electric cooking and lighting, &c. Contractors would be well advised to get into communication with the Ministry of Munitions showing their desire to obtain orders of this nature. It was idle to suppose that we could bridge the next three or four months without a certain degree of dislocation and of unemployment.

In looking forward to the future, Mr. Churchill desired to emphasise the real importance of everybody endeavouring to stimulate alternative peace productions and taking every step in reasonable relation to that. "Let every man endeavour to find his peace job, and let the country as a whole have courage and confidence in its immediate future. . . . There ought to be a period of great activity following this transitional period, and everyone should look forward to the future in the spirit of hope and of confidence, for by that process they will more or less stimulate the revival which they desire and which is so essential to our well-being."

The Westinghouse Manager and Engineering Output.—The *Manchester Daily Dispatch* on Saturday last published an interview with Mr. H. Mensforth, manager of the British Westinghouse Co., and the new president of the Manchester and District Engineering Trades Employers' Association. He said there were years of ample trade ahead, but to obtain it ca' canny methods would have to cease, and no restrictions must be put on the development of machinery to obtain the maximum output with the minimum of energy. Mr. Mensforth said that at present many customers would not place orders because of the impossibility of firms giving definite prices and times of delivery. As an instance of the loss of trade through the latter, he mentioned that the Westinghouse Co. had an order from Norway for a lot of switchgear, but through the Government not giving a promise as to priority until too late the firm was unable to guarantee deliveries as required, and the order had gone to the Siemens-Schuckert Co., in Berlin.

A great question now was whether the skilled men's unions were going to realise that maximum production was as much in their own interests as the employers'. "In other words, if employers were willing to put down modern machinery and use modern methods, are the unions prepared to allow the fullest output? If the answer is in the affirmative—and there will be the maximum production in America, and certainly in Germany also—then not only shall we absorb all the skilled labour available in the country, but all the semi-skilled as well, and also as many of the unskilled men now engaged in engineering works as are capable of being utilised." "If the skilled man will make it his interest so to develop machinery that we can get the maximum of output with the minimum of energy, the 47-hour week, too, will have the sympathy of any good employer. We need not have the slightest fear of the future," declared Mr. Mensforth.

Industrial Lighting.—A good overhead system of lighting is the modern standard for industrial establishments, and usually provides all the light that is required for the lighting of most interiors. Quite frequently, however, local lighting is employed in addition to the overhead lighting for certain machines or locations in the shop.

To assist local lighting it has been found that the use of white paint has proved very effective. In one case a large machine shop, containing massive vertical slotters, was lighted with an overhead system to an average intensity of about two foot-candles. The heavy machines were finished with very dark paint, so that the lighting of the tables in the region where the cutter operated was insufficient for setting the cutter accurately to the pencil markings on the rough castings ready to be machined. As a remedy a lamp on a drop cord was provided for each machine, and the surfaces of the machine which faced the table were painted

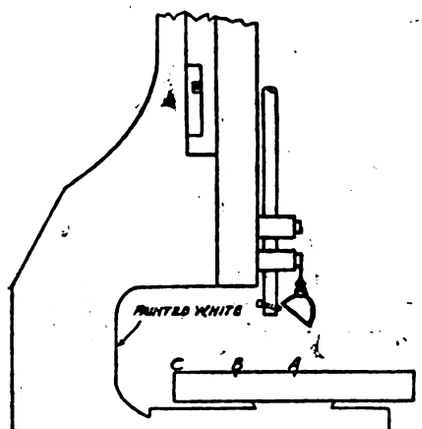

DIAGRAM OF MACHINE, SHOWING THE IMPROVEMENT IN LIGHTING OBTAINED BY PAINTING THE VERTICAL SURFACES OF THE MACHINE FACING TABLE.

white. This improvement avoids any shadows from the local lamp, as the reflection from the white painted surfaces softens the shadows very materially and increases the illumination on the table by about 75 per cent. Thus (see accompanying illustration) the foot-candle meter readings taken at the base-plate showed an improvement with the use of paint of 100 per cent. in the lighting at the points A and C, and over 50 per cent. at the point B.

Owing to the present necessity for strict economy by reason of the coal restrictions, the use of white paint would appear to be a most desirable practice for all machines and workshops.

National Control of Electricity in West Prussia.—Among the numerous treatises which have recently appeared concerning the management of the supply of electricity, one by Regierungsbaumeister a. D. Aschoff deserves special notice. The author assigns the duty of producing electricity to the State, and the distribution to the provincial associations, and supplies a number of interesting figures. He calculates the total energy requirements in Prussia at 17 milliard K.W.-hours, and the surplus profit for the State from the annual energy production at Mk. 25 millions, a sum which, in consequence of compensations paid to the compulsorily suspended existing power works, would be reduced by Mk. 38 millions, thus effecting a loss of Mk. 13 millions. From the distribution of the energy he estimates a profit of Mk. 177 millions, so that from the entire management of the electricity a net surplus would remain of Mk. 164 millions. The State will take 50 per cent. of this, viz., Mk. 82 millions, the other moiety will be assigned on an ingenious and equitable scale to the provinces, whose shares vary from Mk. 20 millions annually (Rhine Province) to Mk. 1½ million (West Prussia). —*Kommunale Praxis*, October 12th.

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Industrial Fatigue.—A Reaearch Board has been appointed by the Department of Scientific and Industrial Research and the Medical Research Committee jointly to consider and investigate the relations of hours of labour and of other conditions of employment, including methods of work, to the production of fatigue, having regard both to industrial efficiency and to the preservation of health among the workers.

The *Times* states that the duty of the Board will be to initiate, organise, and promote by research, grants, or otherwise investigations in different industries with a view to finding the most favourable hours of labour, spells of work, rest pauses, and other conditions applicable to the various processes according to the nature of the work and its demands on the worker.

For these investigations the Board looks forward to receiving the help of employers and workmen in the industries which are studied, and in appropriate cases representatives of both will be invited to serve as temporary members of the Board. The Board has been constituted as follows:—

Prof. C. S. Sherrington, ScD., F.R.S. (Professor of Physiology, University of Oxford), chairman.

E. L. Collis, Esq., M.B. (Director of Welfare and Health, Ministry of Munitions).

Sir Walter Fletcher, K.B.E., M.D., F.R.S. (secretary, Medical Research Committee).

W. L. Hichens, Esq. (chairman of Messrs. Cammell, Laird and Co., Ltd.).

Edward Hopkinson, Esq., D.Sc. (director of Messrs. Mather and Platt, Manchester).

Kenneth Lee, Esq. (director of Messrs. Tootal, Broadhurst, Lee Co., Ltd.).

T. M. Legge, Esq., C.B.E., M.D. (H.M. Medical Inspector of Factories).

Colonel C. S. Myers, M.D., F.R.S. (director of the Psychological Laboratory, Cambridge).

R. R. Bannatyne, Esq. (assessor representing the Home Office).

D. R. Wilson, Esq. (H.M. Inspector of Factories), secretary.

The Board will be glad to receive suggestions as to any problems of the kind described. All communications should be addressed to the Secretary, Industrial Fatigue Research Board, 15, Great George Street, Westminster, S.W. 1.

Posts for Ex-Officers.—A letter to *The Times*, of December 10th, signed by Captain F. Le Neve Foster, secretary of the Inns of Court Regimental Association, 10, Stone Buildings, Lincoln's Inn, W.C. 2, draws attention to a scheme which he has started to assist ex-officers to find suitable employment, and which has shown good results. Under this scheme a number of gentlemen in positions of influence in the professions, commerce, and industry have volunteered a personal interest in the welfare of a selected number of officers, with a view to advising and finding suitable openings for them, within their respective spheres of influence. For instance, one eminent civil engineer, with interests at home and abroad, is fathering the cases of six officer members of the association who have engineering qualifications. Captain Foster invites any gentlemen who are willing to help in this way to communicate with him, indicating the directions in which they may be of assistance and the type of officer in whom they are prepared to interest themselves. He will be pleased to forward to any such gentlemen a short list of officers of the type and qualifications desired, with any further details that may be required.

Lead.—In their Lead Market Report, dated December 20th Messrs. Jas. Forster & Co. say:—"Although restrictions to dealing in lead have this week been withdrawn, there is in no sense as yet an open market. So long as the whole of the supplies are in the hands of the Government, and this we believe is the case not only with respect to stocks here but also with all lead afloat, there will be no open market. Lead can only be obtained at £40 per ton for some time to come. No doubt with greater shipping facilities the large quantity of lead lying in Australia will in time be available. Production has been greatly stimulated during the last four years, particularly in America, and we anticipate ample supplies as soon as normal conditions obtain. On the other hand, there will be a sustained and heavy consumption. There have been no transactions on the market, but consumers have bought pretty freely for January at £40."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Central Station and Tramway Officials.—The Erith Urban District Council has advanced the salary of Mr. J. C. Williams, the electrical engineer and tramways manager, by £150 per annum. The circumstance that this advance was granted spontaneously by the Council, without any application from himself, must be gratifying to Mr. Williams, but it will probably cause other engineers, whose Councils have so far forgotten to be either just or generous, to wish that the tide of good fortune would flow in their direction.

Aylesbury U.D.C. has appointed Mr. M. Mortimer station superintendent at the electricity works.

Mr. A. Slaven, who is leaving the employ of the Urban Electric Supply Co. after 15 years' service, has been presented by the staffs at Newton Abbot and Dartmouth with a gold watch.

Mr. A. H. Gates, chief technical assistant at Luton Corporation electricity works, has resigned, having received another appointment.

Mr. S. Cohen, A.M.I.E.E., who recently left the position of senior charge engineer with the South Lancashire Tramways Co., to take up an appointment in the electrical department of the Oldham Corporation, was on 18th inst. presented with a dining-room clock from the engineering staff of the company.

Mr. Pilling, tramways manager, of Accrington, recently a candidate for the position of tramways manager at Huddersfield at a commencing salary of £600, and who lost the situation by one vote, has had his salary increased from £400 to £500 by the Accrington Council.

General.—Mr. C. G. Quetton, A.C.G.I., has joined the engineering and technical advertising staff of Messrs. Greenly's, Ltd. Mr. Quetton, who took his engineering degree at South Kensington, has spent six years in practical work in England and the U.S.A. After transferring his attentions in the States to the publicity side of engineering he returned to England, and in 1908 became publicity manager to the Sun Electrical Co., Ltd., and later was with the Union Electric Co. in a similar capacity. During the past three years he has been mainly in Russia organising publicity for a large combine of British firms and assisting Allied war propaganda, from which work he returned to a minor technical position at the Air Board.

Sir J. A. F. Aspinall is retiring from the general managership of the Lancashire & Yorkshire Railway Co. at the end of the year, and is to take a seat on the board. Major Arthur Watson, C.B.E., M.Inst.C.E., superintendent of the line and assistant general manager, has been appointed general manager to succeed Sir John. He is 45 years of age. He was articled to the chief engineer of the railway in 1890.

Sir Guy Granet will retire from the end of this year from the general managership of the Midland Railway Co., and will take a seat on the board. Mr. F. Tatlow, the deputy-general manager, becomes general manager.

Sergeant J. Conway Price, who recently had a severe attack of influenza, has been invalided Home, and is now in England, never more to return "over there."

The Victory number of the *Court Journal* contains an article on the "War Romance" of the firm of C. A. Vandervell & Co., Ltd., with a photograph of Mr. C. A. Vandervell.

Roll of Honour.—Lieutenant G. T. Lyall, of the Ontario Regiment, a Darwen (Lancashire) officer, awarded the V.C. for courageous conduct in the field, was an electrical engineer in Canada. He rushed a strong enemy point at Cambrai, and, single-handed, killed the officer in charge, subsequently capturing 45 prisoners and five machine-guns. During two days' operations he captured three officers, 182 other ranks 26 machine-guns and one field gun, exclusive of heavy casualties inflicted.

Private S. A. Plant, Essex Regiment, who has been killed in action, was employed at the works of Messrs. Siemens, Stafford.

Alderman Knowles Edge, Deputy Mayor of Bolton, last week presented the D.C.M., which was awarded at Gallipoli in January, 1916, to Sergeant J. G. Jones, R.F.A., who was employed as an electrician in Bolton.

Obituary.—Mr. J. R. Berry.—Amongst the many victims of the recent influenza epidemic (estimated to number about eight thousand in Cape Town and suburbs) is Mr. James R. Berry, the local manager of the Telegraph Manufacturing Co. Mr. Berry was a native of Bury, Lancashire, but had occupied his position in Cape Town for about eight years. Our Cape Town correspondent says that his wide knowledge and experience of electrical matters was always at the disposal of electrical engineers, and his genial disposition caused him to be endeared to a large circle of acquaintances, many of whom showed their appreciation by paying him the last mark of respect at his funeral. Three other victims were Messrs. James McConville and William Hope, foremen in the cable department of the Cape Town Corporation, and Mr. T. M. Maskew, correspondence clerk in the electrical department. As about 75 per cent. of the staff of the electrical department were affected at one time, it can readily be understood that the supply was kept going under exceptional difficulties.

Mr. W. McCannam.—The death has taken place from influenza of Mr. W. McCannam, a member of the staff of the electric light works at Neston (Cheshire).

Mr. W. Yardley.—The death occurred recently of Mr. W. Yardley, electrical engineer, of Leatherhead, aged 54 years.

Mr. J. A. Baker.—The death is announced of Mr. J. A. Baker, who was in business as an electrical engineer and contractor at Northampton.

Mr. Harvey du Cros.—Mr Harvey du Cros passed away suddenly on Saturday last at Dalkey, Co. Dublin, aged 72 years.

Wills.—The late Mr. James O. Callender left £17,320.

The late Colonel Bertram Hopkinson, who was killed in a flying accident, left £16,457.

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NEW COMPANIES REGISTERED.

English Electric Co., Ltd. (152,250).—Private company. Registered December 14th. Capital, £5,000,000 in £1 shares (1,500,000 pref. and 3,500,000 ord.). The pref. shares are entitled to a fixed cumulative preferential dividend at 6 per cent., and in a winding up they take priority as regards return of capital and arrears of dividend, but they carry no right to further participation in profits or assets. Each share confers one vote. The objects are: To carry on the business of electrical, mechanical, hydraulic, and general engineers and contractors, manufacturers of, and dealers in, vehicles, galvanic, and magnetic apparatus and appliances, suppliers of light, heat, sound, and power, manufacturers and repairers of, and dealers in, vehicles, cycles, engines, chassis, bodies, airships, aeroplanes, armour plates, gun mountings, missiles and explosives, dealers in petrol and other volatile oils and spirits, lubricants, metallic compounds and chemicals, &c. The first directors are:—C. T. Cayley, 5, Portland Place, W. (chairman of Dick, Kerr & Co., Ltd.); B. A. Firth, Norfolk Works, Sheffield (chairman of Thos. Firth & Sons, Ltd.); W. Rutherford, 3, Abchurch Yard, E.C. (managing director of Dick, Kerr & Co., Ltd.); J. Sampson, 8, The Sanctuary, Westminster, S.W. (director of John Brown & Co., Ltd.); P. J. Pybus, Thornbury, Bradford (managing director of Phœnix Dynamo Co., Ltd.); Col. J. H. Mansell, The Chase, near Coventry (managing director of Coventry Ordnance Works, Ltd.); A. Gracie, Fairfield Works, Glasgow, engineer; W. L. Hichens, 3, Central Buildings, Westminster, S.W. (chairman of Cammell, Laird & Co., Ltd.); C. E. Ellis, Rampton Manor, Notts., manufacturer. Minimum cash subscription, seven shares. Directors' qualification, £1,000. Remuneration, £250 each per annum, with £100 extra for the chairman, and, if the directors so determine, for the deputy-chairman. The directors may borrow on security up to the nominal amount of the share capital without the consent of a general meeting. Registered office: 3, Abchurch Yard, E.C.

CITY NOTES.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

The annual meeting was held on Thursday, December 19th, at the offices, 106, Cannon Street, E.C. Major LEONARD DARWIN, who presided, said that early in the year the death occurred of Mr. G. W. Smith, extraordinary director, who for 50 years had faithfully served the company in France. He was appointed manager in 1870, during the time when their factory at Persan was occupied by the Germans, and he had only relinquished his charge at the beginning of the present war, when Persan was again threatened by a second occupation. In addition, they had also to note with regret other losses in the English staff. Mr. Geale, the accountant, who had been with them 35 years, Mr. Williams, the controller of agencies, with a record of 43 years, and Mr. Stables, for many years manager of the india-rubber department at Silvertown, had all passed away. Capt. Nigel Hanbury, a director, who had been with the Colours since October, 1916, was still away on the Continent. Col. Jarvis, who had served since the commencement of the war, and went through the trying experiences of Gallipoli, was happily with them that day, on leave. Having referred to the appointment of Mr. Russell, the manager at Silvertown, as an extraordinary director, the chairman said that the net profit, after making provision for doubtful debts and excess profits duty, was £143,589. That had allowed the directors to put £50,000 to the reserve fund, and to carry forward the substantial sum of £90,955. He thought they would agree that it was very satisfactory to have a reserve fund (£500,000) which was equal to the whole issue of their ordinary shares. For many years it had been the ambition of those who had the interests of the company at heart to be able to reach that figure. As to the future, they had now to study and carry out the necessary changes which would help them to bridge over the transition period between war and peace conditions. That was a very serious problem, and it was made the more so by the fact that the Government had not yet been able to give the country any information of a definite nature as to their future fiscal policy in connection with our Colonies and foreign countries. During the war their turnover had greatly increased, both in volume and in value. They had had, it was true, to sacrifice their pre-war business, and use their plant for the production of great quantities of Government requirements, manufactured from materials at artificially inflated prices, and with increased labour costs. It was an easy operation to lose one's business, but, as they could all imagine, it was one of very great difficulty to regain lost trade. Home competitors, who had done less war work than they themselves had, had been able to invade their home markets, whilst the advantages reaped by neutral countries by invading their foreign markets would not cease to be felt with the advent of peace. They hoped, however, to regain those markets as soon as they could put themselves in a position to produce their manufactured articles in the necessary quantity and quality, and at competitive prices; and, in addition, they thought that some of the information obtained and lessons learned during the war period might be of considerable assistance to them in reaching that goal. During the period of reconstruction, it was obvious that their aim should be to so adjust their operations that as much as possible of the labour at present employed should be smoothly transferred from war work to more peaceful occupations, but in those operations they must not forget what they owed to those members of the staff who had been fighting their country's battles at the Front, and whose claim to employment stood first. All those questions of material, labour, and markets presented great difficulties, but with a knowledge of the business, and given the necessary support from the Government whilst their control continued, they hoped, and thought that they would be able to steer the company's barque through the troubled waters of reconstruction on a comparatively even keel. Their factory at Persan had done very well during the year under review. At the height of the German offensive last spring the position there again became critical, and the French Government intimated that, in distributing their orders, preference would be given to firms at some distance from the Front, where there was less chance of the work being interrupted by the enemy. In order to comply with their views, they took over a small factory in the South of France, to which they could transfer the most important plant in case the advance seriously threatened Persan. Luckily, they were not driven to that expedient, and now they could either dispose of the property on satisfactory terms, or retain it as a second string to their bow in France, whichever proved advisable. He was glad to be able to state that they had started work in their new factory at Burton. The Government had assisted them by allowing a considerable depreciation to be written off the buildings and machinery before arriving at the sum liable to excess profits duty, and the position of the factory, from the point of view of coal, labour, and transport facilities, was such that they had every reason to hope it would prove a valuable addition to the productive capacity of their firm. The period of reconstruction which lay before them gave rise to no little anxiety, and the results of the current year might well prove disappointing. However, they could only deal with the various problems as they arose, to the best of their ability, which, he thought, must be the attitude and methods adopted by all the industries of the country. Having paid a tribute to the excellent way in which the staff of the company had worked throughout the period of the war, he said that the critical times were not yet over. He thought they might look forward to what was coming this year with confidence. The critical times would really begin next October, but, although they would be critical, he did not think they need have any fear.

Mr. C. H. GRAY seconded the motion, and the report was adopted without discussion.

Edison Swan Electric Co., Ltd.

For the year ended June, 1918, the balance to credit of profit and loss account is £129,210, plus £13,267 brought forward. Interest on both classes of debenture stock has absorbed £19,119; interim dividend on the first pref. dividend to January, 1918, £3,793; munitions levy balance £587; expenditure on bomb-proof shelters £1,403; special munitions plant, &c., depreciation £11,739; written off expenses of preference share issue £4,222; cost of debenture stock purchased for sinking fund £975; further provision for debenture sinking fund £8,612; 3 per cent. dividend on first participating preference shares £3,000; transferred to reserve £10,000; 7½ per cent. dividend on the "A" shares £28,761; leaving to carry forward, subject to excess profits duty, £50,265. The capital expenditure during the year, before providing for depreciation, amounted to £17,907 (buildings £2,731, plant and machinery £15,176). The plant extensions have been mainly in respect of special plant erected for carrying out Government contracts, and under arrangement with the Ministry of Munitions £11,739 has been written off as shown above. The new capital provided by the issue of preference shares and the improved organisation have had a very distinct bearing upon the increased profits shown. How far the reconstruction and reorganisation of the industrial undertakings of the country will affect the earning capacity of this company in the immediate future it is at present impossible to foresee. The directors hope that, given an adequate supply of raw materials and an equitable solution of the labour problem, satisfactory profits will be earned. The question of tariffs, however, is a highly important one for all electrical undertakings, and must not be lost sight of. As soon as more normal conditions with regard to the shipment of goods abroad are established it is hoped that the company's export business will become a valuable source of revenue. In order to carry into effect the general policy of expansion which the directors have in view it is proposed to take steps to make a further issue of ordinary shares, which in due course will be offered to the existing shareholders for subscription. The balance-sheet does not disclose the fact that the liability of £2 per shares has now been removed from the partly-paid £5 ordinary shares, or that these shares have now been split into the denomination of £1 each, as the order of the Court cancelling the liability was not made until after the date covered by the balance-sheet. A freehold property in the north of London has been purchased since the date of the balance-sheet for the purpose of manufacturing dry cells and batteries, the capacity of the existing shops at Ponders End not being sufficient to cope with the orders received, and, in addition, 10 acres of freehold land adjoining the Ponders End works have been purchased.

Annual meeting: December 30th.

Barcelona Traction, Light & Power Co., Ltd.—The financial Press states that at an adjourned meeting of the holders of the 5 per cent. first mortgage 50-year bonds, last week, resolutions were unanimously passed sanctioning the scheme of reorganisation.

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Fullers' Carbon & Electrical Co., Ltd.—At the second annual general meeting held last week, Mr. George Fuller, M.I.E.E., the chairman, congratulated the shareholders upon their dividend of 10 per cent. on both classes of shares, as against 8 per cent. last year. The turnover had been increased threefold during the period. The company's products had largely superseded the foreign product, and they already had orders on the books equal to last year's entire sales. This had necessitated the erection of another large building, with a fully-equipped plant, which had materially increased the output.

British Coalite Co., Ltd.—Mr. W. J. Fisher, in the course of his speech to shareholders on December 18th, said that it had been suggested that greater economy and greater strength and efficiency would result from the amalgamation of four companies all tending to the same end:—the Barnsley Smokeless Fuel Co., Low Temperature Carbonisation, Ltd., Coalite, Ltd., and their own concern. If on closer examination the scheme proved feasible the shareholders of all the companies would be made acquainted with the details and called together.

Mirrlees, Bickerton & Day, Ltd.—The "Financial Times" says that the capital of this company is to be increased to £350,000 by the creation of 140,000 ordinary shares of £1 each. 55,000 of the new shares will be offered to ordinary shareholders at par, and 30,000 shares may be issued to members of the staff, employés, and agents of the company.

Callender's Share & Investment Trust, Ltd.—Dividend 3½ per cent., less tax, for half-year, making 6 per cent. for year. £500 has been put to reserve, £741 written off preliminary expenses, and £5,305 is to be carried forward.

Victoria Falls & Transvaal Power Co.—According to the financial Press the net earnings, including those of the Rand Mines Power Supply Co., for the quarter ended September 30th amounted to £225,990, before providing for taxation in South Africa and the United Kingdom.

British Uralite (1908), Ltd.—Profit for the year ended June, £6,162. Dividend 5 per cent. to be distributed as soon as the liquid cash is available. The plant has been improved, increasing production and reducing cost.

Eastern Telegraph Co., Ltd.—Dividend at the rate of 3½ per cent. per annum, less income-tax, on pref. shares for quarter ended December; third quarterly interim dividend of 1½ per cent. on the ordinary stock, free of income-tax.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—Third quarterly interim dividend of 3s. per share, free of tax.

Marconi's Wireless Telegraph Co., Ltd.—Dividend of 7 per cent., less tax, upon the cum. participating preference shares, and an interim dividend of 5 per cent., less tax, on the ordinary shares.

Stock Exchange Notice.—Application has been made to the Committee to appoint a special settling day in:—
Siemens Bros. & Co., Ltd.—120,000 shares of £5 each, fully-paid, No. 1 to 120,000.

Crompton & Co., Ltd.—Interim dividend at the rate of 7 per cent. per annum for the half-year, on the preference shares.

STOCKS AND SHARES.

Saturday Morning.

There is not very much to tell about Stock Exchange markets, where business has come to nearly a full-stop on the eve of the extended holiday. The House has even recovered part of its old-time hilarity, and a good deal of quiet merriment is noticeable. At the same time, there is not a member in the House but has a personal loss to mourn, and this consideration forbids any such boisterous gaiety as used to distinguish the Stock Exchange in Christmas weeks before the war.

The Home Railway position continues to absorb mild interest, and, although prices gave way after their first improvement on nationalisation expectations, this decline has been followed by a small upward reaction, which has lifted prices a quarter to a half above their previous levels. Undergrounds are not greatly affected so far, but Metropolitans are firmer.

The question is being debated as to what is the status of a debenture stock, inasmuch as the answer to the problem may have a distinct bearing upon the price which is likely to be offered by the Government in taking over the securities. The best authorities declare that, in the case of a home railway company, the rights of debenture holders are limited to the appointment of a receiver, who has the power to operate the property for the benefit of the stockholders, but who cannot sell any part of it in order to repay debenture-holders' debt which the company owes them. In other words, it is held that a debenture in a British railway company is in no sense a mortgage, and, therefore carries no such rights as falling to a mortgage debenture stock. The point is interesting, as already indicated, on account of the difference it may make to the price received by debenture stockholders if, and when, their security is taken over by the Government.

The Eastern Telegraph Co. has declared its usual quarterly dividend of 1½ per cent., and the Eastern Extension Co. of 3s. per share, both of these being paid free of tax. The market in cable shares is a little dull for choice, though amongst manufacturing issues there is a decidedly good tone, and Callenders have risen to 10½ on top of their big rise of a few days ago. The Marconi group is also better, not so much in price as in sentiment. Business is quiet in the shares, and Americans at one time gave way to 29s. 9d. Then they rallied to 30s. 3d. Marconi Marines at 3½ are 1/16 better on the declaration of an interim dividend of 1s. per share, less income-tax, on account of the current year. United River Plates are 1/16 up. In other telegraph and telephone issues there is little going on, and no change in prices.

Edison-Swan shares rose to 19s. 9d. on the declaration of a dividend of 7½ per cent., which is better than many had expected. The news was not generally known this (Friday) afternoon, and it may be that prices will improve unless there happens to be profit-taking to follow the announcement. The rest of the electrical manufacturing shares were very steady, prices, however, calling for no particular comment.

Amongst the foreign groups, although Mexican utility bonds are unchanged, the tendency is still depressed, and it is by no means easy to sell stock at the moment. The Argentine Tramway issues are also heavy, the first preference declining to 4 1/16 and the second preference giving way to 3¾. Canadians are rather better, and the 5 per cent. bonds of the Electrical Development of Ontario went up 2 to 88. No alterations have occurred in Brazilians. The rubber market is hard, and amongst base-metal shares, the removal of Government control from some of the principal metals has had no untoward effect upon prices of shares.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Dec. 20, 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	7½	—	£6 18 0
Charing Cross Ordinary	5	4	3½	—	5 14 0
do. do. do. 4½ Pref.	4½	4½	3⅞	—	6 13 4
Chelsea	8	5	4	—	6 5 4
City of London	8	8	13	—	6 3 1
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 5
County of London	7	7	11⅝	—	6 5 7
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 5
Kensington Ordinary	6	7	5⅞	—	5 19 2
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	4	5	4	—	6 5 0
Metropolitan	3	4	3	— ¼	6 13 4
do. 4½ per cent. Pref.	4½	4½	3¾	—	6 18 6
St. James' and Pall Mall	8	9	7¼	—	6 6 4
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	7⅛	—	6 6 4
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	99	—	6 1 0
do. Def.	1½	1½	23⅜	—	6 9 6
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	15½	—	*5 3 3
Eastern Tel. Ord.	8	8	157½	—	*5 1 7
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 5
do. do. Pref.	6	6	10½	—	5 14 3
Great Northern Tel.	24	22	33½	—	6 11 5
Indo-European	13	13	58½	—	5 11 0
Marconi	15	20	4⅜	—	4 6 7
Oriental Telephone Ord.	10	10	3½	—	2 17 2
United R. Plate Tel.	8	8	7⅞	+ ⅛	*5 2 3
West India and Panama	6d.	1/3	1⅛	—	*3 12 6
Western Telegraph	8	8	16½	—	*4 18 7
Home Rails.					
Central London Ord. Assented	4	4	65½	—	6 2 2
Metropolitan	—	1	30½	—	3 5 6
do. District	Nil	Nil	26	—	Nil
Underground Electric Ordinary	Nil	Nil	8⅜	—	Nil
do. do. "A"	Nil	Nil	9/-	—	Nil
do. do. Income	6	4	91	—	*4 8 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅜	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	4⅛	— ⅛	—
do. do. 2nd Pref.	5⅜	—	3⅜	— ⅛	—
do. do. 5 Deb.	5	5	75½	—	6 12 5
Brazil Tractions	—	—	56	—	—
Bombay Electric Pref.	6	6	103	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	67½	—	7 11 5
do. do. Preferred	Nil	Nil	52½	—	Nil
do. do. Deferred	Nil	Nil	45⅜	—	Nil
do. do. Deb.	4½	4½	62	—	6 17 3
Mexico Trams 5 per cent. Bonds	Nil	Nil	67	—	Nil
do. 6 per cent. Bonds	Nil	Nil	56	—	Nil
Mexican Light Common	Nil	Nil	38	—	Nil
do. Pref.	Nil	Nil	49	—	Nil
do. 1st Bonds	Nil	Nil	71	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	9⅜	—	4 0 0
British Aluminium Ord.	10	10	31⅝	—	5 3 1
British Insulated Ord.	20	20	2½	—	4 9 0
British Westinghouse Pref.	7½	7½	2⅝	—	5 14 1
Callenders	20	25	10½	+ ½	5 19 1
do. 5 Pref.	5	5	5⅜	—	5 0 0
Castner-Kellner	22	20	3⅛	—	5 10 4
Edison-Swan, "A"	—	—	—	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	10	1½	—	8 0 0
Gen. Elec. Pref.	6	6	103	—	6 2 4
do. Ord.	10	10	17½	—	*5 12 8
Henley	25	25	2½	—	5 11 8
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	—	*5 12 8
Telegraph Con.	20	20	48	—	*5 0 0

*Dividends paid free of Income Tax.

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CARBON BRUSHES: CONSIDERED IN RELATION TO THE DESIGN AND OPERATION OF ELECTRICAL MACHINERY.

By P. HUNTER-BROWN, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

The expression "carbon brush" is here used in a generic sense, and is intended to include brushes made of carbon and/or graphite, with or without the addition of various metals.

A demand is not infrequently made for a universal brush, or at most two qualities which will meet every case of commutating work, with a third quality for slip-rings. The requirements of modern machines, however, are too diverse and too exacting for such a thing to be practicable.

The wide adoption of commutating poles has reduced the duties devolving upon the brushes from the commutating point of view, but it has by no means eliminated them. The wide adoption of 50- and 60-period rotary converters produces difficulties inherently connected with the high frequency.

Special machines such as low-voltage aero dynamos and magnetos have brought in their train their own particular brush problems, demanding the development of special grades to meet the case in question.

To secure satisfactory operation, then, the problem may be stated thus:—

(*a*) In the case of slip-rings the brushes must maintain uninterrupted contact with the rings and carry the current with minimum frictional and electrical losses. Distribution of current between the various brushes must be sufficiently uniform to prevent local heating, and the rate of wear of both rings and brushes must be kept within reasonable limits.

(*b*) In the case of commutating machines the brush must run satisfactorily on a composite surface, and must possess the commutating characteristics necessary to give the required assistance in this direction, and must be capable of withstanding the unequal distribution of current which inevitably occurs in each individual brush.

Properties of Carbon Brushes.—In the manufacture of carbon brushes a well-equipped laboratory is an absolute essential if consistent results and uniformity of product are to be maintained. The properties must be studied individually and then collectively by running the brushes under actual operating conditions.

In this paper the word "collector" is used as a common term to denote either commutator or slip-ring.

The terms "positive" and "negative" are used in a motor sense; that is to say, by "positive brush" is meant the one by which the current passes to the collector, and by "positive ring" is meant the ring under the positive brush.

The resistance of graphite and carbon grades varies from a minimum of about 0.0003 ohm per inch cube to a maximum of about 0.0030 ohm per inch cube according to the proportion of graphite and other materials. Even taking the highest of these figures, the actual loss due to the resistance of the brush is only about 10 to 15 per cent. of the loss caused by friction and contact resistance.

The specific resistance has a much smaller influence in determining the carrying capacity of a brush than the contact drop, coefficient of friction, and thermal conductivity of the material.

If a small proportion of copper is added, the effect is actually to increase the resistance, though the alteration in the nature of the contact surface thereby produced may nevertheless prove very beneficial. By increasing the copper content the specific resistance may be reduced to about 0.000005 ohm per inch cube, there being still sufficient graphite in the brush to have a marked lubricating effect.

A low coefficient of friction is of vital importance with the high peripheral speeds of modern machines. Apart from the actual loss incurred, if the friction is high it may (though not invariably) lead to chattering of the brush. An imperfect contact between brush and collector, even if it does not produce destructive sparking, will at least increase the contact drop, so that the high friction increases the commutator loss directly, and also indirectly, by increasing the I^2R loss. Chipping and breaking at the contact surface are not by any means always attributable to high friction.

The coefficient of friction (μ) is influenced by the brush material, the composition of the collector, the condition of the surface of the latter, the pressure on the brush, the peripheral speed, and the condition of the atmosphere. The author has read a statement that μ may easily be increased 25 per cent. by heating, and again elsewhere that it decreases with an increase of temperature. He is of the opinion that no temperature variations likely to occur in practice affect the coefficient of friction.

The passage of current through a brush alters the nature of its contact surface and in this respect affects the friction. Samples for test should therefore be bedded with current flowing. After the surface appears to have been completely formed the first readings may be taken, but the test proper should continue for not less than three days with the machine running night and day.

The effect of a variation in the pressure applied to the brush is very marked. If the pressure is increased from, say, 2 to 4 lb. per sq. in., the friction loss is very much more than doubled. The explanation of this apparent increase in the coefficient of friction (which may be anything from 10 to 100 per cent.) is not obvious, but may be due perhaps to some kind of suction effect. That a partial vacuum is sometimes produced under a brush there seems little doubt. The phenomenon is probably confined more or less to the laboratory where the friction machines are maintained in specially good condition, and no doubt under normal working conditions there is sufficient vibration to prevent its occurrence.

The peripheral speed has a pronounced influence upon the coefficient of friction, the latter falling with an increase of speed, though not always to the same extent. Fig. 1 shows an instance in which the effect of speed variation upon the coefficient of friction is very great. An inspection of the curve reveals that the total friction loss was actually greater at the lowest speed than at the highest. It seems probable that this decrease of μ with increasing speeds is due to a film of air between the brush and the collector.

The contact drop of a copper gauze brush is of the order of 0.2 volt. With a carbon brush this is increased some 4 or 5 times. This contact drop is the most valuable property a carbon brush possesses. To quote the late Professor S. P. Thompson, "its presence is the whole secret of success in natural commutation. The price paid for the sparkless working of the machine is the voltage drop of 1.6 to 2 volts."

The voltage drop at the contact does not vary proportionally with the current, but remains remarkably constant over a wide range, and there is for each quality of brush a critical value below which no current at all will flow. In this respect the behaviour somewhat resembles that of an electric arc.

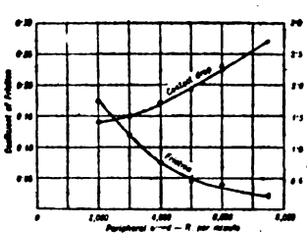

Fig. 1.

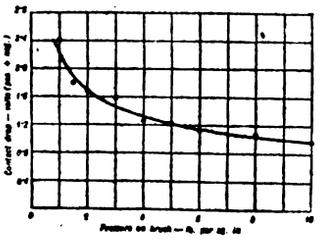

Fig. 2.

Fig. 1.—Coefficient of Friction and Contact Drop at 40 amps. per sq. in. of a Pure Graphite Brush. Pressure 2 lb. per sq. in.

Fig. 2.—Contact Drop of Carbon Brush Containing no Graphite. Current Density 40 amps. per sq. in. Speed 3,500 ft. per min.

An exceptional case is depicted in fig. 1. This shows the coefficient of friction of a pure graphite brush at various speeds. The curve is so steep and the value of μ so low at the highest speeds as to suggest the air-film explanation mentioned above. Contact-drop readings were taken at the same time as the friction readings, and these also are plotted.

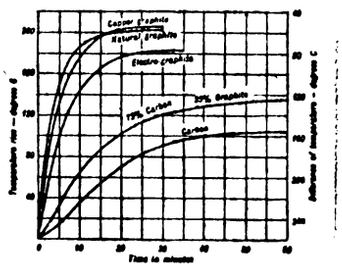

Fig. 3.

A large increase occurs in the contact drop as the speed approaches the maximum, again suggesting the presence of an air-film.

The immediate effect of an increase in temperature is usually a reduction in contact drop, but the extent is difficult to determine because the increase in temperature accelerates oxidation of the collector and this increases the contact drop. Many tests have been made, but it is not easy to obtain consistent results. Some tests have been made with the rings running at 3,500 ft. per minute, and with a view to eliminating some of the variables others have been made with the rings at rest. Starting with perfectly clean rings, generally speaking a drop of about 20 per cent. occurs very shortly after switching on. The contact drop then rises much above the original value. On cooling again, the behaviour is uncertain, but the contact drop does not return to anything approaching the original value. After cleaning the rings with fine glass paper without disturbing the contact surface of the brushes, a further test reveals a large reduction of contact drop.

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The behaviour of graphite brushes appears to be more consistent than that of carbon.

In actual practice considering the combined effects of an increase of temperature per sec. and the resulting oxidation, it seems highly improbable that any large reduction in contact drop occurs, otherwise we should have an unstable condition of things, since the contact resistance forms such a large proportion of the entire brush resistance. If an increase of temperature produced a decrease in the total brush resistance, to attempt to run brushes in parallel would be similar to attempting to run compound dynamos in parallel without equalisers.

The contact drop is very definitely affected by the amount of pressure applied to the brush. A typical curve is shown in fig. 2, which refers to a carbon brush. The test was made at 40 amps. per sq. in., the speed being 3,500 ft. per min.

The thermal conductivity has a very definite bearing upon the performance of carbon brushes, as relatively very large amounts of heat are generated in very small volumes of material, and unless the heat escapes rapidly a destructive temperature rise is the result.

Over 90 per cent. of the loss occurs at the contact. Unequal distribution of the current, overloads, and circulating currents, all tend to increase and localise the heat still more.

The thermal conductivity of the various classes of brushes varies very largely It is greatest in the pure graphite and highly metallic copper-graphite brushes, and least in the carbons. In fig. 3 are shown the results obtained by heating blocks of various materials at one end and measuring the temperature rise at the opposite end.

Under working conditions the heat generated at the contact surface is dissipated partly into the collector, and partly into the brush, and therefrom to the holder by direct contact and also via the flexible. For a given contact loss a brush made of carbon is likely to reach a much higher temperature near the contact surface than one made of natural or artificial graphite. If a pure carbon brush is suddenly called upon to carry an excessive current the temperature at the contact surface is liable to be raised to glowing point, with the result that the surface is burnt. Graphite brushes, owing to their greater thermal conductivity, are able to carry correspondingly heavier loads without such a high temperature being reached.

Incidentally this great difference in thermal conductivity explains the observed fact that flexible conductors in graphite brushes are more liable to burn out than the flexibles in carbon brushes.

The terms hardness and abrasiveness are frequently confused, whereas in reality there is a very definite distinction between them. By the former is meant the degree to which the material resists permanent deformation, and it may be measured conveniently by means of a Shore scleroscope, or rough comparisons may be made by scratching tests. A brush may be very hard and yet only very slightly abrasive. Frequently a harder brush is asked for, when what is required is either a more refractory brush or a more abrasive one.

The purely mechanical abrasive action of the majority of brushes is very slight indeed, and in some instances it may be necessary in the course of manufacture to incorporate a small quantity of abrasive material to prevent a brush from smearing the collector.

Tests made with no current flowing, however, reveal that even the last-mentioned brushes do not produce very rapid collector wear by abrasion. The following figures relate to tests made upon bronze slip-rings, the test brushes being 1" in. thick circumferentially, mounted one per ring. The pressure was 4 lb. per sq. in.; peripheral speed about 4,000 ft. per min. The radial wear of rings per 20 million revs. with pure graphite was less than 0.001 mm.; with carbon (non-abrasive), less than 0.001 mm.; and with carbon (abrasive), less than 0.070 mm.

The most abrasive of these brushes is not a type that would be fitted upon high-speed machines, but might, for instance, be fitted upon a 4-pole motor running at 800 R.P.M. Assuming the brushes were ¼ in. thick with four mounted on each track of the commutator, then on the basis of the above figure to produce a radial wear of 1 in. on the commutator the machine would have to run 10 hours a day for 21 years, and this with a pressure double that to be expected in practice.

Design of Brush.—The use of large brushes effects economy in holders, but a moderately small brush gives much more satisfactory operation. It is suggested that for ordinary commutator work the brush width should not be greater than 1¼ in., and the thickness should be that required by the commutating conditions, but preferably not more than 1 in.

Brushes of the slide type are immensely superior to the grip type, owing to their lower inertia and consequent ability to respond readily to inequalities in the collector. An exception may be necessary in the case of induction motor brushes which are lifted after the motor has been run up to speed; but in this case the need for a slide type is largely eliminated by the fact that the brushes are only in service for a few moments at a time.

A brush should be reduced as far as possible to its simplest elements, and all unnecessary fittings avoided which add to the inertia of the brush and are seldom essential to its satisfactory operation. If any protection is required on the top of the brush it should take the form of insulating material; this is lighter than metal and is more effective for the purpose, as the excessive wear sometimes produced on the top of a brush by the pressure finger is more an electrical effect than a mechanical one. Solder should be avoided whenever possible. Certain classes of brushes cannot be made to possess the requisite characteristics without making them comparatively fragile; in such cases an envelope of copper materially strengthens them. Coppering, however, has its attendant disadvantages. The brushes must have sufficient clearance in the holders over the coppered portion, and therefore an undesirable amount of clearance over the uncoppered portion. Copper plating on a brush also encourages the current to pass directly from the sides of the brush to the holder. This causes rapid wear of the brush boxes, and the excessive clearance resulting therefrom prevents a brush from bedding perfectly on the collector if it does not actually lead to serious chattering and breakage of the brush. In the author's opinion it is almost impossible to exaggerate the importance of making the mechanical conditions as perfect as possible. Half the battle is to maintain intimate contact with the collector. The total clearance in the holders should not exceed, say, 0.2 mm. in the circumferential direction and 0.3 mm. in the axial direction, and these figures may be halved with advantage. The brush boxes should be deep and should have four complete sides with unbroken surfaces. Flimsy holders are poor economy; they are usually very inaccurate, and vibrate excessively under adverse conditions. Substantial cast holders are a great assistance to satisfactory operation.

For high-speed work the majority of constructors have adopted the type which embodies a spiral spring directly behind the brush. This type possesses the additional advantage of taking up a minimum amount of room in the circumferential direction, and therefore affords a minimum of assistance to an arc to maintain itself between spindles of opposite polarity.

Every brush should be fitted with flexibles proportioned to carry full current with a reasonable margin for overloads and unequal distribution of load, but they should not be larger than is necessary, especially if they are short. A shoe-type terminal should be used which can be positively clamped under the head of a screw. Pin-type terminals cannot be recommended.

For many years traction brushes were rarely, if ever, fitted with flexibles, the pressure finger and box sides being depended upon to carry current. The reason for this seems to have been largely due to the difficulty of providing satisfactory means of securing the terminal end of the brush to the holder. This has been solved by a form of spring grip which can be operated in inaccessible positions, and has no parts that can work loose and cause damage inside the motor. The use of flexibles increases the life of both brush and commutator, wear at the top of the brush is prevented, and an all-round better performance is obtained.

(To be concluded.)

Discussion in London.

Mr. C. H. Wordingham said the subject was a most important one, both to makers and users of brushes. There was a sub-committee, of which the author of the paper was a member, at work at the present time on the standardisation of brushes. The work of this sub-committee should help greatly to improve the haphazard methods of purchasing brushes that were in use at the present time.

Mr. A. Constable regretted that although there were a number of brush experts their knowledge was not always interpreted in the drawing office. It was very difficult to find a really true commutator, and he thought that all the troubles and curious phenomena that were encountered were the results of untrueness of the commutator; that might also explain the rapid drop of the coefficient of friction. He could not say whether the film of air that the author had explained existed under the brush or not. If it did, then he could not see how any current would pass at all. He found it difficult to understand contact drop, and he maintained that there was no such point as the author had mentioned below which no current would pass. So long as the brush was in contact current was bound to pass, even without any pressure on the brush at all. He thought that the suction effect which the author mentioned might be similar to the attraction between two highly polished metal surfaces. Regarding the size of brushes, he certainly thought large brushes were undesirable, because they were difficult to bed properly; on the other hand, small ones should not be allowed to lead to the multiplication of parts. Standardisation was desirable, but difficult to accomplish, though it should not be difficult to secure uniformity of quality. He advocated that all brushes should have distinguishing marks of some kind, so that when they were being replaced from the works' stores there could be no chance of mistakes being made. Two brushes might appear to be identical from all outward appearances, but in reality they might not be so. Recessed mica gave trouble; he knew of one firm which had to go back to smooth commutators on account of trouble experienced due to oil getting in the slots, although the machines would have run better with undercut commutators. If the mica was recessed cleanliness was absolutely essential, or trouble would be experienced. The ordinary method of bedding brushes was by no means good. When a sheet of emery paper was drawn backwards and forward under the

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brush the curve given to the face of the brush was not the true one; it would be a curve having the radius of the commutator plus the thickness of the paper. Under such conditions the machine would have to run for at least three hours before the brush assumed its correct shape. With regard to copper pitting, he did not think the action could be termed an electrolytic one, because there was no electrolyte. He thought it was really due to very minute sparks, which could not be seen at all, jumping across from the commutator to the brushes. He did not believe in lubrication; if carried out the result was the introduction of a film of resistance under the brush which would still further increase the difficulties.

Prof. J. T. McGREGOR-MORRIS described the paper as being a very valuable one; it gave certain definite facts upon which a solid foundation could be built. There were one or two points about which he would like to have more information. First, how had the author measured his contact drop; was it by the ammeter and voltmeter method? Also, did his fig. 1 refer to a collector ring, to a commutator without an armature, to a commutator with an armature, or to a complete machine? Referring to some experiments that he had made, he said he had quite failed to find any such critical point as mentioned by the author below which no current would pass. He asked the author whether he really meant that there were no sparks at all when he used the word "sparkless." It was extremely difficult to determine whether such a condition existed, and if it really was so then the theory of the thing would be different. With regard to the volt-ampere curve, he spoke of experiments that he had carried out with a microphone, and said that he believed the theory of the microphone also applied in this case; he thought the theory was the same whether there were many or only one contact. He asked the author whether he had taken his tests on a running machine or not. It was difficult to take such measurements on a machine when on load, but unless that was done the results would not be applicable in practice.

Mr. R. ORSETTICH said he did not think it was quite so difficult to produce a universal brush as some people thought. He had known of a certain type of brush which, if it could not exactly be styled universal, at any rate went very near being so, and it was a pity that it had not been further developed. He called attention to the superiority of twisted over braided leads; he always specified for twisted leads. When such leads became overheated they could be easily untwisted, and so offered greater cooling surface without interfering with the running of the machine. He spoke of the defective methods of fixing leads to brushes, and said he knew of brushes being split due to the unequal expansion when a metal pin passed through the brush. Personally, he favoured the oscillating slip-ring, as it tended to keep the brush in good condition. He did not think a brush could be expected to collect heavy current if it was lubricated, and it was therefore desirable to eliminate artificial lubrication entirely.

Mr. J. McI. CATER regretted that he was unable to speak at any length at the time, but he would have pleasure in putting his contribution to the discussion in writing. With regard to the standardisation of brushes, he thought that should come in the first instance from the designers of electrical machinery, and brush-makers would only be too glad to follow. He was quite in agreement with the author as to the impossibility of developing an universal brush.

Mr. H. BRAZIL was of the opinion that undercutting the mica was the better practice, but care should be taken not to cut too deeply. He had seen much trouble caused by oil vapour getting in between the segments and setting up short circuits, which necessitated the commutator being remade. He was greatly interested in the partial vacuum which the author had explained existed under the brushes; that would increase the coefficient of friction. He uttered a warning against measurements that were taken in a laboratory; they were not the same as measurements taken under working conditions, and would not be of much value in practice. He emphasised the importance of small detail in brush work, and said that the sliding type was the correct type of brush to use. Brush holders and boxes should be of a very solid type, and the latter should have as small a clearance as possible. Flexible leads should be of as large a section as possible, and it was desirable to provide three or four of them instead of the usual one or two. He had found it very difficult to prevent slip-rings becoming grooved due to different parts of the brush being harder than others, but, on the whole, grooving was not objectionable as it gave greater contact surface. The end-play remedy for grooving was not a good one.

Mr. P. R. FRIEDLAENDER spoke of his experience with small motors, which, when running at high speed, threw the brushes off the commutator. This was entirely a mechanical defect, and it should be possible to find some way of remedying it. He also referred to brush leads and the means of applying pressure to brushes; springs for the purpose were not always as effective as they should be, they often prevented the brush sliding properly, so that it could not follow the surface of the commutator and maintain proper contact.

Mr. H. K. WHITEHORN, referring to the author's tests, drew attention to the difficulty of obtaining accurate results with a machine on load due to the flow of circulating currents. He emphasised the great importance of giving proper attention to the mechanical points in the design of brushes, and also to the proper spacing of brush-holders in practice. When mica was undercut great care should be taken to do it properly, or else it was better left alone altogether. He was of the opinion that a small, narrow brush was to be preferred, and he thought a good deal to improve matters could be attained by a proper selection of brushes.

Mr. LL. B. ATKINSON referred to the brush patent he had taken out at the age of 22 years, and to his early experience of brushgear. He had not even yet been able to make up his mind whether the carbon brush was a blessing or a curse. It was a very simple solution of a difficult problem, but its efficiency was low, and from the point of view of commutation he did not think a worse method of collecting current could be devised. The question of contact drop across the brush was one upon which he still had doubts, in spite of what the author had said, but it was a question that required to be settled. He was in agreement with the remarks made by Prof. Morris, that the paper was a foundation upon which much good work could be built.

Mr. S. A. POLLOCK took exception to the author's statement that, nominally, commutating poles produced a flux proportional to the load, but actually they did not. Such a statement was incorrect. He said it appeared to be the author's general opinion that designers were "hit-and-miss" sort of people. If the author had dealt with modern machines he thought that some of his statements would have been worded very differently. He said there should be a constant voltage drop from the tip to the heel of the brush. It would be difficult to standardise the size of brushes, but he saw no reason why all brushes should be of one class. He knew of cases where it had been desirable to change the brushes, but it was not for reasons of commutation. He would like more data on the rates of wear of slip-rings given in the paper, and could the author say what the rate of wear of a copper-graphite brush under the same conditions would be? He agreed that an air film did exist under the brush, although it might be only a very thin film. He did not think such a film would affect the contact drop very much because the heat generated would rarify the air, and so wash out more of the film. He agreed that a large brush was bad practice, but the size should be kept as large as possible, so as to reduce the cost of brush renewals.

Mr. RUPERT S. ALLEN said that standardisation was very desirable; the number of grades of brushes should be reduced. He did not think the paper had taken sufficient account of inertia. They had heard something of brushes jumping and bumping; it was quite essential that the brush should be able to respond immediately, and when these condtions were fulfilled better results would follow.

The AUTHOR, in reply to some of the points raised, said that his fig. 1 was taken on short-circuit by the ammeter and voltmeter method. When the commutator was at rest the curve ran down to the origin. To obtain fig. 6 the brushes were tested individually on a slip-ring, and were afterwards checked. Perhaps it was not quite correct to term the copper pitting action an electrolytic one, as there was no electrolyte, but it was something very similar. The alternative explanation put forward by a speaker he did not think would fit in, as the action was confined to the negative brush. It was advisable to use one brush in place of two whenever possible, because when two were used one invariably wore away quicker than the other. With regard to external lubrication, he could only say that where it was found necessary it could only cast a reflection on the makers of the brushes.

FREQUENCY CONTROL.*

BY HENRY E. WARREN.

THE ordinary method of measuring frequency is by means of a meter which indicates upon a scale the value at any instant. The common method of regulation has certain faults which hitherto have not been emphasised because they have not been obvious, and because there has been no better way of accomplishing the regulation.

A new method of maintaining frequency, which has been in actual use during the past two years by a few of the largest power companies in New England and New York City, differs radically from the conventional plan. No frequency meter of the ordinary type is required. Instead, a device which conveniently and accurately compares the integrated alternations with elapsed time serves as a guide to the operator for adjusting the speed of the turbines. This device is comparatively insensitive to the instantaneous value of the frequency, but shows its average value with the very greatest precision.

The instrument itself, known as the Warren master clock, consists of a complete pendulum clock with two dials. The lower one serves merely to indicate the time of day in the conventional manner. The upper dial, of larger diameter, has a hand which revolves once in five minutes. The clock movement is provided with novel electrical means for regulating the rate with very great precision. The pendulum rod is made of "invar," so that the clock is practically unaffected

* *General Electric Review*, November, 1918. Abstract.

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by temperature changes. It is an extremely accurate time-keeper, and can be regulated to run with an error not greater than a second or two per week.

Mounted upon the upper five-minute dial of this clock is another hand which is gold-coloured to distinguish it from the black clock hand. This gold hand is wholly independent of the clock movement, but is driven through gearing by a small self-starting synchronous motor, illustrated in fig. 1. This motor is connected permanently through any convenient potential transformer to the alternating-current system. The gear ratio between the gold hand and the motor is such that at normal frequency, for example, 60 cycles, the hand will revolve once in exactly five minutes. Incidentally, the synchronous motor keeps the pendulum clock movement constantly wound at uniform tension.

After the Warren master clock has been started and regulated, the gold and black hands on the five-minute dial are set over each other, and the operators are instructed to adjust the speed control switches of the turbines occasionally, if they observe any tendency of the gold hand to gain or lose with respect to the black hand.

It is surprising to observe how slowly these two hands

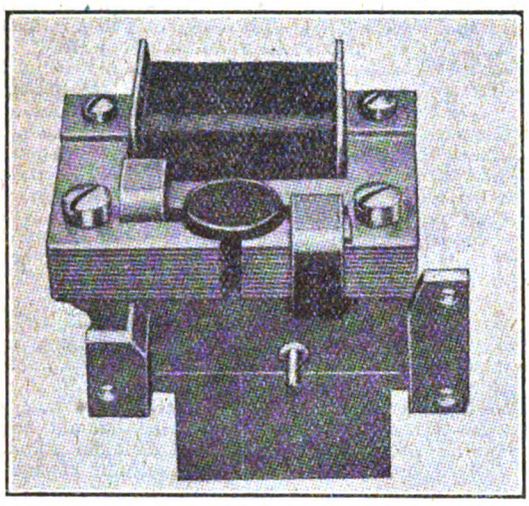

Fig. 1.—Self-starting Synchronous Motor for Driving Synchronising Hand (Full Size).

change their relative positions, after the speed of the turbines has been correctly adjusted. This is because the turbine governors maintain the average speed very accurately indeed, and the momentary fluctuations in speed, which are just as likely to be above as below the average value, cancel out and do not perceptibly affect the relative position of the two hands. The clock gives a true indication of the average value of the speed, it serves therefore to establish a correct base line for the frequency.

From the standpoint of the operator there is a considerable advantage in eliminating unnecessary and objectionable

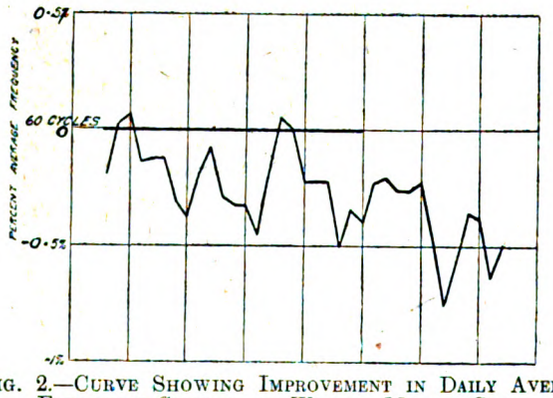

Fig. 2.—Curve Showing Improvement in Daily Average Frequency Secured by Warren Master Clock.

manipulation of the speed-control devices in a continual effort to follow fluctuations in speed which are only momentary.

The new method practically eliminates the effect of all instrumental errors due either to calibration or temperature. The average frequency measured over periods exceeding 24 hours can easily be maintained over periods exceeding a hundredth of 1 per cent. of its true value.

The scale of the instrument is so extended by the integrating process that close reading is wholly unnecessary.

Since October, 1916, the frequency of the Boston Edison Co. has been controlled by this improved method. The original Warren master clock has been running continuously 24 hours each day without repairs of any kind and without attention, except for daily comparison with Washington time signals and infrequent regulation. All the alternating current supplied from this station to 35 cities and towns and more than 50,000 customers has been controlled in this manner.

The improvement in frequency regulation may be seen by referring to fig. 2, where the curve shows the average frequency for 24-hour periods during the month before the installation of the master clock, and the thick straight line indicates the frequency thereafter. The curve and the straight line are on the same large scale. The variations of the curve are probably due more to temperature changes than to any other cause, and it is likely that they would appear materially greater if measured through summer and winter. The straight-line, if continued to the present day, would probably show no variations large enough to be plotted on this scale.

It may be argued that the curve is acceptable commercially, but there can be no doubt that in the long run those manufacturers who use electric power, especially textile mills, gain materially by eliminating errors and variations in the average frequency, even as small as one-half of 1 per cent. This must be so because the speed of all motors, and, consequently, the output of the mills, varies directly with the frequency. One-half of 1 per cent. would mean 50 dollars per day to a mill with a daily output worth ten thousand dollars.

The Warren motors, shown in fig. 1, are very small, and practically foolproof. They consume about two watts, and will bring their load from rest up to absolutely synchronous speed within a second or two. One of these motors may be substituted for any clock mechanism with a certainty that it will run at the same rate as the master clock at the central station.

This means that any power company using the improved frequency control may eliminate all the troublesome clocks in graphic instruments, maximum demand meters, time switches, and similar devices by substituting the small Warren motors, which take up much less room and are many times more powerful. A very considerable saving can be secured in this way, particularly with demand meters which are widely distributed. The cost of weekly winding disappears, and the maintenance expense is greatly reduced, and much more accurate and reliable records are secured. It seems quite certain that for large systems the gain in re-equipping graphic instruments and demand meters will alone pay a generous return on the very moderate cost of adopting the new method. Motor-driven time switches for controlling multiple street lamps and many other purposes suggest very important possibilities for the future.

Whenever two systems are to be interconnected they must first establish the same frequency. This result can be accomplished with ease by the improved method of control.

ELECTRICITY SUPPLY PROGRESS IN WAR TIME.

(*Continued from page* 616.)

AYR.

During the war the Corporation of Ayr (Mr. R. Marshall, burgh electrical engineer) has converted its alternating-current supply system from single-phase, 60 periods, to two-phase, 50 periods, and has increased the capacity of the generating plant by 1,500 kw., making a total of 2,600 kw. In the same period, the horse-power of motors connected to the mains has increased by over 100 per cent., and there is every prospect that, when Government restrictions are withdrawn, there will be a considerable demand for additional supplies of electrical energy for all purposes.

ABERDEEN.

The Corporation of Aberdeen (Mr. J. Alex. Bell, city electrical engineer) has almost doubled its annual output in the four years from 1914 to 1918. The following table summarises the increase in output and connections during the period in question :—

	July 31st, 1914.	July 31st, 1918.
Total units sold	9,663,054	17,408,147
Units sold for power and heating	4,692,626	12,025,681
Total H.P. of motors connected ...	8,441	16,855
Number of motors hired out ...	677	864
H.P. " " ...	3,776	6,077
Total heating and cooking connections	1,202 kw.	2,177 kw.
Total number of hired heating and cooking appliances ...	961	1,598
Total number of hired radiators and fires	351	688
Total number of hired irons ...	364	628

To deal with the increased load a new 5,000-kw. turbo-alternator, complete with surface condensing plant, was put to work in the early part of this year. To accommodate this set it was found necessary to extend the engine-room buildings a matter of 40 ft., as the load was such that it was

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found to be unsafe to remove three 420-KW. reciprocating sets, which would otherwise have had to be done. A further 5,000-KW. turbo-alternator is on order for delivery in the spring of 1919, and this is to occupy a position in the main engine-room in place of the above mentioned old reciprocating sets, which have now been disposed of. The plant capacity will thus be raised from 8,380 to 18,380 KW. A 1,000-KW. motor-converter has been installed, and a further one is on order.

The boiler-house plant has been increased by the addition of two Babcock & Wilcox water-tube boilers of 18,000 lb. each, and to deal with coal stocks a telpherage system has been installed. Two new electrically-driven pumps have been installed in the pump chamber on the river bank, and a new pipe has been laid to the works for condensing purposes.

A new sub-station for improving supply in the docks area was put into use in November, 1917, and contains one 500-KW. motor converter and one 400-K.V.A. static transformer, with the requisite E.H.T. and L.T. switchgear. Four new static transformer sub-stations of a total capacity of 1,700 K.V.A. have been built and equipped in connection with supply to various works, while two existing sub-stations have been enlarged by a total of 750 KW. of rotary and 400 K.V.A. of static plant.

The opening of these new sub-stations and the rearrangements of the cable system involved the laying of 5.87 miles of E.H.T. feeder and 5.19 miles of L.T. feeder; 8.14 miles of distributor have also been laid.

The principal war industries have been the building of ships (largely Admiralty trawlers), manufacture of shells, weaving of Army cloth, making-up of Army clothing, and tinned rations. Most of the firms engaged on these already used electric power; these have enlarged their plant, while others have taken supply who did not previously do so. Thus one large firm of engineers, which was previously not a consumer at all, has installed over 900 H.P. of motors, an electric steel furnace requiring 750 to 1,000 KW., and a 40-K.V.A. electric welding plant. A firm of shipbuilders which used electricity to a limited extent has added over 800 H.P. between extensions and replacement of old steam plant. Another firm of engineers and shipbuilders has added over 400 H.P. to its previous installation, while a new shipyard started during the war has 350 H.P. of three-phase motors, and no other form of power. A large firm of jute and flax manufacturers has a complete electrical equipment of over 1,300 H.P. in a new mill, while a firm of woollen cloth manufacturers has added 325 H.P. to its previous installation, and has between 200 and 250 H.P. yet to go on.

A bakery and meal mill has changed over from steam to electric driving, with a total of 175 H.P. of motors. A paper works has put in 165 H.P., and has further plant awaiting erection. A chemical works has put up a new plant for the manufacture of superphosphate which requires 130 H.P., and there have been many installations of smaller size.

Aberdeen has not been without its share of new industries. The principal and most interesting is that of electric steel making, one firm having installed a 3½-ton furnace with transformers of 900-K.V.A. capacity. Another interesting departure is the building of concrete barges. The paper makers have taken up some new lines, and while one firm has developed the manufacture of paper from sawdust, another firm has turned its attention to the production of photographic papers. In a smaller way there is toy-making, and one firm is doing its best to capture a share of a trade formerly almost entirely in German hands.

REDDITCH.

The Urban District Council of Redditch (Mr. R. N. Mayne, electrical engineer) originally commenced supply 19 years ago on the single-phase system at 70 cycles for lighting purposes; but there has been a steady demand for electric power which the early type 70-cycle machines, working at a power factor of under 0.5, were unable to cope with, eventually failing altogether. In 1913 the plant had a total capacity of 665 KW., and was carrying a day load—practically all power—of some 450 KW., which increased in the evening, due to the lighting load, to a total of 640 KW. It became evident that if the plant in the industrial district of Redditch was to be driven by electric power and not by gas very drastic alterations in the method of generation and supply were necessary. Ultimately it was proposed to adopt a three-phase system of generation and distribution, but it was not until after the outbreak of war that contracts were placed for the new plant.

The Birmingham Small Arms Co., Ltd., Messrs. Herbert Terry & Sons, Ltd., and other large manufacturers entered into agreements for bulk supplies for power and light, but, although matters were accelerated as much as possible, it was not until September, 1916, that a supply of three-phase power was available. This delay, unfortunately, resulted in the loss of the cream of the war power peak, gas engines taking up the drive for essential war supplies.

The new plant installed consists of two 1,000-KW., 3,800-volt, 3-phase Parsons reaction type turbo-generators, with electrically-driven auxiliary plant, and a Heenan & Froude wet-air filter. Additional steam is provided by a 13,000-lb. Babcock & Wilcox boiler, which unfortunately had to be put down in a temporary position, further extensions to the old boiler-house being prevented by the destructor house at one end and a cooling tower at the other. This arrangement has been a very expensive one, as it took two sets of firemen per shift, and two coal-storage bunkers had to be stocked. New H.T. and L.T. 3-phase, 4-core feeders and distributors were laid to convenient centres, the H.T. cables feeding into new sub-stations, fitted with modern B.T.H. truck-type switchgear, and B.I.W. switch-fuse L.T. units; 0.2 4-core, L.T., 3-phase cables feed into the surrounding single-phase underground sub-stations, the original single-phase distributors being balanced as nearly as possible between the phases and neutral. This arrangement has done away with the high-pressure fuse and switchgear and transformers, always a dangerous and unsatisfactory combination in underground sub-stations.

The two problems which presented themselves on the change-over from 70 to 50 periods were: The correct registration of consumers' meters, and the reduced speed of the one-phase motors. The meter department required overhauling, and a new building was put up for this purpose, equipped with modern testing arrangements.

It has not been possible entirely to do away with the running of single-phase machinery, and for this purpose two motor-alternators of 150 KW. and 300 KW. respectively have been put down. Normally these are motoring on H.T. single-phase supply, as there are a number of large consumers having their own H.T. transformer sub-stations giving a L.T. supply to their works.

The three-phase has proved so reliable and satisfactory that the single-phase motor has been displaced by the three-phase in a number of cases by consumers; in fact, the demand has increased so rapidly—in 1916 the units generated were 1,648,733, for the year 1918, 3,792,286—that it has been necessary to order another 3,000-KW. turbine and auxiliaries; the engine room will be extended and will take the place of the temporary boiler house. A new boiler is to be put down at the same time.

The opportunity will be taken to bring all the boilers under one roof, the old destructor house being done away with to enable this to be done, and with overhead coal bunkers, economisers, and induced-draught fans, considerable economies are to be looked for.

The needle and fish hook trade is the staple industry of Redditch and district, together with a newer but important industry of springs, bicycles, and motor-bicycle manufacture. These trades require a number of isolated shops, for which the electric motor is particularly suited.

Redditch has for the past four years been engaged solely on war work, but the machines are rapidly being diverted back to their normal work, for which there is a great demand.

(To be continued.)

THE SUPPLY OF SINGLE-PHASE POWER FROM THREE-PHASE SYSTEMS.

Prof. MILES WALKER read his paper (an abstract of which appeared in our issue of December 13th, 1918) before the NORTH-MIDLAND CENTRE of the I.E.E. at Leeds, on December 10th.

Mr. R. H. CAMPION, the Chairman, observed that they were much indebted to Dr. Walker for his up-to-date paper; he ventured to prophesy that it would become a classic one so far as the Institution was concerned. Some of them had been keener to get electric furnaces on to the mains than in thinking about the best way in which they should be employed. The author's paper on this subject was well worth careful study, though perhaps it would bring back again one of the famous old battles of the past, as in the paper the single-phase furnace was most strongly and ably advocated, and one wondered whether the rotating balance transformer would be able to withstand all the big loads which were thrown on and off the furnaces without flashing over. He understood there were several towns where only three-phase furnaces were allowed on the mains.

Mr. SIMPSON remarked that he had read the paper with very great interest from the point of view of supply rather than from that of the actual user. He thought Dr. Walker had justified the points he had set out to cover. The Americans had some very interesting experiences five or six years ago; they experienced their first troubles with the heating of machines giving the single-phase supply from three-phase generators. He would like to know whether Dr. Walker would in the case of an 11,000-volt supply or more—say, in the case of a 400-K.V.A. balancer—put in windings for that voltage or prefer to step down to a low voltage on the machine. If that was so, one would have to consider the additional cost for such a case. Another point was whether Dr. Walker would propose to run several furnaces in parallel off the same piece of apparatus and the balancing transformer? As he (Mr. Simpson) looked at the matter, the stabilising advantage which Dr. Walker got at present by keeping the balancer transformer as one unit would be lost.

Mr. BROWN said that the apparatus might be useful for electrical welding apart from electrical furnaces. He knew a

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good deal was shortly to be done in the way of electric welding by alternating current.

Mr. IMBRAY was of the opinion that as regarded single-phase work they had to consider the possibility commercially. When a man was asked to spend £2,000 on a small installation for the addition of a rotary-converter and balancer he looked a long time at the proposition of installing a balancer. From the point of view of an electrical engineer, the true science of doing a thing was to do the thing most effectively at the least capital outlay without in any way depreciating the work done.

Mr. TOWNLEY was of opinion that with every three-phase furnace with bottom connections the supply authority had got to allow for unbalanced load. A point to remember was the size of furnaces that could be dealt with by a particular size of plant. The size of the furnace should not be more than 15 per cent. of the size of the plant running in the station. That was found to give very successful results. With a furnace of 25 per cent. of the capacity of the plant running in the station very bad results had been obtained.

Mr. LAING agreed with the Chairman that the paper was likely to be a classic on the subject. It would be interesting to watch developments in the future to see if Dr. Walker proved to be a wise prophet. Even if they had the battle of the phases over again it would be on a subject of primary importance, and would be of great interest to all concerned in the electrical industry. It was important to point out that so long as one was within 20 per cent. of the load of a station one could with safety use one-phase power only for particular work.

Mr. SELVEY said he would like Dr. Walker to say something bearing on the use of a single phase for railway electrification.

Prof. MILES WALKER, replying to the discussion, said that many points of interest had been brought out. As regarded condensers, there was no real limit to the output if one could get enough to pass the condenser. Of course, one was always a little afraid with condensers. The voltage was across a small thickness of dielectric, and although it might be found in practice that it did not get hot, still there would always be some difficulty in using condensers on high voltage. In the future they might have condensers sufficiently cheap to work them at a very low voltage gradient. With regard to the powers of furnaces, there was quite a possibility that in the future they might go to thousands of kilowatts in furnaces, not only for steel melting, but also iron smelting, and, whilst at present it was not altogether a commercial proposition, yet there were so many advantages to be gained that the matter was very seriously under consideration by a number of people, although it might be some years before power became sufficiently cheap to make it worth while. With regard to losses on load, makers made a guess at the losses, and it was only a matter of guessing big enough to calculate the efficiency lower than the efficiency obtained, so that there was nothing in that. As to the question of 11,000-volt machines, that would depend on the size of the machine; it was possible to make thoroughly reliable windings for a large machine. If it was a small machine a transformer would probably have to be put in, which would be a drawback. An electric furnace could make such a tremendous lot of money in a year that it paid the capital cost, apart altogether from paying interest on the capital. It was quite possible to put furnaces in parallel. As to electrical welding, he had not considered the matter, and did not know enough about the characteristics required for welding. If one required a lot of electric furnaces it would be an advantage to have one's own power station, although he thought some of the power suppliers would be pleased to cut prices even then with them. In many stations power engineers would not allow a single-phase furnace to be put on their line. They were so nervous of having it short-circuited that even 10 or 15 per cent. would not have to go on their line without some transformer. As regarded the application of single phase for railway work, the supply required was always on such a large scale that there was no doubt it would be dealt with by generators of special design. He was not anticipating that there would be any great demand for balancers for electric railway work. The electric railways were so big that they would adapt special plant for their special purposes.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

20,396. "Electromagnetic wave navigational systems." J. ROBINSON AND J. E. MURRAY. December 9th.

20,411. "Electrically-driven vehicles." J. E. STOTT. December 9th.

20,432. "Selective apparatus for wireless control systems." A. M. LOW. December 9th.

20,452. "Sparking plugs." K. E. L. GUINNESS. December 9th.

20,459. "Telegraphic systems." V. E. CASTELLI & E. FRATTOLA. December 9th.

20,474. "Signalling apparatus in telephone exchange switchboards." J. T. HOGARTH. December 10th.

20,477. "Means for converting alternating current into continuous or direct current." E. H. JONES. December 10th.

20,482. "Manufacture of socket supports for electric lamp bulbs." ETABLISSEMENTS BELIN. December 10th. (France, December 11th, 1917.)

20,486. "Electric lighting for stage, &c." E. BOOTH & N. R. BC December 10th.

20,502. "Safety devices for prevention of theft or interchangeability electric bulbs or globes." W. H. COX. December 10th.

20,518. "Rectifying X-ray systems." W. A. WINTER. December 1 (U.S.A., December 10th, 1917.)

20,543. "Induction coils." M. A. CODD. December 10th.

20,546. "Make-and-break devices for induction coils." M. A. CODD. December 10th.

20,547. "Devices of the vibrated diaphragm type for giving audible signals." M. A. CODD. December 10th.

20,561. "Electrically-operated gears." H. LEITNER. December 11th.

20,564. "Means for mounting dynamos, &c., on motor cycles and driving same." C. W. PIDCOCK. December 11th.

20,569. "Electrical fire alarms, &c." R. CAWTHORNE. December

20,576. "Protective arrangements for electric distribution systems." J. R. BEARD, ELECTRICAL IMPROVEMENTS, LTD., & P. V. HUNTER. Dece 11th.

20,602. "Electric switches." ELECTRIC CONTROL, LTD., & O. ELLESEN. December 11th.

20,604. "Electric terminals for switches, &c." G. O. DONOVAN & W. DONOVAN. December 11th.

20,605. "Apparatus for electric protection against corrosion, pitting, &c. of tubes, ferrules, doors, &c., of surface condensers, &c." L. J. KETTLE. December 11th.

20,619. "Trolley heads for electric traction." J. B. PARKER & J. SMITH. December 11th.

20,640. "Metallic electrodes for electric arc welding operations." C. J. HOLSLAG. December 11th.

20,650. "Electric heaters for auto-radiators." J. D. BROWDER. December 11th.

20,685. "Casings, &c., for electrical fuses, &c." CABLE ACCESSORIES CO., A. CRAWFORD & F. H. REEVES. December 12th.

20,686. "Electrical fuses." CABLE ACCESSORIES CO., A. CRAWFORD AND F. H. REEVES. December 12th.

20,713. "Portable electric starter for motor-car engines, &c." C. B. CAVE-BROWN-CAVE. December 12th.

20,727. "Dynamo-electric machines." F. ALWYNHAIGH & BRITISH THOMSON-HOUSTON CO. December 12th.

20,746. "Electrical furnaces." F.I.A.T. SOC. ANON. December 12th. (Italy, December 12th, 1917.)

20,757. "Firing electric mines." J. L. V. DA CRUZ. December 12th.

20,759. "Magnetos." COMPAGNIE GENERALE DE MAGNETOS. December 12th. (France, August 31st.)

20,762. "Electric welding apparatus." QUASI ARC CO. & A. P. STROHMENGER. December 12th.

20,784. "Magnetos for internal-combustion engines." E. G. BEKEN. December 13th.

20,793/4. "Electrical phase-converting systems." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. December 13th. (U.S.A., December 13th, 1917.)

20,813. "Electric change-over switches." EVERSHED & VIGNOLES AND J. C. NEEDHAM. December 13th.

20,828. "Sparking plugs." T. ANTOINE. December 13th.

20,832. "Dynamo-electric machines." E. HARRISON. December 13th.

20,858. "Electric furnaces." J. HARRISON. December 14th.

20,863. "Electric alternating-current slip-ring motors and short-circuiting and brush-lifting gear therefor." MAVOR & COULSON, LTD., & M. S. MOORE. December 14th.

20,899. "Truck type electric switchboards." JOHNSON & PHILLIPS & W. A. WALKER. December 14th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

16,749. ELECTROMAGNETIC CLUTCHES OR BRAKES, MORE ESPECIALLY INTENDED FOR THE DRIVING AND CHANGE-SPEED GEAR OF MOTOR ROAD VEHICLES. G. Pollard & Menco-Elma Syndicate. November 14th, 1917. (120,757.)

17,013. INDICATOR, ELECTRIC ALARM, AND IGNITION CUT-OFF APPARATUS FOR THE LUBRICATION SYSTEMS OF ENGINES. A. J. Hill. November 19th, 1917. (120,762.)

17,172. ALTERNATING ELECTRIC CURRENT PROTECTIVE DEVICES OF THE TYPE ADAPTED TO OPERATE ON REVERSAL OF CURRENT. British Thomson-Houston Co. and E. B. Wedmore. November 21st, 1917. (120,775.)

17,398. ELECTRICAL CONNECTIONS OF ELECTRIC TORCHES, ELECTRIC POCKET LAMPS, AND OTHER PORTABLE ELECTRIC LAMPS. Efandem Co. & A. H. Williams. November 26th, 1917. (120,782.)

17,608. AUTOMATIC TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. & A. J. Ray (Automatic Electric Co., in part). November 28th, 1917. (120,785.)

17,612. ELECTRIC FURNACES. E. Grammont. November 28th, 1917. (120,786.)

18,032. CONTROLLERS FOR ELECTRIC MOTORS. G. Ellison & J. Anderson. May 31st, 1918. (120,798.)

18 153. ELECTRODE HOLDERS FOR ARC WELDING PURPOSES. P. F. Smith and V. S. Robinson. December 7th, 1917. (120,801.)

18,496. ENGINE STARTERS. V. Bendix. December 13th, 1917. (120,806.)

18,641. MEANS FOR LOCKING INCANDESCENT ELECTRIC LAMPS TO THEIR HOLDERS. H. Smith. December 15th, 1917. (120,810.)

1918.

71. ALTERNATING-CURRENT MOTORS. A. C. Bell & T. R. Bell. January 2nd, 1918. (120,822.)

2,235. ELECTROMAGNETIC SWITCHES. British Thomson-Houston Co. (General Electric Co., U.S.A.) February 7th, 1918. (120,829.)

3,188. CONTROLLING MECHANISM FOR USE IN ELECTRICAL INSTALLATIONS. Soc. Anon. des Etablissements L. Bleriot. November 7th, 1917. (120,545.)

3,237. ELECTRIC CONTROLLERS OF THE BARREL OR DRUM TYPE. Veritys, Ltd., and W. G. Pipkin. February 23rd, 1918. (120,832.)

5,173. COMMUTATOR BRUSHES OF ELECTRIC MOTORS. Sykes' Interlocking Signal Co., W. R. & R. W. Tarrant. March 23rd, 1918. (120,842.)

9,750. ELECTRIC MOTOR CONTROL SYSTEMS. British Westinghouse Electric and Manufacturing Co. June 13th, 1917. (116,724.)

Reconstruction Problems.—Pamphlet No. 9 issued by the Ministry of Reconstruction deals with various points in regard to "Naval Demobilisation." The scheme is explained in the form of question and answer.

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